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INVESTMENT IN AIRPORT CAPACITY -

A CRITICAL REVIEW OF THE MANS STUDY

by

G. MILLS

No. 55 January 1982

DEPARTMENT OF ECONOMICS

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INTRODUCTION

1.1 For the past thirteen years, the Commonwealth and New South Wales governments have been actively studying proposals for the expansion of airport capacity in Sydney, the most recent of these governmental studies being the MANS (Major Airport Needs of Sydney) enquiry. This paper deals with the MANS study and with some questions arising from it. Sections 2 to 9 below describe and evaluate the work undertaken in the MANS enquiry itself. In section 10, the present runway pricing policy is examined together with an alternative pricing strategy which would better represent the principle that each user should pay enough to cover the direct attributable cost of his use, while users in aggregate should pay enough to cover all the costs. Later sections argue that implementation of this principle would reduce traffic levels; that because of the relative neglect of this aspect in the MANS study, its results are not conclusive; that it seems unwise to rush into early runway investment; and that a new pricing policy should be implemented at Sydney, the results to be used to guide a later investment decision.

1.2 Notwithstanding some shortcomings, the MANS study is a major contribution, embodying many man-years of work by a range of highly-skilled professionals. The size and complexity of the study makes it difficult for the outsider to test all the details of the work. While the public reports enable examination of the overall structure of the study, many other matters (especially relating to the choice of input data and to some of the assumptions used in processing these data) have to be taken on trust.

ORGANISATION AND CONTEXT OF THE MANS STUDY

2.1 The Commonwealth and New South Wales (NSW) governments jointly established the MANS study in 1976; although the earlier governmental studies had not led to a conclusive political outcome, much of this earlier work was used in the MANS study. The two governments established a MANS committee, with its own secretariat, and with an official from the Department of Transport, Australia, as chairman. The three other Commonwealth members were officials drawn from the Department of Finance, the Department of Construction (now the Department of Housing and Construction) and the Department of Environment, Housing and Community Development (now the Department of Home Affairs and the Environment). The four state members were officials drawn from the State Pollution Control Commission, the Planning and Environment Commission (now the Department of Environment and Planning), the Traffic Authority of NSW, and the Premier's Department.

2.2 Because airports have such diverse aspects and consequences, a wide range of studies has to be undertaken before embarking on airport development. For this reason the MANS committee established nine consultative groups and a number of working groups, each to consider and report on one or more aspects of the problem. Appendix B gives the names of these groups and their composition by departmental affiliation. Note the numerical predominance of Commonwealth government officials, especially those from the Department of Transport, Australia (DOTA). In many cases, this predominance follows inevitably from the role of DOTA as the only operator of major airports, and from the fact that the NSW government does not operate any airport. One consequence is that it is difficult to find expertise on airport design and operation outside the Commonwealth public service, and it may be that the state government officials felt themselves to be at some disadvantage in that aspect of the work.

2.3 Because of the politically controversial nature of airport development, it was decided to publish a great deal of the results of the study and to invite public participation. To this end, the MANS committee established a further group, the Public Participation Consultative Group; again see Appendix B. Most of the work of the various consultative groups was done in 1977 and early 1978, with the groups reporting by mid-October 1978. These reports were made publicly available; the details are shown in Appendix A which lists all the documents publicly issued under the MANS programme. Included in the publications are a series of Information Bulletins, most of which seek to summarise in simple terms the technical details of the consultative group reports. The MANS committee also commissioned several firms of consultants to work on various aspects of the study, and many of their reports have also been issued publicly.

2.4 In 1978 and 1979 the committee invited submissions from the general public and from the aviation industry; Appendix A gives details of publicly-issued submissions from industry interests. During 1979 the MANS committee was unable to agree on policy conclusions; presumably, this reflected the differing stances of the two governments. In December 1979 the Commonwealth members of the MANS committee issued a short report outlining their policy recommendations, and this was promptly criticised by the NSW government. During 1980 and 1981, the Commonwealth government pressed the NSW government to support these recommendations, and in particular urged NSW to accept the proposal for a further runway at the present Sydney Airport. In July 1981, the NSW Premier publicly rejected this proposal and urged the Commonwealth government to get on with the job of selecting a second airport site. This in turn was publicly rejected by the Commonwealth Minister for Transport who said (DOTA, News Release, July 22, 1981) that the NSW position "ignores the fact that a second jet airport cannot be relied upon to provide any relief until the mid 1990s" and this "leaves me no alternative but to instruct my Department to begin detailed planning for the orderly and progressive restriction of air services to and from Sydney". The entrenched positions and the statements of the two governments suggest more concern for electioneering than for the realities of airport operation, but the electioneering aspect is not pursued here. However the question of airport management over the next few years is considered below, in sections 11 and 12.

TRAFFIC FORECASTING

3.1 The MANS committee asked the Bureau of Transport Economics (BTE) to develop demand models and to prepare forecasts of the annual totals of passenger and aircraft movements at five-year intervals to the year 2010. The Forecasting Report [23] gives an account of this work and of the results, while BTE (1978) reproduces an almost identical text and also gives in appendices some further details, especially of the econometric models used to forecast passenger numbers.

3.2 The BTE makes it clear - see pp. 2 and 38 of BTE (1978) - that it was required to adopt methods and assumptions laid down by the Forecasting Consultative Group, and that the BTE might not choose the same assumptions in an independent study of the same topics. This reservation applies particularly to the predicted values of the exogenous variables used in applying the econometric demand models.

3.3 The principal exogenous variables, and the assumptions about future values were:

real disposable income per head, for Australians	high, median and low forecast growth rates of (respectively) 3%, 2.25% and 1.5% per annum, throughout the study period
population levels for Australia and for each state	high, median and low forecasts of annual growth rates; median forecasts are 1.48% initially declining to 1.22% for Australia, 1.03% declining to 0.90% for NSW
real airfares	(forecasts discussed in the next paragraph)
real costs of car travel	growth rate of 2.5% per annum
travel time by air and road	no change in future years
other variables (including real imports per capita, real exports, income of overseas residents, and population of overseas countries).	extrapolation of past trends

3.4 On trends in real airfares, it was assumed that market situations would not change significantly and hence that changes in (nominal) airfares would reflect cost changes. Each cost component was supposed to have a constant, albeit distinct, growth rate. Of particular interest are the assumptions ([23], paragraph 2.6.7) on fuel prices and costs: for international services, a growth (in real terms) of 3.3% p.a. to 1985, and for domestic services 10% (to reflect the transition to import parity pricing for oil); after 1985, for both categories, a decline of 2% p.a. in fuel costs, to reflect economies in fuel consumption.

3.5 Growth rates for the various cost components were combined to give two sets of assumptions for real airfares; the more optimistic of these (used for a high forecast of passenger numbers) is as follows:

routes	annual growth rate in real fares (%)	
	1976 to 1985	1985 to 2000
international		
- business passengers	-0.5	-0.6
- non-business passengers	-2.5	-0.6
interstate	0.0	-0.7
intrastate	0.0	-0.3

The less optimistic set differs only for the period 1976-85, for which interstate fares are assumed to rise at 2% and intrastate fares at 1.5% p.a.; this set was used in both the median and low passenger forecasts.

3.6 The details of the econometric demand models are considered to be beyond the scope of this paper. However it may be said that the BTE work is distinguished by considerable disaggregation of passenger movements by route, purpose of travel and whether or not the passenger is in transit. (In the historical data of passenger movements, a transit passenger is counted both on arrival and on departure.) However, the use of these demand equations for predicting future passenger movements is open to much more serious challenge, not only because of the (inevitably) arbitrary nature of forecasts of many of the exogenous variables (and the assumptions relating to future trends in real airfares look particularly fragile) but also because of the need to make assumptions about growth in the supply of direct flights, which will give fewer transit passengers compared with the (significant) numbers observed in past years. Although the BTE report gives the estimated demand equations (in Appendix I), in many cases the units of the variables are not stated, and thus generally it is not possible to explore the sensitivity of the results to changes in the forecast values of the exogenous variables.

3.7 These doubts put on one side, it is worth noting that the median forecast growth rates for passenger movements, averaged over the years 1976 to 1985, are 8.7%, 4.6% and 5.5% p.a. for international, interstate and intrastate services respectively. These rates are lower than those experienced during the earlier years on which the econometric models were calibrated.

3.8 Before these passenger movements can be converted into forecasts of aircraft movements (where a movement is an arrival or a departure), it is necessary to make further supply-side assumptions. It was generally anticipated that there will be a number of structural changes, each having the effect of reducing the number of aircraft movements at Sydney for a given level of passenger movements in Australia; these include trends to higher load factors (percentage of seats occupied), to larger aircraft, to a larger number of direct domestic flights (bypassing Sydney), and to greater use of Melbourne and other Australian airports for international flights (thereby reducing the proportion of international transit passengers at Sydney). The BTE analysis makes some allowance for all these factors, but it is of course difficult to judge how much allowance should be made. Certainly there are doubts about the accuracy of this aspect of the exercise, doubts which are fostered by the naiveté of the assumptions concerning the introduction of Concorde supersonic services - see p. 86 of BTE (1978).

3.9 The principal median forecasts for aircraft movements are reproduced here in Table 1. For the traffic categories employed, the following definitions should be noted:

- interstate airlines: defined *de facto* as Ansett and TAA
- intrastate airlines: all services operated by East-West Airlines, and Airlines of NSW - at present these use Fokker Friendship turbo-prop aircraft
- commuter services : regular airline services provided by companies operating under Air Navigation Regulation 203 (which does not require a full airline licence, but which restricts such operators to aircraft not exceeding a certain weight limit, effectively restricting capacity to not more than about 18 seats)
- other aviation : charter, business, private, flying training, aerial work, etc., involving many aircraft types, but predominantly those which are very small indeed.

TABLE 1 MEDIAN FORECAST OF AIRCRAFT MOVEMENTS AT SYDNEY, 1980 - 2010

(thousands)

Year	1976[1]	1980	1980[1]	1985	1990	2000	2010
Airlines							
international	19.5	20.2	18.4	20.9	21.3	24.5	30.1
interstate	54.1	69.1	59.5	72.0	73.5	100.0	128.1
intrastate	27.6	30.8	28.8	38.0	43.1	50.4	65.3
Commuter	19.5	19.5	35.1	21.0	22.9	26.1	30.6
Other aviation	30.9	38.2	40.0	41.2	44.4	51.6	59.9
TOTAL	151.6	177.8	181.8	193.1	205.2	252.6	314.0

1 Actual movements for the year ending June 30.

Source: Tables 7.1 and 7.3 of Forecasting Report [23], and Table 2 of Cosgrove (1981).

As Table 1 also shows, the forecasters have not had much luck so far: for the three airline categories, the forecasts for 1980 are significantly above the actual outcome (10%, 16% and 7% too high, respectively) while the other forecasts are too low, especially commuter flights (where the outcome is 80% higher than the forecast).

3.10 The forecasts made initially by the BTE are of "what demand would be in unconstrained conditions" and "do not account for the impact congestion may have on these movements" (paragraph 2.2.7 of [23]). Also "the impact on demand of alternative locations for a new major airport for Sydney are not considered" (paragraph 2.2.8). With increased congestion in mind, the Forecasting Consultative Group subsequently made a modest reduction to the forecast movements for the 'other aviation' category, and it is these reduced figures which are included in Table 1. This mention of future congestion brings out the need to consider future pricing and regulatory policy at KSA; see sections 10 and 11 below. Here it is sufficient to note that all movement forecasts should depend upon trends in airport charges, as part of the trends for real airline costs. The report gives no information on this, and it seems unlikely that any major change in pricing policy was envisaged in the course of the forecasting exercise. This apparent omission could be of crucial significance, at least for forecasts for commuter airlines and other aviation. On a related matter, the forecasting exercise provided estimates for 'essential' and 'non-essential' other aviation; the distinction is entirely arbitrary, and the details may be found on pp. 45-6 of [23].

3.11 As Table 1 shows, aircraft movements by commuter airlines and 'other aviation' comprised about 33% of total actual movements in 1976, and 40% in 1980. Such traffic does not require the facilities of a major airport such as KSA, and might be transferred to a lesser airport (see paragraphs 5.2, 7.3 and 11.6 below).

3.12 These macro forecasts were extended (by officers of the Department of Transport, Australia) to give daily time-profiles of aircraft movements, mainly to obtain more insight into the situation at peak periods. Such profiles were developed for an average day, a 'busy' day and a 'busiest' day, and may have some degree of upward bias ([23], paragraphs 2.8.3 and 4). Perhaps the single most important use of these profiles is in the prediction of runway congestion (section 4 below). It may be noted here that the time profile used for that purpose measures the <u>proportion</u> of a day's total movements occurring in each hour of the day. The difficulties of prediction are illustrated by the remark (paragraph 5.4.22 of [28]) that, before its use in making congestion predictions, "the selected profile was smoothed by reducing activity in peak periods to correspond with forecasts" of the manner in which the airport will be operated so as to spread the peaks. Once again we see the need to spell out airport pricing and other policies which will influence airport utilisation.

THE PRESENT KINGSFORD SMITH AIRPORT AND RUNWAY CONGESTION

4.1 The present Kingsford Smith Airport (KSA) is one of the oldest big-city airports in the world, its site at Mascot having permitted successive schemes for expansion, culminating in major extension of the north-south runway southwards by land reclamation from Botany Bay. The present runway layout is shown in Figure 1.

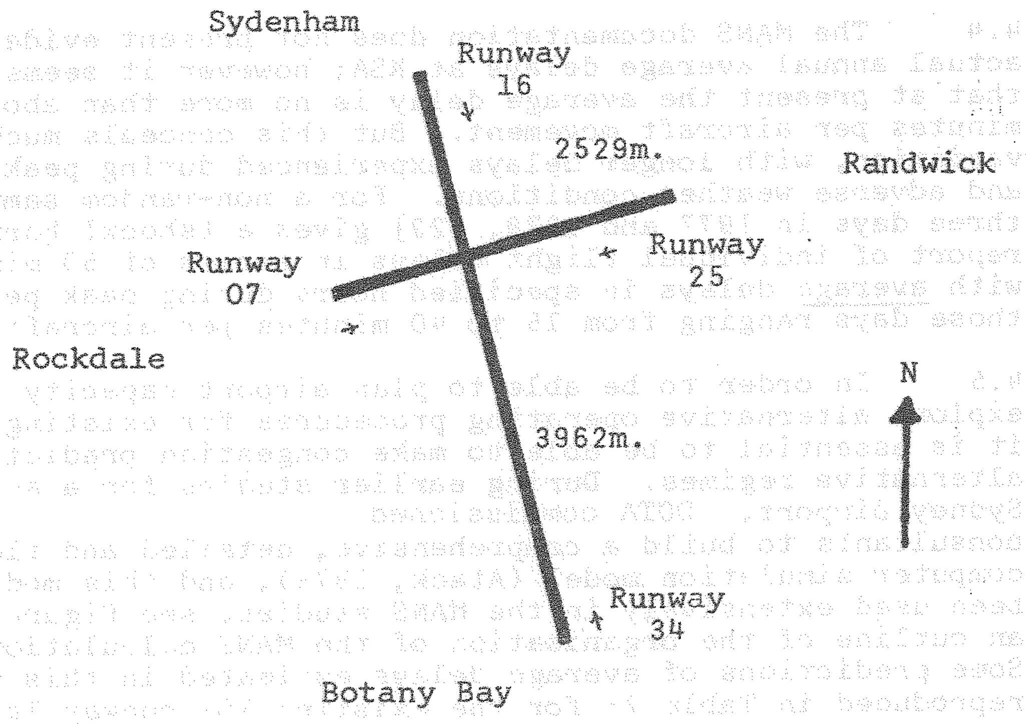

FIGURE 1 RUNWAY LAYOUT AT KINGSFORD SMITH AIRPORT

4.2 Because the airport is so close to densely populated residential and industrial areas on all but its southern boundary, measures are taken to limit the noise nuisance experienced near the airport and in other inner-city areas. There is a curfew between 11 p.m. and 6 a.m. on the operation of pure-jet aircraft; of course, this reduces the total amount of traffic which can be handled at KSA, and pushes up aviation costs. (For impressionistic details of these consequences, see [19] which is an extraordinarily partisan document.) Furthermore, various procedures to reduce noise-nuisance are used by pilots and air traffic control: during the curfew, propellor and turbo-prop aircraft may use KSA, but are directed to land on runway 34 (i.e. approach over Botany Bay - see Figure 1) and to take off on runway 16 (again over Botany Bay), whenever weather conditions permit (as they do most of the time); during other hours, it is mandatory for jets and many other aircraft to use runway 16 for departures (weather permitting), and there is some restriction on runway selection for arriving aircraft. One effect of these procedures is to increase runway congestion compared with that which would prevail in the absence of these noise-abatement procedures (paragraph 5.4.4 of [28]).

4.3 Under these procedures and in reasonable weather conditions, KSA can handle a maximum of about 54 aircraft movements per hour [22]. Because of random fluctuations in aircraft arrival/readiness-for-departure rates, and because of peak/off-peak variations, congestion delays build up as the average hourly rate approaches this figure, and as in any queuing situation, delays increase more than proportionately as traffic levels increase.

4.4 The MANS documentation does not present evidence on actual annual average delays at KSA; however it seems likely that at present the average delay is no more than about three minutes per aircraft movement. But this conceals much variation, with longer delays experienced during peak periods and adverse weather conditions. For a non-random sample of three days in 1977 and 1978, [22] gives a (shock! horror!) report of individual flight delays in excess of 50 minutes, with average delays in specified hours during peak periods on those days ranging from 15 to 40 minutes per aircraft.

4.5 In order to be able to plan airport capacity and to explore alternative operating procedures for existing airports, it is essential to be able to make congestion predictions under alternative regimes. During earlier studies for a second Sydney airport, DOTA commissioned consultants to build a comprehensive, detailed and flexible computer simulation model (Atack, 1978), and this model has been used extensively in the MANS studies; see Figure 2 for an outline of the organisation of the MANS calculations. Some predictions of average delays estimated in this way are reproduced in Table 2: for the existing KSA runway layout and

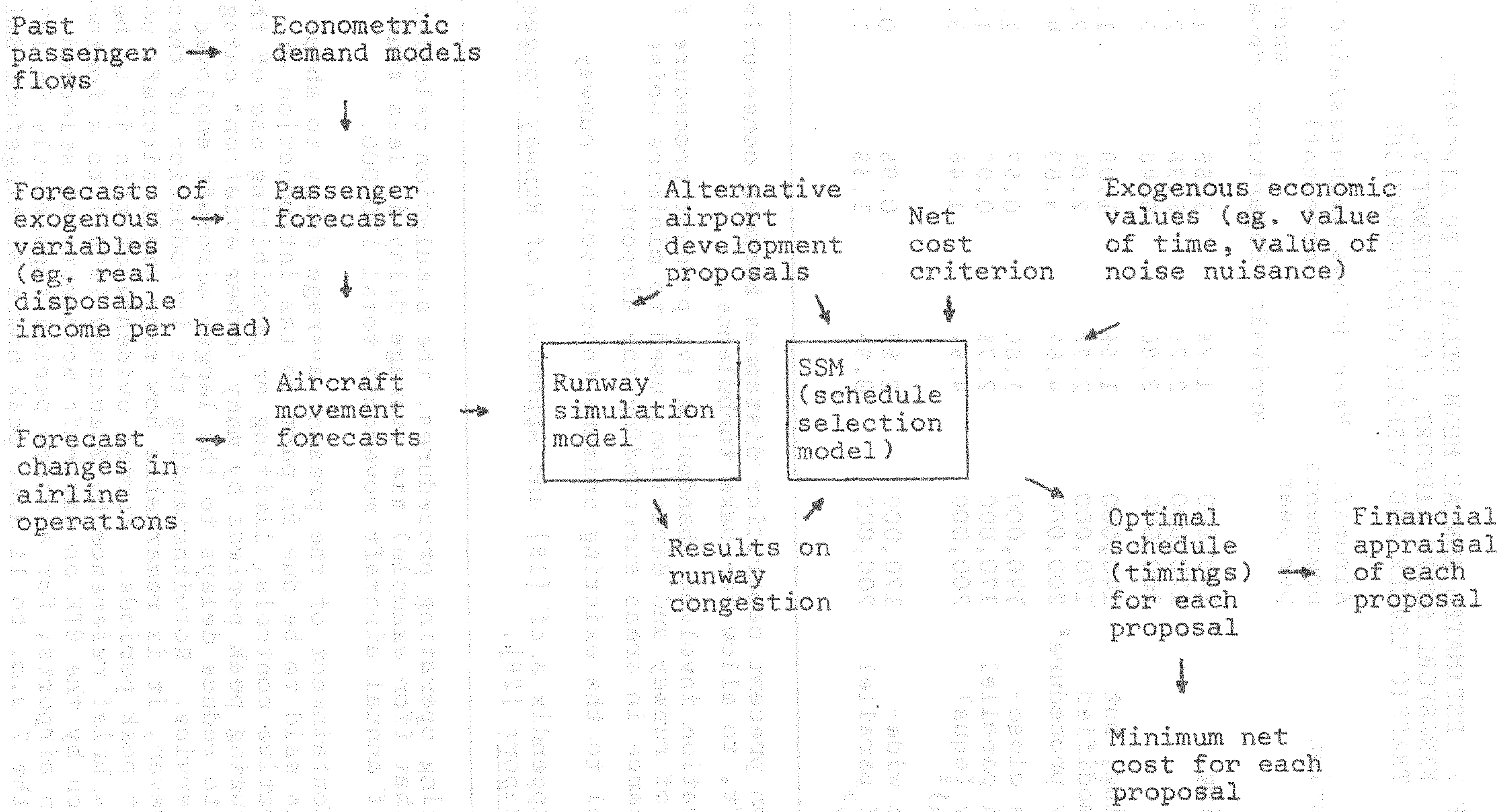

FIGURE 2 FLOW DIAGRAM SHOWING ORGANISATION OF MANS CALCULATIONS

TABLE 2 ESTIMATED ANNUAL MEAN DELAYS[1] TO AIRCRAFT, KINGSFORD SMITH AIRPORT, FOR ALTERNATIVE TRAFFIC LEVELS AND AIRPORT CONFIGURATIONS

Configuration	Aircraft movements per year	Mean delays (minutes/aircraft movement)		
		arrivals	departures	arrivals & departures
1. Existing	140,000	1.28	1.66	1.47
	170,000	2.25	3.36	2.81
	200,000	3.80	6.48	5.14
2. Existing, but with modified runway procedure[2]	140,000	1.58	1.09	1.34
	170,000	2.76	2.04	2.40
	200,000	4.62	3.63	4.12
3. With a close-spaced parallel runway (equal length)[3]	140,000	1.60	0.57	1.08
	170,000	2.78	0.93	1.86
	200,000	4.64	1.46	3.05
4. With a wide-spaced parallel runway[3]	170,000	0.57	0.95	0.76
	200,000	0.84	1.39	1.12

1 Based on present separation distances between consecutive aircraft, to allow for wake turbulence.

2 Modification involves abandoning the present procedure for choice of runway and direction, used to minimise noise disturbance in areas surrounding the airport.

3 Parallel to the existing primary (north-south) runway.

Source: Appendix A of [18] and Appendix A of Runway Congestion Report [28].

the existing operating procedures, the simulation calculations suggest that (for example) the average delay is less than three minutes if annual aircraft movements total 170,000.

4.6 Containment of the present average delay to about three minutes is said to be due in part to the introduction of administrative controls, limiting or prohibiting use of the runways during peak periods by many 'other aviation' categories, in order to reduce delays to the larger aircraft employed in airline service. Notwithstanding the introduction of these rules however, it is remarkable how many small aircraft use the airport at peak periods. Formal evidence of this is to be found in a brief reference by Blackshaw (1981) to a forthcoming publication by the BTE on aircraft movements at selected Australian airports; for a study period (apparently in 1979 or 1980) of the 7 a.m. to 11 a.m. peak hours at Kingsford Smith Airport, commuter services accounted for 20% of total aircraft movements, and other aviation for 26%; put another way, airline movements totalled only 54% of all movements during this peak.

4.7 Conventional aviation wisdom suggests that the practicable capacity of the present airport regime is no more than 200,000 movements per annum (assuming a time profile similar to the 1976 pattern). The argument then is that this level will be reached in a few years' time (unless steps are taken to restrict usage by pricing or regulation). Even at 200,000 movements p.a., the figures in Table 2 suggest that the average delay will not be very great; but the conventional wisdom points to what are regarded as 'intolerable' delays in peak periods. As will be argued below (paragraph 6.4), this approach is in conflict with an economic appraisal which seeks to measure and weigh all the costs.

THE AIRPORT DEVELOPMENT PROPOSALS

5.1 Runway congestion may be reduced by restricting the amount of traffic and/or increasing airport capacity by constructing new runways (and perhaps by altering operating regimes). The emphasis in the MANS study is on the construction of more runways. The only major exceptions are the so-called Base Cases (considered later, in section 8) which propose alternative ways to restrict traffic to a level of about 195,000 aircraft movements per annum. All the other proposals are for airport development, at KSA and/or at a Second Sydney Airport (SSA), to provide capacity sufficient to handle the predicted levels of aircraft movements shown in Table 1. (Save that in some of these development proposals, certain categories of light aircraft are to be excluded from KSA and transferred to Bankstown Aerodrome, with consequential development proposed for Bankstown and Camden airports.)

5.2 The development proposals may be summarized thus:

(a) Construction of a second airport: six potential sites were examined in detail, and for each of these, two (alternative) roles were considered. The so-called K role has KSA handling all international traffic, while in the S role all international traffic is handled at the SSA. (Closure of KSA was not considered.)
(b) Runway development at KSA: five runway options were considered in detail.
(c) Traffic management measures at KSA:
 (i) HICAP - abandonment of the present preferred-runway procedure (used to limit noise nuisance), in order to increase runway capacity.
 (ii) EXCL - the exclusion by administrative decree of some or all of the following traffic categories (with the exclusions beginning in the same or different years):
  NOA 'non-essential' other aviation;
  C commuter aircraft;
  I non-jet aircraft of intrastate airlines.

5.3 Of the six SSA sites, those lablelled SW4 and N1 seem to be superior on most criteria ([26] and [16]). This paper includes details only for SW4; this site is to the south-west of the city (west of South Creek and near Badgery's Creek) and the main runways would be aligned approximately east-west. This and the other sites are intended to have capacity for two pairs of primary runways, and two secondary (cross) runways.

5.4 Of the five KSA runway development options [20], three are included here:

(i) CSPE (closed spaced parallel equal threshold - to the east of, close to, and the same length as, the present north-south runway;

(ii) WSPE (wide-spaced parallel east) - to the east of, and well apart from, the present north-south runway; alternative lengths (e.g. 2000 metres) were considered;

(iii) STOL (short take-off and landing) - a runway of 800 metres in length, parallel to, and to the east of, the existing north-south runway.

For a single-runway airport, the addition of a wide-spaced parallel runway (at least 1500 metres from the initial runway) permits the two runways to operate independently, and thus airport capacity is doubled. With a close-spaced parallel runway, aircraft movements on the two runways interact, and thus the two runways have to be controlled together; capacity increases by about 40%. However, in the present KSA layout, the intersecting east-west runway is used concurrently with the main north-south runway in order to increase airport capacity; the construction of a new runway in this context would give smaller capacity increases than those quoted above. (See also paragraph 11.3 below.)

5.5 Tables 3 and 4 give a sample of the data on capital costs. It should be noted that all the KSA proposals, including those with no runway development, NRD, (at KSA, that is), postulate considerable expenditure on terminals etc., and this requires some land reclamation from Botany Bay. Although it is claimed that this expenditure is necessary if the airport is to handle more airline traffic, there is a suspicion that the engineering plans which have been costed may be unduly lavish; cf. paragraph 11.2 below.

THE ECONOMIC APPRAISAL IN THE MANS STUDY

6.1 These alternative development strategies were appraised by the Evaluation Consultative Group, using a restricted form of cost-benefit analysis. As is clearly explained in the Economic Report (paragraph 2.2.3 of [23]), the MANS study "was unable to evaluate the major social benefit and some of the social costs". "Lack of suitable data on what travellers would be prepared to pay for the use of airports in the Sydney region or ready access to such airports, precluded evaluation of the total benefit to consumers from such facilities."

TABLE 3 CAPITAL EXPENDITURE TO BE INCURRED BY COMMONWEALTH GOVERNMENT, FOR SOME SELECTED MANS STRATEGIES[1]

(undiscounted) $ million (1977 prices)

Strategy[2]	Aggregate (undiscounted) capital expenditure					
	Land acquisition	Site preparation	Airport construction	International relocation	Defence relocation	Total
1. KSA - NRD[3]	0	85	95	100	-	280
SSA - SW4	60	130	50	0	25	265
						545
2. KSA - STOL	0	85	105	100	-	290
SSA - SW4	60	130	50	0	25	265
						555
3. KSA - CSPE	0	125	115	100	-	340
SSA - SW4	60	130	50	0	25	265
						605
4. KSA - WSPE	35	130	105	100	-	370
SSA - not needed						
5. KSA - NRD[3]	0	85	65	70	-	220
SSA - SW4	60	145	125	80	25	435
						655

[1] Median traffic forecast, with 'non-essential' other aviation traffic excluded; expenditure common to all strategies has been excluded.

[2] Strategies 1 to 4 have all international traffic at KSA: strategy 5 has all international traffic moving to SW4 when the SSA is opened (in 1995, in the case of this strategy).

[3] NRD = no runway development at KSA.

Source: Appendix I of Airport Planning [16].

Similarly it was not possible to prepare a monetary evaluation of environmental impacts other than aircraft noise nuisance. Accordingly it was decided "to calculate the net social cost (the present value of the quantified social costs less any quantified social benefits)".

6.2 As the report itself indicates, ranking of the strategies according to this net social cost will be a helpful guide to the decision maker only if two conditions are met:

"(a) The total benefits to consumers which have not been evaluated are exactly equal for all strategies;

(b) The total benefits to consumers exceed the calculated net social cost."

TABLE 4 AIRPORT CONSTRUCTION COSTS (FOR ALL PARTIES) FOR SOME SELECTED OPTIONS

(undiscounted) $ million, 1977 prices

Airport:	KSA	KSA	SW4	SW4
Option :	NRD[1]	CSPE	K role[2]	S role[3]
Site preparation (including land reclamation)	41	38	91	119
Runways, taxiways, etc.	-	42	151	313
International airlines				
- terminals	104	104	-	164
- airline buildings	41	41	-	109
- other	48	48	-	57
Interstate airlines				
- terminals	58	73	75	53
- airline buildings	63	63	68	49
- other	29	33	33	21
Intrastate airlines				
- terminals	5	5	15	11
- airline buildings	7	7	3	7
- other	13	11	14	13
Other	43	64	48	39
Total	452	529	498	955

[1] NRD = no runway development at KSA

[2] K role = all international traffic remains at KSA

[3] S role = all international traffic moves to SSA (here, at SW4)

Source: Tables 3.07, 3.08, 3.18 and 3.24 of Airport Planning Report [26].

For the strategies involving more runways, the first of these conditions is largely satisfied; to the extent that it does not hold exactly, an attempt is made to allow for the (small) difference in gross benefits to airport users - this is discussed below in paragraph 6.10. Since the Base Cases imply major restrictions on airport use, however, the condition is seriously breached there; this is discussed later, in section 8.

6.3 The appraisal makes no attempt to show that the second condition is met. But, as is pointed out in paragraph 2.2.5 of [24], even if this condition does not hold, this "does not change the *relative* economic merit of the strategies in question" provided the unquantified social costs and benefits are the same for each of the strategies. In other words, if the decision-makers are determined to go ahead with a runway-development strategy, then the net social cost analysis does provide a good guide as to which one to choose.

6.4 In the economic analysis of any one development proposal, there are many choices as to the timing of the components: for example, when to build a new runway at KSA, when to exclude a class a traffic from KSA, and when to build a SSA. Thus a principal task is to find that version of the proposal which minimises net social cost, for that proposal. To do this it is necessary to compare runway congestion costs with the costs of providing additional runway capacity. Postponement increases the former, and reduces the present value of the latter costs. Thus, if these various cost elements are satisfactorily estimated for the purpose of the economic analysis, the optimal timing of the components could be determined by minimising (discounted) net social cost. However, instead of relying solely on this optimisation, the Evaluation Consultative Group decided to impose an exogenously-determined standard for the quality of service: the calculations were performed in such a way as to ensure that average runway delays did not exceed a certain level, based on perceptions of what the aviation industry would regard as acceptable. The effect of this procedure is to constrain the economic choice of timing of runway developments, and sometimes to lead to slightly earlier construction of additional runway capacity than would be the case if the timing were determined solely by a balancing of the costs included in the model. Paragraph 2.4.7 of [24] offers a rationalisation for this procedure when it refers to "levels of runway congestion which would produce significant disruption in other parts of the [Australian] airport network", and notes that "it was impossible (because of an absence of data) to evaluate the cost of this disruption". However, there is a risk that the procedure favours investment which is 'too early', even on a more comprehensive net cost criterion; see also paragraph 6.6 below.

6.5 The determination of the timings of all the components of any one development proposal is far from being a trivial calculation, since it requires examination of a large number of alternative possibilities. For each such proposal, the calculation to find the optimal schedule (subject to the congestion level constraint) was carried out by a computer model, called the schedule selection model (SSM) and developed by consultants for the earlier Sydney Airport Study; this model uses dynamic programming to search among the many discrete alternatives. See also Lack et al. (1979); and Figure 2 above shows how the SSM is deployed in the MANS calculations.

6.6 The economic appraisals were made in present value terms (usually at a real discount rate of 10% p.a.), for a 35-year period (1976-2010). Costs and benefits were discounted back to the year 1977, and in the main these were measured in 1977 prices; the exceptions were cases where changes in real prices (i.e. money prices relative to the general price level) were anticipated - these are discussed in the following paragraphs. The types of costs included in the net (social) cost criterion are described in paragraph 2.6.3 of [24]; a brief identification is given here in Table 5. There is always a problem in an optimisation analysis with a finite time horizon: if true (overall) optimisation (i.e. under an infinite horizon) requires a major investment just before the finite horizon, the restricted (finite) optimisation may reject this investment because it recognises all the capital outlay but only those benefits accruing before the horizon. In the present model, a 35-year horizon with a 10% discount rate means that any such error will have a negligible effect on the aggregate net cost. But the investment programme details could be seriously misleading. The use of the quality-of-service constraint (paragraph 6.4) will reduce the risk of error, as will the (rather unusual form of) residual-value calculation included in the analysis. The nature of the results is such that in nearly all cases, it is clear that no such error has arisen.

6.7 Aircraft noise nuisance was valued using techniques developed in the earlier Sydney Airport studies. On this basis, it was supposed that the annual value of the noise nuisance per house in 1977 ranged from $194 to $749, depending on the degree of noise exposure, and that the real value of noise nuisance for a household with given noise exposure would increase by 5% per annum. It was also assumed that 20% of households subjected for the first time to a noise level of 30 NEF or more, would move away from the area; each such removal was costed at $5,120.

6.8 The assumed values of time for air passengers were (for 1977):

	$ per person per hour
domestic flights	
- business passengers	6.93
- leisure passengers	1.95
international flights	
- business passengers	3.82
- leisure passengers	1.95

These values were supposed to increase (in real terms) by 3% per annum - see Appendix B of [33]. They were used in assessing both access costs (travel to and from the airport) and aircraft delay costs. No explanation is provided for the difference between the valuations for domestic and international business passengers; this difference may significantly influence the choice of airport for international passengers (paragraph 7.3 below).

6.9 Aircraft operating costs were also taken to increase over time (to reflect supposed rises in the real cost of labour and of aviation fuel).

TABLE 5 COST ELEMENTS INCLUDED IN 'NET COST' IN THE ECONOMIC APPRAISAL

Category	Components
1. Airport	- capital and operating costs for KSA, and SSA where relevant
2. Airline	- capital costs - additional operating costs of splitting services between two airports (where relevant)
3. Aviation	- route and taxiing costs to airlines, reflecting differences in distance for different airport locations and layouts
4. Re-location	- cost of re-locating defence and other installations not compatible with the particular development strategy
5. Aircraft delay	- cost of runway congestion: aircraft operating costs and passenger time costs
6. Access to airport	- capital costs (the additional cost of upgrading the Sydney road network to cope with airport-generated traffic) - user costs (vehicle resource and passenger time costs of airport surface traffic, and congestion costs imposed on non-airport related traffic)
7. Demand suppression	- loss of consumer surplus (value of the trip to the traveller, less the time and resource costs) for journeys suppressed in two cases: (a) if no development at KSA, airport capacity limits passenger movements to a total less than the forecast (b) if SSA established, longer surface journey discourages some passengers and hence total is less than otherwise forecast
8. Aircraft noise	- annual value of noise nuisance - costs of householders moving out of an area because of noise
9. Urbanisation	- costs of additional land consumed by households, facilities and services - costs due to under-occupancy of housing when people move away from areas close to developing airports
10. Residual value	- value of any runway capacity still not in use by the end of the study period (see text for explanation).

Note: Many of these cost measures are incremental costs i.e. extra costs of a strategy over and above the levels which would prevail no matter which strategy is chosen.

Source: Section 2.6.3 of the Economic Report [24].

6.10 In the runway development proposals in general, the perceived cost to passengers would rise in real terms whenever there are significant increases in runway congestion and road congestion at KSA, and also when the SSA is opened, because of the longer journey time to the more distant airport. These effects would reduce the amount of travel, leading to a loss of gross benefit. An attempt was made to allow for this in the net cost criterion, under the heading of demand suppression. The method used is essentially the same as that used for the Base Cases, and so the discussion of the method is postponed until section 8. Except for the Base Cases, the estimated cost of demand suppression is small, and has little impact on the comparisons of total net cost.

SOME RESULTS OF THE ECONOMIC APPRAISAL

7.1 The results are presented and discussed in some detail in the Economic Report [24]; more detail is to be found in the supporting paper [40]. The present values of the costs of alternative development strategies are all large, and the differences between them are often proportionately modest; nevertheless the absolute differences range up to $400 million, and it seems that many of the cost differences are large enough to be significant, even after allowing for likely errors in the data.

7.2 The range of development strategies evaluated is such as to enable exploration of many of (but not all) the important trade-offs inherent in the situation. As already noted, postponement of runway construction reduces the present value of airport construction costs at the price of higher congestion costs. By delaying runway construction, the HICAP strategy (which obtains more effective capacity from the existing KSA runways by abandoning the noise-preferred runway selection procedure) saves on congestion and construction costs at the expense of more noise nuisance for those living or working near the airport. Similarly, exclusion of smaller aircraft from KSA saves on congestion and construction costs at the expense of possibly higher costs for those excluded. (These costs of exclusion were omitted from the SSM calculations; see section 7.7 below.)

7.3 A sample of the more important results is given in Table 6. Traffic exclusion, abandonment of noise restrictions (not shown in Table 6), and an additional runway at KSA (each taken separately) serve to postpone the date when it is optimal (or necessary, to satisfy the congestion constraint) to open the SSA. Furthermore, progressive traffic exclusion and abandonment of noise restrictions both significantly reduce the present value of the aggregate net cost. However, construction of the CSPE (one of the more promising runway development options at KSA) leaves aggregate net cost largely unaffected: as shown by the details in the table, the CSPE (with SW4 later) is marginally better than NRD (with SW4

TABLE 6 SELECTED RESULTS OF THE NET COST ANALYSIS

KSA			Airport for international traffic	SSA at SW4	Net Cost
Option	Traffic excluded	Timing of runway		Timing of opening	(present value, $m)
NRD	None	-	KSA	1987	2,500
	OA	1987(2)	KSA	1995	2,330
			SSA	1995(1)	2,547
	OA + C	1995(2)	KSA	2001	2,175
			SSA	2003(1)	2,269
	OA + C + I	2001(2)	KSA	2008	2,100
			SSA	2009(1)	2,133
CSPE	None	1980	KSA	1996	2,466
	OA	1984	KSA	2005	2,323
			SSA	2008(1)	2,394
	OA + C	1989	(3)	-	2,212
	OA + C + I	1989	(3)		2,145
Base Case					2,136

Notes: The median traffic forecasts are used, adapted for demand suppression or traffic exclusion, as appropriate. Traffic categories:

OA 'non-essential' other aviation
C commuter
I intrastate non-jet aircraft

The columns on 'timing' indicate year of opening, etc.

(1) denotes that the timing is not an economic optimum: instead opening of SSA is triggered by KSA reaching attainable capacity (as defined)

(2) denotes year of exclusion of (incremental) traffic category

(3) the CSPE development gives sufficient total capacity at KSA up to year 2010; thus SSA not required until after 2010, and international traffic remains at KSA up to the horizon.

Results in this table are for a SSA located at SW4.

Source: Derived from Tables 4 and 5 of Economic Report [24], and Appendix of [8].

later) if no traffic is excluded, but marginally worse if all three traffic categories are excluded. (The results for the Base Cases are considered in section 8.) In all cases where the comparison is made, aggregate net cost is higher when international traffic is assigned to the SSA than it is with international traffic remaining at KSA. (This reflects the higher capital cost of building the SSA to international standard, the cost of re-locating the Qantas maintenance base, and the additional cost of surface access.) Not covered by the results in Table 6 are site-comparisons for the SSA: some alternative sites give substantially similar results, with N1 as good as SW4 (cf. Table 3.1 of [40]).

7.4 Examination of the detailed results of the computer runs gives insight into the trade-offs. The (assessed) noise cost varies little in the various alternative cases, and abandonment of the noise-preferred runway procedure adds only $5 to $10 million to the present value of the noise cost for the NRD cases at KSA; savings under other headings (notably airport, airline and access costs) easily outweigh this effect.

7.5 The choice of role for the SSA affects not only the cost of construction of the new airport but also its timing. Since its access costs are higher (per passenger) the new airport is opened a few years later if it is to be used for international traffic than if it is to be used for domestic traffic; this follows because international flights have more passengers per aircraft, and optimisation postpones the date at which these extra annual costs are to be incurred in order to achieve congestion cost savings.

7.6 A greater impact on the SSA timing comes from the decision to build an additional runway at KSA. Compared with no runway development, the CSPE (for example) gives a postponement of about 10 years, in most cases, because of the reduction in annual runway congestion costs at KSA; however, because high levels of KSA congestion are accepted for more years, the total cost of such congestion rises; access costs are reduced by the postponement of the SSA, and this is particularly important for the cases with international traffic at the SSA.

7.7 Also of considerable importance, for their impact both on aggregate net cost and on the timing of the SSA, are decisions on the exclusion of certain traffic categories. As shown in Table 6, exclusion of all three categories postpones the SSA by at least eight or nine years, compared with no exclusion at all. The main economic consequence of such exclusions is a reduction in aircraft delay costs, but there is also a significant reduction in (the present value of) airport costs by virtue of the postponement of airport development. The present value of aggregate net cost is reduced by about $300 million, when the CSPE is built; for the case of no runway development at KSA, the saving is about $400 million.

The figures shown in Table 6 are those used in the economic analysis. However, as pointed out on p.18 of [40], the comparison needs to recognise the cost of diverting this traffic to other airports; it appears that this cost was never included in the economic analysis using the schedule selection model. Much of the missing data is developed elsewhere, in the Airport Planning Report [26], pp.168-174, where it is argued that the displaced traffic categories would be accommodated at Bankstown and Camden, and that the major significant incremental costs are those relating to airport capital costs. Total (undiscounted) expenditure is put at about $27 million for exclusion of the first two categories, and a further $41 million for non-jet intrastate traffic. For all three categories, the contribution to the present value of net cost is only about $30 million, and this is so small that the previous conclusions are not significantly affected.

THE BASE CASES

8.1 Unlike all the development proposals considered in the previous sections, the Base Cases suppose no runway construction whatsoever. Furthermore, there is no administrative exclusion from KSA of any particular class of traffic (considered as a whole). Instead, once the total of aircraft movements reaches the 'attainable' capacity of the airport (regarded de facto as 195,000 movements p.a.), steps are taken to prevent any further increase in the total amount of traffic seeking to use the airport. Three alternative ways of doing this are considered:

- Base Case 1: each class of aircraft traffic is restricted (by decree) to the number of annual movements then reached;
- Base Case 2: a uniform surcharge per passenger is applied, just sufficient to keep total aircraft movements within the attainable capacity (and this implies a surcharge which increases over time);
- Base Case 3: as for Base Case 2, except that a uniform surcharge per aircraft is applied.

8.2 When assessed by the net cost criterion, it is obvious that the net cost of the Base Cases is reduced to the extent that there is no capital expenditure. Now each Base Case provides for much less traffic than do the various development proposals (as is easily seen from Table 1). However, the net cost does not include a measure of total gross benefit (i.e. value of the airport facilities to the passengers, before they pay for the use of airport capacity). Thus to enable proper comparison between the Base Cases and the runway development proposals, it is necessary to include in the net cost criterion a measure of the reduction in gross benefit which attends each Base Case. (In the MANS documentation a reduction in gross benefit is called a 'cost of demand suppression'.)

8.3 This loss of gross benefit is taken in practice to be the area under the relevant section of the market demand curve; for the technical details, see [39]. The empirical estimates are made from the demand functions obtained in the BTE forecasting study, and depend on the assumption that the demand elasticity is constant throughout the relevant portion of the demand curve. For major movements along the demand curves (as in the assessment of the Base Cases), the assumption may lead to significant estimation errors.

8.4 Furthermore there is an important conceptual shortcoming in the approach. It implies that suppressed passenger trips are not made at all. However, in practice, the pressure of limited runway capacity will lead to various reactions other than outright loss of the trips: passengers will to some degree substitute other transport modes, other times for their journeys, other routes or other destinations; also airlines will increse load factors and substitute larger aircraft (at least in Base Case 3 with the surcharge per aircraft); airlines will substitue more services which bypass Sydney; and commuter airlines will substitute use of the smaller Sydney airports for use of KSA. These responses are not recognised in the calculations of demand suppression costs, and hence the loss of gross benefit is overestimated, since the alternative arrangements will yield <u>some</u> gross benefit. The Evaluation Consultative Group did eventually recognise this point (see paragraph 2.7.28 of [24]), but found that lack of data prevented much in the way of appropriate refinement of the calculations. (However, see also paragraph 8.8 below.)

8.5 In some of the runway development proposals also, there is a noticeable reduction in the volume of passenger movements, this time because of higher perceived costs to the passengers (as indicated in paragraph 6.10 above). The calculation of the consequent loss of gross benefit is done in precisely the same way as for the Base Cases, and the same empirical and conceptual criticisms apply. However, the estimated loss is never at all large (usually a present value of less than $25 million), and so the importance of the criticisms is here much reduced.

8.6 However, in the Base Cases the costs of demand suppression, <u>as estimated</u>, are very large, as shown at the bottom of Table 7. Base Case 1 is particularly ill-conceived, since (for example) it involves suppression of a significant number of international flights, each carrying large numbers of passengers, in order to accommodate the previous level of commuter flights, each carrying only a small number of passengers. Not surprisingly, there is a very great loss of gross benefit, and in consequence the aggregate net cost for Base Case 1 is very high. A priori, Cases 2 and 3 are more sensible; as is to be expected, Case 3 gives the smaller suppression cost and the lower aggregate net cost, because the reduction in flights, and hence passengers, falls to a greater

TABLE 7 ANALYSIS OF THE THREE BASE CASES

Passengers in 2010 (millions)	Forecasts[1]	Base Cases 1	Base Cases 2	Base Cases 3
International	11.5	8.5	11.0	11.3
Interstate	29.9	21.1	18.2	21.6
Intrastate and commuter	3.3	2.3	2.5	2.0
Total	44.7	31.9	31.7	34.9
Aircraft movements in 2010 (thousands)				
International	30	22	29	30
Interstate	128	90	77	92
Intrastate and commuter	97	68	74	59
Other	20	14	14	14
Total	275	195	195	195
Present value of aggregate net cost ($ million)				
normal elasticities (based on demand forecasts)		3,407	2,671	2,505
previous elasticities x 3		3,015	2,566	2,416
Present value of suppression cost ($ million)				
normal elasticities		1,708	732	448

[1] Median forecast, but with other aviation movements reduced to reflect administrative restrictions on the use of KSA.

Source: Tables 7.1 and 7.2, Paper Econ-3 [40].

extent on intrastate and commuter traffic rather than on international and interstate. (When the shortage is of runway capacity, it is intuitively obvious that the better results will be obtained by a direct charge per aircraft - and a uniform charge, on the assumption that all aircraft movements take essentially the same time - while the indirect method of a uniform surcharge per passenger will be less satisfactory; the point is established rigorously by Park (1971) in a theoretical model, which however does not represent all the complications to be found in the present situation.)

8.7 Because of the difficulties (already discussed) of measuring demand elasticities for major movements along the demand curves, the results for the Base Cases are particularly unreliable; in order to explore this aspect, alternative calculations were made using elasticities which are three times larger than those embodied in the demand forecasts; as shown in Table 7, these alternative calculations give somewhat lower net costs, but the aggregate figures are still relatively high. On this basis, the MANS study concludes (on p.23 of [40] that "these results indicate a severe economic penalty if no runways are built during the period". Even if these calculations were on a satisfactory basis, this criticism would have to be regarded as being excessive.

8.8 However, in later work in the MANS study (paragraph 2.7.32 of [24]) a further calculation was made to allow for the principal reaction of airlines; it was assumed that average load factors would increase to 85% in response to the surcharge on aircraft movements. This calculation gives a net cost of $2,136 million, and it is this figure which is shown in Table 6 as a proxy for the cost of the (best) Base Case. The argument in [24] is that this calculation provides a better indication of net cost than the calculations summarized in Table 7.

THE FINANCIAL APPRAISAL

9.1 The financial study [25] gives a financial ranking of the principal strategies selected in the course of the economic appraisal. It differs from that economic appraisal in that:

(a) it excludes all costs and benefits for which there is no cash representation;
(b) it substitutes cash valuations where the economic appraisal uses shadow prices (resource costs); and
(c) it <u>does</u> include airport revenues (whereas the economic appraisal does not attempt to value all benefits - cf. section 6 above).

Its scope was confined to measuring the financial impact on the Commonwealth and NSW governments, and even there a number of simplications were made: airport-induced expenditures on <u>other</u> infrastructure (i.e. the impacts on the provision of eg. water, sewerage and power for other, non-airport, users) have been ignored, as has the financial impact (if any) of possible restriction, as a result of the development of KSA, on the use and development of Botany seaport.

9.2 Although the drafting of the financial report [25] is not altogether clear, the main point in the report is a ranking of alternative proposals by reference to a concept of 'cumulative cost recovery' which appears to be defined as the cumulative net cash flows (revenues net of costs), without time-discounting, but with some allowance (at rates not specified) for the inclusion, on the cost side, of depreciation and interest charges. For each proposal, these cumulative sums are prepared for each year up to the horizon of 2010. While such computation on the basis of cash flows may be useful in portraying the impact of any proposal on the government budget, the procedure does not make adequate allowance for the value of capital assets remaining at the time horizon (2010). This invalidates some of the ranking comparisons between proposals (notably those comparing the addition of capacity at KSA with the construction of the SSA). Nevertheless it is worth noting two of the report's conclusions:

(a) "From a financial point of view the Base Cases involving no runway development in the Sydney Region appear to be the least expensive solution. However, they require substantial changes in the market preferences of consumers which could cause variations in community and user attitudes towards airports. These changes are not amenable to financial analysis." (Paragraph 3.5.15)

(b) "On strict financial criteria there is no penalty at all attendant to delaying a decision on the desired strategy. In fact delayed decisions will suppress traffic and ... this could be the most financially desirable strategy for the Commonwealth Government. Alternatively traffic up to and including non-jet intrastate standard could be diverted as required from KSA to other airports in the region. This would be the next most financially desirable strategy." (Paragraph 3.5.20)

9.3 For the development proposals with early construction expenditure, the cumulative cost recovery totals are strongly negative in the early years, and then improve in later years as the further cumulation brings more revenue into the sum. These revenue figures are based (paragraph 2.2. of [36]) on DOTA pricing policies designed to secure full recovery of attributable costs (cf. section 10 below); except for the Base Cases, they appear to rest on the assumption that demand is wholly inelastic. Furthermore "it is expected that the cost of the selected airport strategy would be borne by the industry and users of the facilities". However, "capital expenditure 'peaking' may be sufficiently severe for all development strategies to require special funding arrangements or a reconsideration of the timing of development" (paragraph 3.5.17 of [25]). All these points illustrate the vital importance of first spelling out pricing and funding policies before undertaking the investment appraisal. This issue is avoided in the MANS study, but is considered below in paragraphs 11.7 and 11.8. To prepare the way, the next section reviews existing and possible future charging policies.

AIRPORT CHARGES

10.1 At present, the Commonwealth levies 'air navigation charges' (ANCs) which are composite charges for the use of air navigation and search and rescue services as well as airports. These charges vary with the weight of the aircraft and also depend on the purpose for which the aircraft is used. Except for very light aircraft, the charges increase approximately proportionately with weight. (See Chapter 9 of DOTA (1981) and pp.295-305 of BTE (1981).)

10.2 Aircraft operated by holders of airline licences (corresponding to the international, interstate and intrastate categories in the MANS study) pay charges on a per flight basis, and the charge depends not only on weight but also on the nature of the flight-sector, i.e. its length (and hence the use made of (Australian) air navigation facilities) and whether or not the airports at both ends of the flight-sector are in Australia. The following are examples based on scales applicable in early 1981:

Boeing 727-200	Sydney to Brisbane	$ 327
Boeing 747B	Sydney to Perth	$3,495
Boeing 747B	Sydney to Nandi	$1,659

If the aircraft has a load factor of 67% (for instance), the charges in these examples are equivalent to charges of $6 to $12 per passenger.

10.3 For the commuter and 'other aviation' categories of the MANS study (categories which together are described commonly as 'general aviation' (GA)), ANCs are levied on an annual basis, with the fee varying with the category of operation (private; aerial work; and charter, including commuter services) in the ratio 1 : 2 : 2.5. Some typical annual fees are:

	take-off weight (kg.)	private $	charter $
Cessna 150	680	94	234
Embraer Bandeirante	5,670	2,129	5,324

(The Cessna 150 is a small, light aircraft, while the Bandeirante typifies the largest of the aircraft used for commuter services.)

10.4 The various airport costs which are regarded as attributable are aggregated over all DOTA airports. Together with the non-airport costs, these are allocated to the various traffic categories (traffic flows at all airports). These allocations are inevitably arbitrary, and the total cost to be allocated is (arguably) too small to represent the full opportunity cost of the provision of facilities. While DOTA seeks ultimately to recover all its (allocated) costs, at present this target is reached only for international flights; for commuter and other general aviation, only about 15% is recovered - see p.87 of DOTA (1980).

10.5 The system of annual fees for GA does not impose any direct charge for the use of airport runways, and thus there is effectively no use of the price mechanism to ration scarce runway capacity. For airline services, however, the charging is much more direct but is still only loosely related to costs. Each airline movement occupies the runway for essentially the same amount of time, and on grounds of pricing efficiency this would suggest uniform charges wherever there is a significant degree of congestion. The present system, whereby charges vary with aircraft weight, implies a measure of discrimination, on the basis of (presumed) demand elasticities (ability to pay), as well as differentiation on the basis of wear-and-tear and other variable costs of runway provision.

10.6 In 1979, the Department of Transport established a committee to study general aviation, and this has led to the recent publication of two BTE papers - BTE (1980 and BTE (1981) and a report - DOTA (1981) - by the Department committee itself. This report recommends the introduction of GA aircraft movement charges of $20 per movement (landing or takeoff) at primary capital city airports (such as Sydney KSA), $10 per movement at selected shared airports (eg. Canberra, Tamworth), and $4 per movement at major GA airports (eg. Bankstown, Camden). The proposal is to introduce these gradually over a 5-year period; they would be in addition to the existing annual ANCs, and would materially increase the cost recovery rate. It is noteworthy that they do not discriminate by aircraft weight. The new scheme would make little difference to the total payment made by many private operators (especially those whose aircraft are based in country areas), but would have a major impact on charter and commuter operators presently using primary capital city and other major airports - see Chapter 12 of DOTA (1981).

10.7 If implemented, the proposed scheme would constitute the first major change to the style of ANCs since their introduction in the late 1940s, and it prompts the obvious question: what further changes are contemplated? The DOTA committee itself refers to various possibilities:

(a) It recommends "the objective be adopted of placing commuter operations on a new charging system involving route-charge related ANCs in place of [annual] lump sum ANCs, plus movement charges at selected airports. It is considered appropriate that a similar charging system be investigated for application to the airline sectors". (Section 17.2.)

(b) "It could be argued that a higher level of charges [than that here proposed, for GA aircraft] would be appropriate at some airports. For instance, airports which are already operating close to full capacity could be considered in this light." (Section 12.3.2.)

(c) "An additional refinement could involve a surcharge to be levied on aircraft movements at those airports where additional facilities are necessary to handle operations during peak periods." (Section 10.11.2.)

In short, the Departmental committee joins earlier commentators (see eg. Mills (1980)) in envisaging a change to a system in which charges are more closely related to costs. It not merely proposes the introduction of GA aircraft movement charges, but envisages the possibility of peak surcharges for GA, and of route-specific ANCs for commuter flights. It also envisages the extension of these arrangements to airline traffic as well. Although the costs on which the committee focuses attention are the financial outlays of the Commonwealth government rather than the delay costs which are the principal relevant (social) cost in the MANS study economic appraisal, such a scheme of aircraft movement charges could nevertheless have considerable implications for future traffic levels at KSA; these implications are considered in the following section.

10.8 Before leaving the subject of airport charges, however, it has to be noted that the Minister for Transport announced on July 16, 1981 that the government had rejected the cost recovery recommendations of the general aviation report. This decision followed intense and ruthless lobbying by the commuter airlines and the major charter operators, who claimed that the general aviation industry would be largely destroyed if the charges were introduced.

CRITIQUE OF THE MANS STUDY

11.1 The MANS calculations could and should be extended in a number of ways. One potentially important extension is to consider alternative values for the exogenous variables; while the SSM has already been used to quantify a number of alternatives, some other sensitivity analyses are probably worth doing. In particular, a number of economists have expressed surprise that the assumed valuations for noise nuisance are so low. It would surely be worth reworking the calculations with significantly higher values, and this is something which may be of particular interest to the NSW government.

11.2 Another extension is to consider a further list of development and non-development proposals. In the former category come some possibilities for useful re-examination of the engineering aspects of development at KSA. The present airport site is sufficiently crowded to make further development more expensive than might commonly be expected. Nevertheless, examination of the alternative airport layout plans given in [26] suggest that for some of the proposals at least, unduly lavish engineering standards may have been applied. For those who are not professionals in airport planning, it is of course difficult to judge this issue. However, the comment by Qantas that "a $100 million [international] terminal expansion at KSA prior to 1995 seems excessive", seems to support the hypothesis. Even the Commonwealth members of the MANS committee may be hinting at the general proposition when they urge "development of a master plan to minimize reclamation of Botany Bay for terminals and other ground facilities" (paragraph 3.2 of [48]). Certainly it is desirable to bring forward more economical plans if such are feasible.

11.3 Similarly, there may be scope for achieving greater effective capacity at KSA for a given level of expenditure. Since the publication in October 1978 of the various reports of the consultative groups, there has apparently been a further set of calculations made with the help of the SSM, and many of these relate to a revised airport operating procedure which could be used in the event of a close-spaced parallel runway being built; the new scheme is known as CSPB (and involves the same runway layout as CSPE); it is claimed that the revised procedure gives an attainable capacity of 278,000 movements per annum, which is an increase of about 40% above the present 'attainable' capacity (compared with the increase of 15 - 20% previously estimated for CSPE).

11.4 However, the most important extension of the SSM calculations is to undertake a much more systematic treatment of pricing policy at KSA (and at the SSA, if built). The cost-benefit analysis of the Victoria underground railway line in London (Beesley and Foster, 1965) illustrated the impact that pricing policy can have on the benefits gained from investment in new capacity, and demonstrated the need to establish, <u>before</u> conducting the investment appraisal, what the pricing <u>policy</u> is to be. (This point is now so well known as to have appeared in at least one textbook - see p.171 of Layard and Walters, 1978.) As seen in earlier sections, the pricing policy supposed in the analysis of the development proposals is not made explicit; and Base Cases 2 and 3 employ uniform surcharges (apparently on top of the existing system of ANCs) in a manner somewhat divorced from actual Department of Transport policy on ANCs. This treatment is inadequate; at the very least, each alternative scheme should include a proper specification of the pricing policy pre-supposed in the calculations.

11.5 When a major investment is contemplated on the grounds of shortage of capacity, however, a merely passive specification of the status quo on prices is not sufficient. Instead it is necessary also to ask whether the present prices adequately represent the costs of provision of services at the particular airport; and if they do not, then alternative charging systems must be considered. To go ahead with new investment when costs are not being covered implies subsidisation, and runs the risk of providing expensive capacity to users whose valuation of the service is less (perhaps much less) than the cost of provision. (In an airport context, a similar point is also made in Forsyth (1972), section IV.)

11.6 Furthermore, any other (non-price) policy changes which may attend such major investment should also be considered concurrently, and this should include any development of nearby lesser airports for general aviation. Thus it is disturbing that "the General Aviation Strategy Planning - Sydney (GASP-S) Study has already been suspended for some two and a half years, pending decisions on the MANS study" (Cosgrove (1981), p.5). Rather than make this study a last gasp, such work should be prepared as an input to the MANS study: GA plans should be prepared on a contingent basis, with one plan for each major MANS alternative, thereby showing what would happen to GA under each alternative; the MANS economic appraisal could then include an appraisal of these GA plans.

11.7 The account in section 10 makes it clear that present prices at KSA do not cover allocated (financial) costs in the case of commuter and other aviation flights, and may not cover such costs in the case of lighter airline aircraft (which do pay flight fees but only at a low level because of the differentiation by weight). Equally it seems that most prices do not cover the alternative cost concept of marginal congestion cost (cost of delay) per aircraft movement. (Estimation of that equilibrium value of marginal cost which would obtain under such a marginal cost pricing policy is difficult; note however (from Cosgrove (1981), p.2) that, using the MANS valuations, average congestion cost per aircraft movement when traffic is 178,000 movements p.a. is about $140 (in 1980 prices); the marginal cost at that traffic level will be a great deal higher.) Changes in pricing policy along the lines proposed or envisaged by the DOTA general aviation committee will not only relate the charges more closely to both cost measures, but will also have a major impact on the traffic levels at KSA; in particular, a large reduction in commuter and other aviation flights may be expected, and (depending on the details of any new charging scheme) intrastate flights may also be significantly reduced. In addition, a system of uniform charges would give the other airlines an additional incentive to economise on runway capacity, and this may lead to a modest but significant reduction in aircraft movements through use of larger aircraft, higher load factors and so forth. Peak period surcharges may also have a role to play; they were considered, but dismissed, in an earlier Traffic Management Measures Study, undertaken by consultants (Amos and Bullock, 1977). Any new charging scheme should be explicitly related to cost recovery targets, and to the assocaited question of how any airport expansion is to be funded.

11.8 Thus an early extension of the SSM calculations would postulate one (or more) revised charging schemes, and recalculate the net cost of the principal alternative proposals: no runway development at all, CSPE (or CSPB) at KSA, and the SSA at SW4 or N1. Likely charging schemes may give effects which (in part) might have some similarity to the traffic exclusion proposals already evaluated. Nevertheless the two approaches are not synonymous: cost-based pricing promises greater economic efficiency than administratively-determined arbitrary fiat; and such prices encourage other economising behaviour which would not be obtained by exclusion of certain traffic categories. Accordingly, recalculation is necessary. It will require careful evaluation of the impacts of the new charges on the various traffic flows, and this will not be easy to do; nevertheless this is no reason for not attempting it.

11.9 At the same time, steps should be taken, as soon as possible, to implement a new charging scheme, at KSA at least, if not at all Australian airports. The present levels of congestion costs at KSA (cf. paragraph 11.7 above and Cosgrove (1981), p.2) demonstrate the urgency of this; indeed a new scheme should have been implemented some years ago. Taken together with limited development of the alternative airports at Bankstown and Camden (to be undertaken provided the benefits of such development can be shown to cover the costs), a new charging policy will yield not only an early reduction in congestion costs at KSA, but also a better basis for further SSM calculations (a few years hence) to see whether major airport development can be justified; once the new style of charges is in use, and once aircraft operators have been given time to adjust, it will be possible to gauge more accurately the response of operators, and hence to assess more accurately (through the SSM calculations) the value of extra capacity. (This point is noted by the BTE which, in dealing with the specific aspect of peak period surcharges at airports, writes (BTE, 1981, p.449) "peak surcharges should be implemented as a prelude to any investment planned for the relief of delays"; more generally, the argument applies to all features of a new system of charges which is designed to reflect costs more accurately.)

PUBLIC PARTICIPATION AND POLITICAL DECISIONS

12.1 Given the complexities of the MANS study, there are of course very great difficulties in explaining the work to the general public. While many of the MANS Information Bulletins dealing with physical descriptions seem to be very successful, those dealing with economic issues seem less so. The present author found Bulletin 8 (The Economic Analysis) difficult to follow, and found it necessary to draw inferences on methodology. These inferences were confirmed by a subsequent reading of the Economic Report [24], which is very well written and seems much clearer (though perhaps not to a novice). One general moral may be drawn: in many respects, it is much more difficult to write a good layman's account than to write a technical report; any public participation programme should recognise this and should devote appropriate resources to the writing task.

12.2 The feature of the study which has made the greatest impact on the public is (of course) the set of alternative proposals for physical development in specified geographical locations. As noted by the Commonwealth members of the MANS committee (p.26 of [48]), "in the course of the public participation program it became apparent that there is resistance within the community to each of the strategies examined". Recently the NSW Premier has been quoted as saying that he thought it undesirable to announce alternative locations (under consideration for a major development such as an airport) because this upset several different groups of people, whereas in the outcome only one group would be affected. Evidently full public participation no longer seems such a good idea.

12.3 Notwithstanding these difficulties, it is to be hoped that such public participation will not be abandoned. Quite apart from considerations of principle in relation to democratic government, there are very great practical advantages in presenting planning and evaluation work for public examination. Arguably it may make the professionals think a bit harder about what they are doing and why they are doing it. Certainly it makes it easier for interested parties and the public at large to see what is being done; this helps to clear away misconceptions, and makes it easier to put forward sensible suggestions for alternative development proposals and alternative evaluations. One of the strengths of the MANS economic evaluation is that it was done with a carefully-specified conceptual framework with ingredients which are publicly known. Thus, for instance, if the valuations of noise nuisance are not acceptable to any group, alternative valuations can be proposed, and the calculations readily reworked, to see if the change makes a significant difference to the overall outcome. The availability of this facility is important for any cost-benefit analysis where (inevitably) at least some of the values used are rather arbitrary.

12.4 As already indicated (paragraph 11.3), some additional, recent calculations have been made for the CSPB version of the second runway. If the greater capacity of the CSPB scheme can be realised, then presumably this proposal would be more attractive than CSPE. Nevertheless, when judged by the net cost criterion, it seems likely that, for some years yet, an improved pricing policy and no runway development will give results as good as (and perhaps better than) the best of the runway development schemes. On the other hand, major airport construction has a long lead-time, perhaps as much as twelve years in the case of a SSA. For this reason, Cosgrove (1981) argues that a decision is needed now, and that further indecision will lead to unacceptable congestion delays. However his Figure 1 (which shows traffic growing to fill all capacity by 1993) presupposes that KSA is to accommodate all the traffic in the median forecast, apart from 'non-essential other aviation'. Once it is recognised that a sensible pricing policy will reduce demand below that level, the investment decision is seen to be less urgent. Instead, the argument about the congestion penalties arising from indecision should be directed to the failure to implement such a pricing policy.

12.5 The other step which should be taken now is to consider whether to reserve a SSA site in case it is needed later. If no contingent reservation is made, further housing and other development may take place on and near the site, making an airport more costly to develop. On the other hand, such reservation is not costless; however the costs of reservation of a site never used for an airport (costs of urban development in other locations rather than on the site in question) are likely to be much smaller than those of resumption and degradation of developed areas. If this asymmetry were confirmed by empirical examination, it would probably be wise to make the contingent reservation. Certainly this matter should be examined now.

CONCLUSIONS

13.1 It is convenient to summarise here the principal conclusions:

(A) the MANS study is a skilful evaluation made on a systematic basis, but it is flawed by the inadequate range of the alternative policies which are examined;

(B) the results of the MANS calculations do not suggest that it is obviously desirable to undertake runway development now;

(C) arguments presented in this paper suggest that it is desirable to introduce an improved runway pricing policy at KSA, with charges designed to reflect congestion costs; and that this should be done whether or not a runway development programme is started now;

(D) further MANS calculations should be made, using this congestion pricing policy as an ingredient;

(E) it will probably be desirable to postpone runway development for quite some years, during which time the calculations can be refined further, in the light of experience with the new pricing policy;

(F) since it may well prove desirable to develop a second airport at a later stage, a site should be reserved now on a contingent basis.

APPENDIX A 'MANS' DOCUMENTS PUBLICLY ISSUED

Ref. No.*		Information Bulletins
1.	No. 1	Aviation Bulletin (December 1977)
2.	No. 2	Report on the Siting of Second Sydney Airport in the Southern Zone (February 1978)
3.	No. 3	Preliminary Runway Layouts for Possible Second Airport Development (February 1978)
4.	No. 4	Bankstown Airport Feasible Development Options (February 1978)
5.	No. 5	General Guidelines on Government Land Acquisition (March 1978)
6.	No. 6	Attainable Runway Capacity of Sydney (Kingsford Smith) Airport (April 1978)
7.	No. 7	The Assessment of Aircraft Noise in the Major Airport Needs of Sydney Study (June 1978)
8.	No. 8	The Economic Analysis (September 1978) The Options (October 1978) - Appendix to No. 8
9.	No. 9	The Financial Analysis (September 1978)
10.	No.10	The Environmental Analysis (September 1978)
11.	No.11	Forecasting Techniques and Results (September 1978)
12.	No.12	The Incidence Analysis (November 1978)
13.	No.13	The Access Analysis (November 1978)
14.	No.14	The Urbanisation Analysis (November 1978)
15.	No.15	General Aviation (November 1978)
16.	No.16	Airport Planning (November 1978)
17.	No.17	Airspace Effects on Proposed Runway Developments (November 1978)
18.	No.18	Runway Congestion (November 1978)
19.	No.19	Not issued. Substituted by "Curfews and A Second Sydney Airport" (December 1978)
20.	No.20	Sydney (Kingsford Smith) Airport Development Options (November 1978)
21.	No.21	Traffic Management Measures at Sydney (Kingsford Smith) Airport (November 1978)
22.	No.22	Aircraft Delays at Sydney (Kingsford Smith) Airport (November 1978)

Consultative Group Reports

23.	Forecasting Report (Forecasting Consultative Group, October 1978)
24.	Economic Report (Evaluation Consultative Group, October 1978)
25.	Finance Report (Finance Consultative Group, October 1978)
26.	Airport Planning Report (Airport Planning Consultative Group, October 1978)
27.	Airspace Report (Airspace and Congestion Consultative Group, October 1978)
28.	Runway Congestion Report (Airspace and Congestion Consultative Group, October 1978)

Ref. No.*	Consultative Group Reports
29.	General Aviation Report (General Aviation Working Group, October 1978)
30.	Bankstown Aerodrome Report (Bankstown Aerodrome Working Group, October 1978)
31.	Land Use and Urbanisation Report (Urbanisation Consultative Group, October 1978)
32.	Technology and Operations Report (Technology and Operations Consultative Group, November 1978)
33.	Access Report (Access Consultative Group, October 1978)
34.	Environmental Report (Environmental Consultative Group, October 1978)
	Consultants' Reports
35.	Paper Fin-1 - Role and Scope of the Financial Analysis (April 1977)
36.	Paper Fin-2 - Outline Specification for the Financial Model
37.	Supplements to Paper Fin-2
38.	Paper Econ-1 - Approach to Economic Evaluation (April 1977)
39.	Paper Econ-2 - Costing of Demand Suppression (March 1978)
40.	Paper Econ-3 - Summary of Results of Economic Evaluations (March 1978)
41.	Paper Econ-4 - Summary Documentation of Schedule Selection Model (March 1978)
	Incidence Analysis:
42.	Handover Paper No. 1 - Summary of Incidence Analysis (July 1978)
43.	Handover Paper No. 2 - Incidence Analysis of Quantified Costs (July 1978)
44.	Handover Paper No. 3 - Household Survey for Incidence Analysis (July 1978)
45.	Handover Paper No. 4 - Industry Survey for Incidence Analysis (July 1978)
	Other Reports
46.	Submission by Aviation Industry to Commonwealth/State Committee (July 1978)
47.	Supplementary Submissions by Aviation Industry to Commonwealth/State Committee (March - May 1979)
48.	Abstract Report - Commonwealth Mmebers' Recommendations (December 1979)

* These reference numbers have been assigned by the present author.

APPENDIX B CONSULTATIVE GROUPS AND THEIR COMPOSITION

The following table records the number of members of each group, as initially constituted, and classified by the Department in which each individual was located.

	Consultative Groups											
	Forecasting	Evaluation	Finance	Airport Planning	Airspace & Congestion	General Aviation	Bankstown Aerodrome	Urbanisation	Technology & Operations	Access	Environment	Public Participation
Commonwealth Government Departments												
Transport	7	13	6	11	7	7	2	7	8	8	7	8
Finance	1	1	1		1							
Environment, Housing & Community Development	1	2						2		1	3	2
Bureau of Transport Economics	1	1										
Construction		1		1						1	1	2
Defence		1		1	1			1	1	1	1	
Administrative Services				1				1		1	1	
NSW Government Departments, etc.												
Transport and Highways	1	1		1					1	1		1
Planning and Environment Commission	1	1		1				1	1	1	1	2
Public Works		1		1								
Maritime Services Board				1						1		
Lands								1				
State Pollution Control Comm.		1						1			2	
Valuer-General								1				
Premier		1										
Traffic Authority of NSW		1								1		
Treasury		1	1									
Main Roads			1							1	1	
Public Transport Commission			1							1		
Urban Transport Study Group										1		
Local Government												1
Consultants					1							
TOTAL	12	26	10	18	10	7	2	15	11	19	17	16

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In the text, the numbers in square brackets refer to MANS documents, and these are listed in Appendix A. Other references are listed here.

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