An analysis of the economic efficiency of domestic air transportation in South Africa, using a scheduling model

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August 1985

Technical Report **RT/19**

NATIONAL INSTITUTE FOR TRANSPORT AND ROAD RESEARCH, CSIR, SOUTH AFRICA
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DOCUMENT RETRIEVAL INFORMATION

Report No	Date of issue	Pages
RT/19 0-7988-3636-9	August 1985	(ii) + 20

Title

AN ANALYSIS OF THE ECONOMIC EFFICIENCY OF DOMESTIC AIR TRANSPORTATION IN SOUTH AFRICA, USING A SCHEDULING MODEL

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Synopsis

The study revealed that the structure of the South African air transport industry is unbalanced. While SAA minimizes logistics problems for the airline and offer passengers the comfort of jet travel by standardizing its fleet to two aircraft types, these aircrafts are generally too large to service domestic routes economically except for the highest density routes.

Restructuring of the fleet of aircraft available for domestic service to better fit market requirements would free resources for alternative uses in the long term. It would also offer the opportunity to reshape the domestic airline industry.

Market access of the private airlines should be improved. These carriers should be permitted to operate non-stop flights on some of the shorter routes. Routes where SAA is the designated flag carrier but on which it does not operate, should be opened to private carriers on suitable terms. The private airlines should be granted sufficient security of tenure on such routes (unless deregulation were to occur) to encourage market development and investment by these firms.

Sinopsis

Die studie het aan die lig gebing dat die struktuur van die Suid-Afrikaanse lugvervoerbedryf ongeblanseerd is. Alhoewel SAL logistiese probleme vir die lugredery minimeer en passasiers die gerief van stralerreise bied deur sy vloot tot twee vliegtuigtipes te standaardiseer, is hierdie vliegtuie oor die algemeen te groot om binnelandse roetes, behalwe op die hoëdigtheidsroetes, ekonomies te bedien.

Herstrukturering van die vloot vlietuie wat vir binnelandse diens beskikbaar is, om die markvereistes beter te pas, sal geldmiddele vry laat vir alternatiewe gebruike oor die lang termyn. Dit sal ook die geleentheid bied om die binnelandse lugvaartbedryf te hervorm.

Marktoegang vir die private lugrederye behoort verbeter te word. Hierdie vervoerders behoort toegelaat te word om op sekere korter roetes deurvlugte te bedryf. Roetes waar SAL die toegewese vaandeldraer is, maar wat nie deur SAL bedryf word nie, behoort op geskikte terme aan die private vervoerder beskikbaar gestel te word. Die private lugrederye behoort op sulke roetes toereikende sekuriteit van huurvoorwaardes toegestaan te word (tensy deregulasie sou plaasvind) om markontwikkeling en investering deur hierdie maatskappye aan te moedig.

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AN ANALYSIS OF THE ECONOMIC EFFICIENCY OF DOMESTIC AIR TRANSPORTATION IN SOUTH AFRICA, USING A SCHEDULING MODEL

1. INTRODUCTION

The ongoing debate on civil aviation in South Africa revolves largely around the issues raised or touched upon by the Margo Commission. The Commission had been established in 1977 and issued its report in 1982. The recent economic downturn has put a new premium on economic efficiency and adaptability to cope with changed circumstances. In the meantime the effects and implications of deregulation of domestic air transportation in the USA have also become somewhat clearer.

The Margo Report dealt broadly with institutional, political and safety issues affecting all segments of civil aviation in South Africa. However, none of the submissions made to the Commission provided an in-depth economic analysis of air transportation in the Republic. As a consequence, the Commission skirted around issues of economic efficiency and was cautious on the subject of permitting competition on domestic air routes.

The present study is intended to complement the Margo Report by providing economic analysis of scheduled domestic air transportation. The study does not look at the international or regional operations of South African air carriers. It will touch on institutional issues only to the extent that they follow from the economic analysis.

2. CURRENT SITUATION

The market for passenger air transportation within South Africa is relatively small at existing fare levels and given alternative modes of transportation, particularly private automobiles. Approximately 2,9 million passengers flew on domestic routes between April 1983 and March 1984. During the same period passenger revenues of SAA on their domestic network totalled roughly R300 million.

An estimated 75 per cent of domestic air travel in that period was undertaken for business purposes. It is not clear what share of non-business travel is related to tourism. A study by Prof. Ferrario, commissioned by the NITRR, may shed more light on this aspect. Analyses elsewhere have shown that business travel is not particularly price-sensitive but responds to the level of general business activity and the availability and convenience of air travel.

Personal travel including tourist travel is price sensitive. The introduction by SAA of promotional fares has significantly increased passenger volumes over the last two years. The potential travel market represented by large population groups has hardly been tapped so far. With appropriate packaging and pricing targetted at these market segments, domestic holiday air travel would appear to offer major growth potential.

In geographic terms, the heaviest flow of air traffic takes place among the three major centres of the Republic: the Pretoria-Witwatersrand-Vereeniging (PWV) area, Cape Town, and Durban. This triangular flow accounts for roughly 60 per cent of total domestic demand. The number of passengers travelling to and from Port Elizabeth on the Cape Town - Durban route represent only approximately 51 per cent of the traffic volume on that route even though virtually all flights between Cape Town and Durban have been making intermediate stops at Port Elizabeth.

Only SAA has been licensed to fly directly, non-stop, among the ten main centres in the Republic (and two in SWA/Namibia). The approximately one dozen private airlines (plus Namib Air in SWA/Namibia) connect over thirty additional points with the major centres. These privately owned airlines share among themselves less than ten per cent of the domestic passenger volume.

SAA is wholly owned by South African Transport Services (SATS), a state corporation. Revenues and expenses are consolidated within SATS accounts, thus permitting cross-subsidization among the various services. Likewise, investment funds are obtained through SATS. In late 1984, the marketing and accounting functions within SAA were split between international and regional/domestic operations. It is hoped that this division of responsibilities will bring into sharper focus the differing requirements and rates of return of these market segments. On its regional and domestic routes SAA operates only jet aircraft. The fleet consists of seven Airbus 300's and 17 Boeing B737's. SAA is currently taking some steps to reduce or subcontract services on routes that are uneconomic to operate with its existing fleet.

The private airlines have been hit hard by the fuel price increase in early 1985. Unlike jet fuel, prices for turboprop aviation fuel are not controlled and have risen more steeply than those for jet fuel. The private airlines remain shut out from serving routes between major centres non-stop which reduces the potential market and the possibility of achieving reasonable economies of scale. The combination of regulatory restrictions, the current high cost of capital and unfavourable exchange rates makes it exceedingly difficult for these airlines to upgrade their equipment which still includes some DC3's. The official policy of devolving a high degree of autonomy on the 'national states' has the side effect of displacing the private airlines from traditional routes. A good example is the Sun City - Jan Smuts route which had been operated by Magnum Airlines before SAA was declared to be the flag carrier on this route. SAA however does not service this route itself nor has it subcontracted the route to a private operator. In consequence the Bophuthatswana operator services both shares on this route.

3. METHODOLOGY

Faced with the bewildering complexity of the air transportation industry and in keeping with the objective of the study - assessing an appropriate structure of domestic air transportation in South Africa - the chosen approach was to build a quantitative model. The construction of a model necessitates the discipline of defining terms, stating assumptions, and explaining the operation and limitations of the model. This in turn permits third parties to judge the reasonableness and appropriateness of the model results. Since the

SAA domestic network represents the lion's share of the South African market and SAA kindly provided a survey of data, the model was designed to analyse a twelve point network which corresponds to the number of points in the domestic operations of SAA in 1984.

In principle the model attempts to match demand for and supply of domestic passenger air transportation in that network (the growing freight operations could not be accommodated). However, it takes into account the constraints posed on the demand side - the geographic and time structure of demand - and the constraints on the supply side - location of an aircraft at a given time, capacity, composition of the actual or hypothesized fleet of aircraft, and cost elements. Given a certain demand structure in the network and a fleet of aircraft, the model proceeds to simulate and assign an efficient schedule to each aircraft in turn, thereby accommodating demand. Demand and supply parameters can be easily changed, thus permitting the simulation and assessment of efficient fleet compositions and service levels under a wide range of assumptions.

Actual demand data were available for the SAA network for March 1984, the 'base period'. The level of demand varies during the day, with peaks in the early morning, early afternoon and early evening. Actual scheduling and load factors on SAA's Cape Town - Johannesburg route were used to distribute a day's demand over individual thirty minute periods. No survey data on passenger travel time preferences were available. The current version of the model makes the simplifying assumption that the same time distribution of demand holds for all routes in the network. However, internally the model works with individual demand matrices for each thirty minute period, and more accurate data, if any were available, could be used in the current framework. Preferred departure times are considered 'soft' data. Travellers are assumed to be flexible, up to a point, in adjusting their preferred to available departure times.

Demand data are further split between business and non-business travel for each SAA route; the model currently assumes that this route-specific proportion is constant for all flights on that route. Full fare and discount fare revenue is calculated on that basis.

First class fares have been factored into full fares; an average of the various discount fares is used for non-business travel.

Time costs are calculated at present rates for business and non-business passengers whenever these conditions apply: Travellers adjust their preferred to available departure times; the available aircraft is slower than the 'standard' airplane (jet); through-passengers experience delays on flights with intermediate stops. Time costs reduce the consumer surplus unless they are reflected in fare reductions. Time costs are an important indicator of service quality.

On the supply side the model assumes that aircraft are to be scheduled in decreasing order of capacity, starting with the largest specified aircraft type. The types and number of actually or hypothetically available aircraft as well as associated performance and cost parameters are specified by the analyst and are easily changed. For example, a change in the price of fuel requires only the updating of one entry for each affected aircraft type. Technical data for the Airbus and the Boeing B737 were supplied by SAA. Estimated performance and cost data under South African conditions for a range of smaller aircraft were reviewed by members of the Airlines Association of SA.

Important assumptions had to be made with respect to overhead and fixed cost elements. Overhead charges for the aircraft types used by SAA averaged 40 per cent of direct operating costs. This rate was also applied to all other aircraft types, since the model makes no assumption as to who operates any particular aircraft or aircraft type. Depreciation and capital cost charges (at market rates) based on the current Rand cost of appropriate new aircraft were found to be greatly above the charges allocated by SAA. These charges have been adjusted for use by the model to the levels used by SAA. There may be diverging views on what constitute appropriate rates in the longer run.

It should be re-emphasized that the structure of any given air transportation network and the specification of demand and supply parameters are under the control of the analyst who can simulate the impact of a wide range of scenarios.

4. RESULTS

4.1 Fleet composition for the domestic network

The outcome of the 'base case' simulation has significant implications for the desirable structure of domestic air transportation in the Republic. The base period was a 'typical' Monday in March 1984. The base case specified as available for assignment the actual SAA Airbus and Boeing B737 fleet as well as a hypothetical fleet of turboprop aircraft seating between 55 and 19 passengers. In satisfying the pattern of demand prevailing on 'base Monday', the model determined that only five of the six available Airbusses and four of the fifteen available B737's could be assigned in a manner that met the minimum criteria of daily utilization and full costing (i.e. net direct operating revenue less passenger time costs). The model found profitable employment for seven 55-seaters, seventeen 30-seaters and (less profitably) nine 19-seaters. Use of an alternate mix of aircraft types or another base day produced a different set of aircraft assignments, but the message is clear in all cases: Under current demand conditions, not much more than one half the available domestic jet aircraft capacity can be utilized economically on the internal route network. The lower density routes and slack periods on the higher density routes would be served more economically by smaller aircraft.

The poor showing of the B737 relative to the Airbus in the simulations does not reflect any inferiority of that aircraft. Rather, it follows from the operation of the model which assigns the larger Airbusses first. The remaining unaccommodated demand does not offer much scope for profitable utilization of the B737 fleet. Reduction of the number of available Airbusses would correspondingly leave more room for employment of the B737.

A variation of the base case was intended to simulate full employment of the existing SAA fleet of Airbusses and B737's as well as the combined fleet of the private operators. Instead of using the rather mixed fleet of the private operators, currently available and usually more efficient aircraft types for which operating data were available were substituted. It was necessary to relax the criteria of daily utilization and full costing, as well as minimum load factor to ensure employment of most of the available B737's in a successively thinner market. In addition, the demand band width (i.e. the maximum time period between preferred and actual departure, for which the model calculates passenger time costs in compensation) was increased from the base case values in order to increase demand for B737 service at the expense of smaller aircraft. The resulting larger gaps between desired and scheduled departures account for the sharply higher time costs associated with the B737 operations in the 'existing fleet' simulation.

While revenues are roughly equivalent in the two simulations, the difference in total operating costs between the 'appropriate fleet' case and the 'existing fleet' case is striking. It amounts to R126 000 for base Monday, or a projected annual difference in the order of R40 million (1984 base). Operation of the existing fleet also uses approximately 13 per cent more fuel than the more appropriate fleet.

The average load factor drops from 67 per cent in the base case to just 60 per cent in the existing fleet case. However, the maximum load factor for any one aircraft had been set at 80 per cent. If full loads had been permitted, as happens in practice, average load factors would have been noticeably higher, and even fewer large aircraft would have been needed for the given volume of demand.

Daily utilization of available jet aircraft was within acceptable limits, except for the lower utilization of B737's in the existing fleet case. Projecting daily utilization to annual values gave estimates of 2 400 to 2 800 hours. Annualized utilization of the commuter aircraft exceeded 3 100 hours in the existing fleet case but was above 3 600 hours in the base case. These estimates refer to 'available' aircraft. Scheduled maintenance requires that the actual fleet is somewhat larger than the number of aircraft available at any time.

Airline industry profits from domestic operations (passengers only) dwindled from 15 per cent of revenue in the base case to just 1,5 per cent in the existing fleet case. It is now known how closely these simulation results correspond to the profit/loss experience of the South African airline industry, but these results tend to underscore the penalty exacted by improper allocation of resources.

In a second variation of the base case, a decrease of 20 per cent for both business and non-business fares was assumed. In reaction to the fare cut, business demand was calculated to have increased by 24 per cent, and non-business demand by 36 per cent, in accordance with price elasticities of demand estimated elsewhere. The differential postulated growth rates of the two demand categories changed the geographical pattern of demand. A limitation of the current version of the model is its inability to accord greater weight to the time preferences of business travellers in its scheduling process. The outcome of the simulation was an average load factor of 57 per cent which entailed an operating loss under otherwise unchanged base case conditions. Modification of the model to permit 'topping-off' of partly filled aircraft (scheduled primarily with full-fare paying business travellers in mind) with discount-fare passengers would undoubtedly improve load factors and profitability.

A final simulation assumed a 50 per cent higher volume of demand at base case fare levels. Such a scenario may come about through population and income growth, leaving unchanged the real level of fares (nominal fares adjusted for inflation). In this case the model developed a schedule that yielded an average load factor of 73 per cent and a healthy profit level of 25 per cent of revenue.

Changes in the desired (i.e. efficient) structure of the aircraft fleet tended to favour utilization of yet more commuter aircraft of approximately 50 seats or less. Route-specific changes of demand in one of the cases described above favoured utilization of three additional B737's relative to the base case, and in the second case resulted in dropping one of the four base case B737's in favour of using the sixth Airbus. These simulations demonstrate the sensitivity of fleet requirements, particularly at the high-capacity end of the spectrum, to changes in the locational and time structure of demand, passenger tolerance of less preferred schedules, and the flexibility of the scheduling process itself (e.g. idle ground time). Even allowing for the use of the current fleet on regional service to neighbouring countries, the simulations demonstrate that overcapacity in large aircraft would persist also at higher levels of demand.

4.2 Quality of service

At first glance the re-introduction of turboprop aircraft on major routes would appear to be a retrogarde step. However, the recommendation in this report is more generally in favour of using smaller aircraft, regardless of the type of propulsion used. Most currently available types of commuter planes are turboprops; however, there exist also several turbofan aircraft in this class, and more fuel-efficient propjet aircraft may be developed in the 1990's.

Unfortunately, no consumer survey was available to indicate the degree and conditions of acceptability of turboprop service to the travelling public. The model does calculate the passenger time cost arising from the longer travel time using a turboprop rather than a jet aircraft. The time costs used for business travel, R13,50 per hour, is probably too low, even for 1984. Here again, a survey may suggest a more appropriate rate.

The model schedules planes to handle appropriate demand conditions. If it were deemed that slower aircraft were not suitable for long-haul domestic routes, even though technically they possess the necessary range, then the range parameter for such aircraft types could be reduced to whatever maximum distance was felt to be acceptable. The model would not assign aircraft to routes whose distances exceeded the permissible range.

Comments were received from several interlocutors to the effect that South Africans would not patronize turboprop aircraft on major routes. Apparently air travellers even exhibit a strong preference for the wide-bodied Airbus over the smaller Boeing B737, although in this case there would be no significant difference in travel convenience. There seems to exist also the preception that jet air service by the flag carrier enhances local prestige and thus should be lobbied for regardless of economic justifiability. Such sentiments are possible under conditions where beneficiaries do not necessarily bear the full cost of the service obtained and where cross-subsidization is acceptable. With respect to the use of turboprop aircraft it should be possible to compensate for higher noise levels and longer travel time on mixed equipment routes with better on-board service or fare discounts.

The greater flexibility obtained through the use of a mix of large, medium and smaller aircraft would result in improved service frequency on many routes. For example, the Johannesburg - Cape Town route had seven flights on Monday during the base period. In the base case, the model scheduled nine Airbus or B737 flights and two flights of a 55-seater for the same day. The nine actual flights on the Johannesburg - Durban run were upgraded by the model to twelve daily flights. For the Cape Town - Port Elizabeth (PE) - Durban route, the model recommended nine daily non-stop flights between Cape Town and Durban, nine flights between Cape Town and PE, and seven flights between PE and Durban, mainly with smaller aircraft.

It is widely accepted that a load factor of 80 per cent should not be exceeded for any flight if a deterioration of service quality is to be avoided. All simulations in this study abide by this stipulation. As a consequence, average load factors obtained have been lower than they would have been if full use of technically available capacity had been permitted. The 80 per cent rule leaves sufficient flexibility to accommodate seasonal and day-to-day variations in demand most of the time. In contrast, under the existing schedules, peak time flights experience load factors of 90 per cent or over as a matter of course which would suggest that some demand remains unaccommodated.

4.3 Fare structure

Current SAA pricing policy appears to be based on charging the same fare on routes of equal length and subsidizing loss-making routes from the net revenue of profitable ones. Under competitive conditions, i.e. deregulation, one could expect fares to drop somewhat on high-density routes. Using current equipment and levels of service, competitive fares would likely be higher on lower density routes, if service could be sustained at all. However, with service provided by smaller aircraft and competitive pressures on costs, higher fares on these routes may not materialize. For example, at 1984 rates it would have cost approximately R1 000 to fly 24 passengers on a 30-seat aircraft between Johannesburg and Bloemfontein or Kimberley. This represents a desirable 80 per cent load factor with a cost per passenger of R42,50. Revenue would have totalled R1 700, leaving a profit. The same 24 people would have taken up only one fifth of a B737. Assuming that no passengers were aboard for destinations beyond (and who would have been inconvenienced by the intermediate stop at Bloemfontein), the cost of using the B737 would have been roughly four times that of the commuter aircraft, resulting in a loss.

Distance-related fare levels taper even faster than direct operating costs, but taking into account useable air time, this fare structure permits approximately the same net revenue per day for a given aircraft type at a specific load factor over a variety of routes. For an Airbus, six flights between Johannesburg and Durban can be scheduled per day (excluding night flights), giving a total of 5,8 hours in the air. During 1984, daily airline net revenue for this one plane would have amounted to R33 000 at an 80 per cent load factor, and R15 000 at a 66 per cent load factor. On the Johannesburg - Cape Town route, four daily flights are possible totalling 7,5 air hours. On this route, daily airline net revenue per Airbus would have been R34 000 at an 80 per cent load factor, and R13 000 at a 66 per cent load factor. If cross-subsidization of domestic routes did not take place, then both full fares and discount fares could be reduced by between 10 per cent and 15 per cent at an average 66 per cent load factor, rising to roughly 30 per cent at an average load factor of 80 per cent, before net revenue would drop below break-even point on routes where this average capacity utilization does occur.

Economic price theory prescribes that the price-inelastic market segment (business travel) be made to bear the fixed cost, whereas the volume of price-elastic travel can be expanded by marginal pricing to fill available capacity. For the base case, average total cost per available seat kilometer (APK) was 7 cents, and direct operating cost (short-run marginal cost) was 3,8 cents. At the average load factor of 66,8 per cent for the base case, these values translate to 10,5 cents average cost per revenue seat kilometer, and 5,7 cents marginal cost per RPK. The base case, employing an appropriately structured fleet, showed an airline industry profit of almost 15 per cent of revenues. This indicates that fare levels could be cut by approximately this percentage at break-even point, provided that the load factor can be maintained in the system. Under the marginal pricing formula, discount fare which in 1984 average 59 per cent of full fares could be reduced to as low as 49 per cent of lower break-even level full fares that could result from fleet restructuring.

Current SAA fare policy permits discount travel on any scheduled flight, provided that advance booking restrictions have been observed. This policy results in fare dilution to the extent that switching among market segments takes place or that full-fare passengers are crowded out. In line with the marginal approach, only anticipated capacity in excess of full-fare requirements should be made available for discount travel. The night flights instituted by SAA are a pertinent example.

Operating results given by the model have indicated that there is some room for fare reductions under South African cost conditions, provided that the fleet is restructured. It remains to be analysed what economies could be achieved in the cost structure itself. Even at prevailing exchange rates the most efficient US carriers can operate a given aircraft type at close to one half of costs experienced in South Africa. Not all the scale economies available to US operators, and the competitive pressures unleashed by deregulation, would apply in the South African market. Cost elements that would need to be reviewed include the restrictions on hours of in-flight work which exceed safety requirements, appropriate depreciation and replacement cost allowances, and ownership charges, inter alia.

5. AVAILABILITY OF NEW AIRCRAFT

Although this is a technical report, political factors cannot be ignored where acquisition of new aircraft by firms domiciled in South Africa is concerned. Commuter aircraft in the 20 to 50 seat range are produced in a limited number of countries, among them Brazil, Canada, the Netherlands, the Soviet Union, Sweden, and the United Kingdom. The USA and France build only the smaller models in this range. A number of the governments listed here are severely critical of South African government policies and, interpreting the United Nations arms embargo stringently, may not be prepared to issue export permits for what may be regarded as dual-purpose equipment.

6. CONCLUSIONS AND RECOMMENDATIONS

The preceeding analysis has indicated that the structure of the South African domestic air transportation industry was unbalanced as of 1984. SAA's total domination of the domestic market allowed the company to standardize its fleet on two aircraft types which, while minimizing logistics problems for the airline and offering passengers the comforts of jet travel, were generally too large to service domestic routes economically except for the highest density routes. At the same time, the private airlines have been constrained by regulation and SAA's dominance to operate on marginal routes, stunting their development.

Restructuring of the fleet of aircraft available for domestic service to better fit market requirements would free national resources for alternate uses in the longer term. It would also offer the opportunity to reshape the domestic airline industry. As a rule of thumb, operating economies of scale are reached with as few as five aircraft of a given type. One could imagine a domestic industry that would be tiered by aircraft size. Company 'A' would operate nationally with jet aircraft of 100 seats or more. Company 'B' (or several regional airlines) would operate 30 to 50-seater commuter aircraft; and one or several tertiary airlines would fill the remaining gaps with aircraft in the 10 to 20 seat range. The appropriateness of this scheme would have to be examined further, of course.

No presumption is made regarding ownership of these airlines; however, it would be preferable from a competition perspective if these companies were required to operate at arm's length. In the absence of route regulation and monopoly power, demand-driven route allocation would tend towards the most economically efficient pattern. If regulation is retained, then the regulatory agency should emulate this pattern to the extent possible. The high-capacity airline would service the high-density routes and the peak periods of medium-density routes. The other carriers would share the low- and medium-density routes and perhaps service some of the off-peak periods of higher-density routes.

Fleet restructuring could be expected to achieve savings in operating costs of 10 to 15 per cent. These savings could be partly or fully passed on to the consumer in terms of lower fares. Proper allocation of capacity between full-fare and discount travel would add some additional net revenue. Reductions in operating costs (not impinging on safety) resulting from some possible degree of competition have not been estimated but could also be significant and used to further decrease fare levels.

The results of the analysis presented in this report should be treated as only approximating the extent of desirable changes, but they do sketch a roadmap towards a more efficient air transportation system. The model could be usefully improved to schedule discount travel more flexibly, for example. More reliable data are needed on preferences of the travelling public with respect to time profiles, types of aircraft, flight frequencies, and sensitivity to fare level changes. Realistic demand data are crucial in allowing the model to make proper assessments of the impact of various policy options.

Recommended changes and resulting benefits could be realized in a gradual process which would allow for some experimentation. It may turn out to be too costly both in pecuniary and political terms to make wholesale changes to physical equipment and to existing institutions. It may be preferable to acquire new aircraft as older equipment is retired, and to test the impact of institutional changes in several stages.

Even without major fleet changes, the following steps would help to raise the efficiency of the domestic airline industry:

6.1 A representative survey of consumer preferences should be conducted, preferably by an independent body, to improve model results and to inform the policy debate.

6.2 SAA should reserve peak hour flights with high load factors to full-fare passengers. Discount fare seats should be allocated according to estimated capacity on scheduled flights in excess of full-fare requirements. Where demand warrants, additional off-peak flights should be offered to improve aircraft utilization.

6.3 SAA should review its fare structure with a view to relating fares on individual routes more closely to actual costs, in order to minimize cross-subsidization. Services demanded for non-commercial reasons should be subsidized from other sources, e.g. the government's general revenues.

6.4 SAA should consider offering more non-stop flights between Cape Town and Durban.

6.5 Market access of the private airlines should be improved. These carriers should be permitted to operate non-stop flights on some of the shorter routes now licenced to SAA, at least during off-peak periods when SAA jet aircraft can only operate at a loss. Routes where SAA is the designated flag carrier but on which it does not operate, should be opened to private carriers on suitable terms. The private airlines should be granted sufficient security of tenure on such routes (unless deregulation were to occur) to encourage market development and investment by these firms.

6.6 The pricing regime of turboprop and jet fueld should be put on the same footing to eliminate competitive distortions with respect to the cost of inputs.

6.7 SAA may wish to consider accelerated retirement of its Basic B737-200's which now incur high maintenance costs. In terms of the industry-wide fleet, these aircraft should not be replaced by an updated version such as the B737-300 until this capacity would be required. Rather, the industry should consider acquisition of smaller commuter aircraft.

APPENDIX

DOMESTIC AIR TRANSPORT MODEL FOR SOUTH AFRICA : DESCRIPTION OF SOME COMPONENTS OF THE INPUT DATA

1. OPTIMIZATION CRITERIA

One of the following three to be used:

1.1 Full costing

Evaluates revenue for each potential flight against direct operating cost plus potential passenger time cost.

1.2 Airline net profit

Similar to 1.1 but exclude passenger time cost.

1.3 Load factor

Concerned with capacity utilization. The criterion materially affects revenue and costs but works at a more technical level.

NOTE : The Full costing criterion was used in the preceeding analysis.

2. REVENUE TO COST RATIO (R/C)

R/C as specified to be satisfied before aircraft is scheduled

e.g. R/C = 1,0 = Break even point

3. TYPICAL MONDAY PERCENTAGE (%) DISTRIBUTION OF DEMAND IN 30 MINUTE INTERVALS

	Time	%		Time	%
1	3h00	0	25	15h00	4,6
2	3h30	0	26	15h30	8,3
3	4h00	0	27	16h00	3,8
4	4h30	0	28	16h30	3,7
5	5h00	0	29	17h00	0
6	5h30	0	30	17h30	5,1
7	6h00	0	31	18h00	5,2
8	6h30	1,5	32	18h30	7,3
9	7h00	3,3	33	19h00	1,7
10	7h30	6,6	34	19h30	3,6
11	8h00	6,6	35	20h00	2,1
12	8h30	1,8	36	20h30	3,4
13	9h00	0	37	21h00	1,5
14	9h30	2,3	38	21h30	1,5
15	10h00	2,4	39	22h00	0
16	10h30	4,3	40	22h30	0
17	11h00	2,1	41	23h00	0
18	11h30	4,4	42	23h30	0
19	12h00	2,4	43	24h00	0
20	12h30	4,0	44	24h30	0
21	13h00	1,6	45	1h00	0
22	13h30	1,5	46	1h30	0
23	14h00	0	47	2h00	0
24	14h30	4,6	48	2h30	0

The sum of percentages may exceed 100 per cent; this occurs in the base case because of the inclusion of "excess" (unsatisfied) demand during peak periods.

4. ROUTE OPTIONS

The model examines non-stop routes between points in the network defined by the square (12x12) demand matrix. In addition, direct flight routes with one intermediate stop may be specified.

e.g. Route	May stop over at one of the following points
CPT-JHB	BFN, KIM, UPT, GRJ
CPT-DUR	PLZ, ELS, BFN
CPT-WDH	UPT
CPT-KIM	BFN
CPT-BFN	KIM

The above examples are specific routes (Terminal Points) and a set of permissible intermediate stops. It includes the to and fro journeys.

5. TYPES OF AIRCRAFT INCLUDED IN THE MODEL FOR THE 'BASE CASE'

Type	Number of air crafts	Number of Passengers per aircraft			
		Maximum		Minimum	
		Capacity	desired	desired	acceptable
AIRBUS-AB2-203	6	263	210	132	91
BOEING-B737-200-ADV	15	117	94	59	41
DE-HAVILLAND-DHC-7	20	50	40	25	17
EM BRAER-120-BRASILIA	25	30	24	15	11
BEECH-CRAFT-1900	20	19	15	10	7

6. RATIO OF NON BUSINESS TO BUSINESS FARES

0,5894

7. VALUE OF TIME PER HOUR

R13,50 - Business

R 2,50 - Non Business

Passenger time cost are calculated in three components:

7.1 Value of the divergence between a passenger's time preference and actual departure time;

7.2 for through-passengers on a direct flight with a stop-over, the value of time lost as the difference between travelling time on the stop-over flight and travelling time on a non-stop flight.

7.3 on any route, the value of the difference of travelling time on the particular aircraft type scheduled and the fastest and/or most popular aircraft type (assumed to be the first type listed) in the fleet.

Component 7.3 above is controlled by a parameter called Inconvenience-cost

If the parameter is coded:

0, Inconvenience-cost

travelling time differences between aircraft types will be omitted;

coding of

1, Inconvenience-cost

will ensure that the value of the travelling time differences is included in the passenger time cost calculation.