STRATEGIC PLANNING FOR AIRPORT CAPACITY:
An Appreciation of Australia's Process for Sydney[1]

Australia has devoted considerable effort, since 1984 or so, to planning for future airport capacity for Sydney, the major center for air transport for the nation (Department of Aviation, 1965; Federal Airports Corporation, 1990a; Federal Airports Corporation, 1990b). Compared to efforts elsewhere in the world, its progress has been remarkable and deserves to be acknowledged.

From an international perspective, Australia has been making an important contribution to the advancement of planning practice. It has been demonstrating by example the advantages of strategic planning as compared to traditional master planning. Strategic planning recognises that there is massive uncertainty in long-term forecasts, and consequently replaces the conventional more rigid master plan with a flexible approach.

To appreciate what Australia has accomplished in adopting strategic planning for airports, the recent achievements around Sydney need to contrasted with the less impressive record elsewhere in the world. This record is all the more remarkable because it was established on the heels of previous attempts to deal with the issues of airport capacity that were ineffective at best (Department of Aviation, 1977). These two points will be made first, by way of background, before proceeding with a discussion of how strategic planning applies to airport planning, to Sydney in particular.

Recent Achievements

Airport planning is one of the more difficult issues for planners for several reasons:

1. Major national airports, such as Sydney's, are large, expensive facilities with major implications for the regional economy;
2. Metropolitan areas offer only a limited number of sites - Sydney in particular is ringed by substantial mountains;

and, perhaps most significantly,

3. There is always massive uncertainty in aviation about both the precise nature of long term requirements and the levels of traffic.

Deciding what to do about airport capacity, where to do it and when to do is thus inherently extremely problematic. It is also generally equally controversial. This has certainly been true for Sydney.

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Australia's recent achievements in this context are internationally noteworthy, both for the positive steps taken and the mistakes avoided. The Australian Federal Government, together with the Government of New South Wales and the Federal Airports Corporation, deserve a lot of credit for what has been accomplished.

Naturally many individuals and organizations always wish more could have been achieved, according to their own agendas. But their disappointment that their personal, conflicting objectives are not satisfied - as indeed they all cannot be - is not a reasonable indication of the value of a planning process that should broadly benefit society. The proper measure of success in planning, when values collide, is the degree to which any major agreements can be attained.

The recent planning process for Sydney's future airport capacity has been successful in that it has secured broad acceptance of three major principles of development. Individually these may not seem remarkable, but collectively their attainment is unique, as Table 1 indicates.

First of all, the planning for Sydney has anticipated future needs by securing Badgery's Creek as a site for the Second Sydney Airport well ahead of pressing need. Sydney is now in a position to add capacity as desirable to permit smooth development of its air transport. Although early selection of sites for needed capacity is possibly one of the more obvious tasks for airport planners, not all cities have managed to do this. Both Atlanta and Boston, for example, do not yet have any options although their airports are among the busiest in the world. Similarly, London's capacity is perennially very tight, to the extent that the national airline, British Airways, has recently been seeking to take over Belgium's Sabena airline to acquire its airport facilities at Brussels as a complementary base to London.

Secondly, Sydney has benefitted from systems planning. Right from the start, the analysis of the options for the Second Sydney Airport have considered its organisation and traffic as part of integrated operations for Sydney. More recently, the Federal Airports Corporation not only takes a regional, indeed a national view, but also integrates both managerial and financial considerations, as the predecessor Federal Department of Aviation could not.

Table 1: Characteristics of Planning Process
for Airports in Major Metropolitan Areas

Metropolitan Area	Anticipated Need	Systems Planning	Market Dynamics
Atlanta	-	-	-
Boston			-
			-
			-
Chicago			-
			-
			-
Dallas/Ft. Worth			Yes
			- -
Denver			Yes
			Yes
			-
Houston			Yes
			-
			-
Los Angeles			Yes
			- -
Miami	Yes	-	-
New York City			Yes
			Yes -
San Francisco	Yes	-	-
Washington/Baltimore			Yes
			-
			-
London			-
			Yes
			Yes
Montreal			Yes
			Yes
			-
Paris			Yes
			Yes
			-

Osaka				
				Yes
			-	
		-		
Tokyo				
				Yes
			-	
		Yes		
SYDNEY				
				YES
			YES	
		YES		

A comprehensive approach to planning airports for a region may seem elementary but, internationally, is more the exception than the rule, as Table 1 suggests. The airports around Los Angeles, San Francisco and Washington for example, are planned, developed and operated by competing interests. At the two Tokyo airports, Narita and Haneda, the airport facilities are financed and managed by different companies, and even their airspace is operated independently of each other. As happened previously at Dallas/Fort Worth and Houston, the company building the new airport for Osaka will find itself competing for traffic with the old airport, Osaka/Itami, which will not close down as some planners had wishfully expected. Sydney has managed to avoid the common problem of partial planning.

Thirdly, the recent planning for the Second Sydney Airport has fully appreciated the market dynamics affecting air traffic in a metropolitan area. The simplistic notion that airlines and travellers will simply go where runways are provided has been discarded. Internationally, that mistaken view has been an integral part of airport planning in the past (de Neufville, 1984) and was indeed a feature of the preceding planning exercise for Sydney's airports (Department of Aviation, 1977). But in Australia now even critics of current plans (Sanders, 1991) recognise that, in air transport as in cities, businesses and clients tend to concentrate at the busiest (and hence the commercially most attractive) sites. It is difficult to pry either airlines or passengers away from popular airports to distant places with little traffic or service.

Understanding the dynamics of development is crucial. Market realities place practical constraints on what can be achieved. Many visions that seem attractive are in fact unworkable. The planners of the secondary airports for Los Angeles, San Francisco, New York, Washington and Montreal have had ample opportunity to regret their lack of insight into market dynamics, as they watched their projects languish over the years. Airport planners in Australia have learned this lesson, and have thus advanced realistic proposals to build up the Second Sydney Airport gradually, consistent with traffic demands.

Master Planning Background

The above accomplishments did not flow naturally from previous planning efforts. Quite the contrary. They are remarkable not only because they are unique from a worldwide perspective, but also because they emerged from a new approach to planning, quite different from the traditional process.

The earlier approaches to planning for airport capacity for Sydney had been squarely in the tradition of airport master planning. They were perfectly congruent, for example, with the guidelines set forth by the United States Federal Aviation Administration (1985). There are three essential elements to this process:

1. A forecast is made of the conditions that might prevail at the end of the planning period, typically around 20 years from the time of the exercise;
2. An evaluation is carried out for each of the options, using the forecast loads on the system; and
3. The selection of the plan as the option that performs optimally under the conditions forecast.

The preceding major attempt to plan for the future airport capacity for Sydney, the Major Airport Needs for Sydney (MANS) study (Department of Aviation, 1977), followed this approach in each of the main elements, and was thus quite in the mainstream of the prevailing practice for master planning of airports. In line with this standard, and as the necessary basis for the subsequent evaluation, the study team forecast traffic a generation ahead in exquisite detail. They attempted to predict not only the aggregate annual levels of traffic -- to a purported accuracy of one part in a thousand -- but also the exact composition of the aircraft fleet and its operations during the peak hours at the beginning of the next century!

The evaluation carried out in the MANS study was corresponding detailed. Specifically it was a cost-benefit study that ascribed value to the time airline passengers would spend getting to and from any airport site, a factor that weighs heavily for distant airports with millions of passengers. As can be imagined, the economic rationale for assigning dollars to these minutes, for people on business and on holiday, for Australians and foreigners, a generation from now, is speculative at best. In the event, this procedure led to numbers which supposedly defined whether a new airport was desirable or not, based on a monetary assessment of the assumed performance of the alternatives for the specified number of passengers far into the future.

As senior Australian planners will recall, the MANS study was extremely controversial. Plenty of experts suggested that they could generate better forecasts, especially since the actual levels of traffic, when the report was published some two years after the MANS forecasts were made, already differed from the predictions. Other experts suggested different ways to estimate the value of time. Viewed from the outside, it seemed as if each of the central portions of the master planning exercise, the forecast, the evaluation and thus

the recommendation, were thoroughly discredited.

This kind of master planning is, we should recognise, doomed to failure. As repeated retrospective studies demonstrate, the long-term forecasts needed for master planning are "always wrong" (Ascher, 1978). The errors are not minor and negligible; they are large and most significant. In the United States, for example, the national forecasts of the US Federal Aviation Administration have been over 20% off, after only 5 years! (de Neufville, 1976, US Office of Technology Assessment, 1984). The accuracy gets worse for longer planning horizons, as Table 2 indicates. The short of the matter is that the premise of the master planning is wrong.

Table 2: Forecast Errors Increase with the Planning Horizon

Planning Horizon (Years)	Average Error (%)	Range of Error - % to + %
5	23	-36 to + 96%
10	41	-42 to + 140%
15	78	-34 to + 210%

Source: Data from New England Airports, Maldonaldo, 1990).

The logic of any attack on a master plan for an airport is obvious from the facts. Since the premise of the entire analysis, the forecast, is wrong, so is the conclusion. Specifically, the assessment of the impacts of any alternative must be wrong, since they are predicated on the forecasts. It is therefore impossible to demonstrate which plan might be best (de Neufville, 1990).

The result of all this master planning effort for airports is unsatisfactory. If a master plan is adopted, it turns out to be almost meaningless as a practical guide to development. A recent retrospective study of planning exercises in the New England region around Boston (Maldonaldo, 1990), for example, indicated that two-thirds of what actually happened at these airports over 15 years had not been anticipated by the relevant master plans. Put another way, the long-term master plans only had validity, limited at that, for the near-term of around 5 years. Whenever people really care about a situation and examine it in detail, the inherent weaknesses of the master plan for an airport become evident, and nothing much of any consequence is accepted. This was the fate of the MANS Study.

Since master planning for airports is flawed at the core, is logically indefensible and produces unsatisfactory results, it must be replaced. This was what was done in the Second Sydney Airport Study (Department

of Aviation, 1985), and this is what largely accounted for the success of this planning exercise. This new procedure is called Strategic Planning.

Strategic Planning Concept

The idea behind strategic planning is really quite simple. Once you think of it, this approach seems obvious. It is rather like the idea of the world being round, it is innovative only in the context of others believing the earth to be flat.

The premise of strategic planning is that the future is highly uncertain and therefore risky. Since any single forecast that experts may come up with is likely to be quite far off the mark, whatever we plan or build for the long term also is likely to be inappropriate for the actual future conditions. Any developments now may later prove to be too small, too big, in the wrong place or of the wrong type: that is the inherent nature of the problem.

Strategic planning recognises risk as an inescapable reality. This is its real difference with traditional master planning for airports. That master planning process on the contrary places the planner, when trying to justify the plan, in the position of trying to defend the indefensible, the specific forecast which actual events demonstrate is incorrect. No matter how elegant the reasoning, or how sophisticated the statistics behind them, the general observation is that the forecasts are not realized.
In recognising risk, strategic planning changes the entire logic of the planning process. Once the reality of risk is acknowledged, the issue is no longer how to identify the best plan, since this question is unanswerable in any satisfactory way (best for which scenario?). As investors know, the issue when there is risk is to identify the actions that will lead to the best, or least unsatisfactory portfolio of risk. The question is: what investments should be made now that will simultaneously minimise the possibility of real losses, while permitting one to cater to plausible needs?

Dealing with risk requires two kinds of actions. Both are in fact commonsense approaches almost anybody uses in daily life. First, we should adopt a strategy, a flexible approach to dealing with contingencies as they occur. Second, we should invest in some kind of insurance, to protect against particularly bad prospects.

A strategy is a general way of dealing with an issue, rather than a particular, detailed plan. A strategy is flexible: it defines a first phase of action, and leaves the later stages to be defined according to the way events develop. A strategy emphasises good positions, moves that permit easy response to the range of circumstances that might arise.

A strategy is the natural way to deal with risk and uncertainty. Think, for example, of playing chess. A reasonable player adopts a

strategy, say to concentrate strength in the middle of the board, and then makes individual moves. Each move is an initial part of many possible sequences, but those sequences are only determined subsequently, as events unfold (i.e., as the other player moves). Following a good strategy, a player will move into positions that permit a broad range of responses to changes in the environment.

Buying insurance is the other natural way to deal with risk. In the simplest terms it involves paying money to acquire protection against nasty eventualities. For well defined forms of accidents, we can do this through insurance companies. More generally, we must think creatively about making investments, about doing things that may not turn out to have been needed -- but will have been most desirable in other circumstances.

Carrying a spare tyre in an automobile is a form of insurance, for example. It costs money both to buy and carry around. It may not be used at all. Yet most people would agree that a spare tyre is an excellent investment: its usefulness when needed makes up for its cost overall. In general, the value of insurance is not defined by whether it is always needed, but by the degree to which its value when needed balances its cost.

Strategic planning, in summary, consists of three elements:

1. Recognition of risk as the reality, and thus dealing with a range of possible futures instead of a single forecast;
2. Adoption of a strategy, a flexible approach to future choice which facilitates adaptation to events that may turn out to be quite different than expected; and
3. Buying "insurance" by investing in projects which may only be needed in some important situations.

Strategic Planning in the Second Sydney Airport Study

The Second Sydney Airport Study (Department of Aviation, 1985) was a successful planning exercise, most definitely in comparison to the MANS Study. It resulted in the broad acceptance, by Federal, State and local interests, of the need for a site for a major airport; the identification of two sites that were preferable from technical and environmental considerations; and the selection and acquisition of a specific site by the Federal Government. All this happened in only a few years, with minimal controversy.

The success of the Second Sydney Airport Study was closely linked with its use of strategic planning. Naturally other factors were involved, such as political alignment of the Federal and State Governments and the personalities of the responsible ministers. Yet these would not have been sufficient, in my opinion, if traditional master planning had been used instead of strategic planning.

The effort to recognise the future uncertainty, and to make this risk the central issue of the study, was key to the success of the Second Sydney Airport Study, as it usually is for strategic planning. This was not a easy task, as is also typical. It was a most deliberate, uphill struggle.

There generally are two obstacles to the acknowledgement of risk. One is the common reluctance to accept ambiguity and the desire for a fixed forecast, even if it is wrong. The other is the institutional presence of a group of persons dedicated to producing forecasts. Both were present for the Second Sydney Airport Study. First off, the official terms of reference for the study team included a traffic forecast of about 2% growth for the next 20 years. Secondly the team had to deal with the forecasting unit for the Department of Aviation, consisting of a formidable array of economists and statisticians.

To overcome these obstacles, the study team first had to challenge its contractual, ministerially approved terms of reference. This is naturally a daunting task: it involves making a lot of important people retract a public pronouncement. Dealing with the forecasters was relatively simple: the study team simply documented their past efforts, in which they and their colleagues had predicted 2%, 5%, and 7% rates of growth in traffic with equally high "confidence limits" and other statistical tests (Department of Aviation, 1969, 1974, 1978, 1983), and asked them to show why any one of these would be more credible than the other. The answer, of course, was that they could not: different experts, or the same experts using different slices of data, invariably get conflicting forecasts.

In the event, the Second Sydney Airport study presented a remarkable position: its report was that it was impossible to demonstrate that any particular forecast was correct, and that traffic over the next 20 years might grow anywhere between the extremes of 0 and 10% annually. Pointedly, the assessment of the alternatives was made in general terms, not numbers; reference was made to "high", "medium" and "low" forecasts.

The basic alternatives in this case were either to select a site or to take no action. They were compared not on the basis of a single number, as done in traditional master planning studies for airports such as the MANS study, but in terms of their performance over the range of possible futures. Table 3 presents the portfolio of risks as summarized in the report of the Second Sydney Airport Study.

Table 3 : Consequences of Alternative First-Stage Decisions in Second Sydney Airport Study

Action	High Forecast	Median Forecast	Lower Forecast

Select Site	**Good decision**	**Good decision**	**Neutral decision**
	Site available to meet demand	Site available to meet demand	Temporary sterilization of site; land put to alternative use until required
No action	**Poor decision**	**Poor decision**	**Neutral decision**
	Congestion at Kingsford-Smith Airport; site at higher cost and greater distance subsequently selected	Congestion at Proposed site Kingsford-Smith Airport; site at higher cost or greater distance subsequently selected	Congestion at put to higher priority use; site at higher cost or greater distance subsequently selected

Source: Department of Aviation (1985)

Table 3 situates the recommendation nicely. The rationale for selecting a site is not because it is demonstrably the best action under all possible circumstances; it is not: it is possible to imagine that a site might never be useful. The rationale for securing the site is that it is the prudent thing to do given the risks.

Recognising the uncertainty, the Second Sydney Airport Study purposefully did not recommend any particular kind of future airport. As required by the Environmental Assessment process, the study did analyze the effects of maximum development, if that ever did occur. While that possibility was acknowledged, it was not pushed.

The Study identified a strategy: take the first step of securing a site, and then decide on the pattern and rate of development, if any, according to future circumstances. Once the site is available, the authorities are in a position to respond flexibly, as necessary, according to what seems most appropriate at the time.

Put another way, buying the site is a way of buying insurance for the aviation future for Sydney. Having the site guarantees that Sydney will be able to expand its air transport facilities regardless of what happens at the existing, Kingsford-Smith Airport. Even if it eventually turns out that the site is never needed, through some technological miracles in air traffic control and noise suppression for example, having the site will not have been a waste: it provides peace of mind so long as the uncertainties exist.

That an investment in a site may be valuable even if the site is not used might seem paradoxical, but really is not. Most of us willingly buy insurance every year and are glad not to use it. I for one, regularly buy life insurance to protect my family, and am quite glad

not to cash it in!

Strategic Planning in the Third Runway Study

The Third Runway Study (Federal Airports Corporation, 1990a) examined the desirability of building a major parallel runway at the existing Kingsford-Smith Airport. Both it and the concurrent Sydney Airport Planning Strategy (Federal Airports Corporation, 1990b) built upon the basis of the planning strategy for the Second Sydney Airport. Most obviously, efforts were not wasted on trying to determine the best forecast: the study recognised the uncertainties clearly associated with deregulation and fads in foreign travel, and simply worked with a broad range of possible futures.

The Third Runway Study also emphasised the reality of the market dynamics in aviation, specifically the fact that airlines and passengers tend to concentrate at primary airports, and thus that second airports develop traffic only when service at the primary airport becomes sufficiently difficult. (This fact was clearly presented in the Second Sydney Airport Study, but was not a major issue in that case.) This point is important in contrast to the "cargo cult" mentality which believes that airlines and passengers will automatically go to where runways are provided.

Australian planners will remember that at the time the question of the Third Runway was debated in Cabinet in March 1989, the alternatives were widely seen to be to build a runway either at the existing Kingsford-Smith Airport (the Third Runway) or at the Second Sydney Airport site. Once one recognises the market dynamics however, building a major runway at the remote site is now, in the near term, an economic non-starter for all practical purposes.

Discussions with the airlines demonstrate their determination not to move their facilities to a Second Sydney Airport in the near future. From their perspective, this development is commercially premature. Also, Qantas and the other airlines simply cannot afford the expense given the available traffic. Worldwide experience with the development of second airports confirm this perspective (de Neufville, 1984).

The current real alternatives, as regards the Third Runway, are either to build it or not. The concept of airport capacity is relative: if an airport is at "capacity", this does not mean that it cannot serve more people. As with a bus that is "full" when all seats are occupied, more travellers can crowd in. If the runway is not built, airlines and passengers will simply squeeze into the existing facilities, enduring delays and aggravation, but preferring these for a long time to the prospect of using a second airport. Clever pricing of service at peak hours and other forms of rationing would alleviate these delays to some degree but they would still exist. In any event,

most of the traffic, the priority traffic would somehow be served at Kingsford-Smith if the Third Runway is not built.

The choice between the "build" and "no-build" alternatives is really a choice between two portfolios of risk. As for the Second Sydney Airport Study, a table can be constructed to illustrate the performance of the options for the different scenarios. In this case, the important variable defining the level of risk is not the level of traffic, but the disparity between the level of traffic and the capability to serve it decently, the "capacity gap".

The central issue, as regards the Third Runway, is: What should be done between now and the time that the Second Sydney Airport is a viable proposition? What portfolio of risk is preferable? Australia can decide either to build the Third Runway or not. The "no build" alternative will "work" in some sense, as the Third Runway Study indicates. The major difference between the "build" and "no build" alternatives is in the degree of pain to aviation associated with not building, and thus having to resort to what is known as "active management" of the capacity, that is to some aggressive form of rationing.

The "capacity" of an airport, as the "capacity" of a bus, reflects a standard of performance and service that is widely regarded as being decent. It is legitimate to adopt other standards if and when one chooses; in time of crisis for example. In the event, the "capacity gap" presented by the Third Runway Study reflects the estimated difference between the capacity of the available facilities to provide decent service and the traffic that would exist before the Second Sydney Airport is commercially viable.

The significance of the "capacity gap", of the pain associated with not having the Third Runway, can be stressed or discounted according to one's judgement. This can be formed in many ways. One can be impressed with the possible effectiveness of the pricing schemes to ration traffic, for example. Alternatively, one may suggest that the gap is different than that presented by the Third Runway Study, either because the threshold for the viability of the Second Sydney Airport is quite complex (certainly true), or that the capacity of the existing facilities might increase faster than anticipated (Sanders, 1991). All this speculation is possible but, since it can no more be conclusive than any other forecast, does not change the essential issue concerning the Third Runway.

The choice between the "build" and "no build" alternatives is greatly a choice between two risk profiles concerning the pain to the travelling public. (Environmentally, the Third Runway lessens noise over a considerable area, since it pushes traffic away from the population and minimises East-West operations; however it does fill in part of Botany Bay. It may be considered that one impact balances the

other to some degree.) Different persons will differ in their judgement of the probability of each scenario and of their importance, but the structure of the issue is the same.

The essence of the matter is that the "build" alternative is more secure. Building the Third Runway would guarantee that good service could be provided, that Sydney would continue to have good access to the world, until the Second Sydney Airport became viable.
Not building the Third Runway is more risky. Sydney might be lucky and get by without significant pain; then again, Sydney might not.
Table 4 presents the issue.

The evidence in the Third Runway Study supports the notion that the project be built because it is the prudent thing to do. Building the Third Runway insures the smooth development of air transport for Sydney, the Nation's primary destination. The runway makes sense as part of a comprehensive, long-term strategy building.

Whether Australia will choose to build the Third Runway is a political matter. Does the Government wish to make the investment and bear the costs that will insure good operations at the center of its air transportation system, or does it wish to accept the risks of no action?

Table 4 : Consequences of Alternative Runway Decisions

Action	Capacity Gap Significant	Capacity Gap Median	Capacity Gap Insignificant
Build Runway	**Good decision** Airport capacity available to meet demand	**Good decision** Airport capacity available to meet demand	**Neutral decision** Parallel runways safer, more efficient than existing configuration
No Build	**Poor decision** Congestion at Kingsford-Smith Airport; higher costs to public and airlines	**Poor decision** Congestion at Kingsford-Smith Airport; higher costs to public and airlines	**Neutral decision** Capital costs lower but extra operating expense of exiting configuration

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