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AFRICA INFRASTRUCTURE COUNTRY DIAGNOSTIC

Air Transport
Challenges to Growth

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Sustainable Development
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About AICD

This study is part of the Africa Infrastructure Country Diagnostic (AICD), a project designed to expand the world's knowledge of physical infrastructure in Africa. AICD will provide a baseline against which future improvements in infrastructure services can be measured, making it possible to monitor the results achieved from donor support. It should also provide a more solid empirical foundation for prioritizing investments and designing policy reforms in the infrastructure sectors in Africa.

AICD will produce a series of reports (such as this one) that provide an overview of the status of public expenditure, investment needs, and sector performance in each of the main infrastructure sectors, including energy, information and communication technologies, irrigation, transport, and water and sanitation. The World Bank will publish a summary of AICD's findings in spring 2008. The underlying data will be made available to the public, through an interactive Web site, allowing users to download customized data reports and perform simple simulation exercises.

The first phase of AICD focuses on 24 countries that together account for 85 percent of the gross domestic product (GDP), population, and infrastructure aid flows of Sub-Saharan Africa. The countries are: Benin, Burkina Faso, Cape Verde, Cameroon, Chad, Congo (Democratic Republic of Congo), Côte d'Ivoire, Ethiopia, Ghana, Kenya, Madagascar, Malawi, Mali, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, South Africa, Sudan, Tanzania, Uganda, and Zambia. Under a second phase of the project, coverage will be expanded to include additional countries.

AICD is being implemented by the World Bank on behalf of a steering committee that represents the African Union, the New Partnership for Africa's Development (NEPAD), Africa's regional economic communities, the African Development Bank, and major infrastructure donors. Financing for AICD is provided by a multidonor trust fund to which the main contributors are the Department for International Development (United Kingdom), the Public Private Infrastructure Advisory Facility (PPIAF), Agence Française de Développement, and the European Commission. A group of distinguished peer reviewers from policy making and academic circles in Africa and beyond reviews all of the major outputs of the study, with a view to assuring the technical quality of the work.

This and other papers analyzing key infrastructure topics, as well as the underlying data sources described above, will be available for download from www.infrastructureafrica.org. Freestanding summaries are available in English and French.

Inquiries concerning the availability of data sets should be directed to vfoster@worldbank.org.

Summary

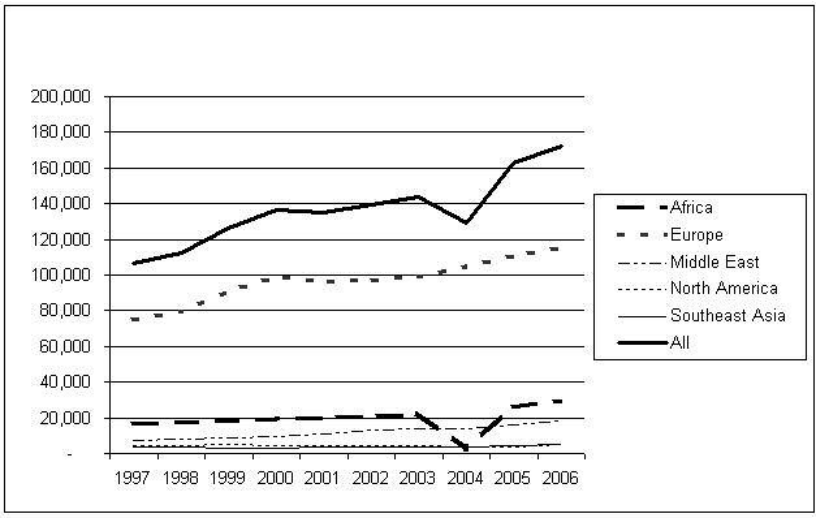
The air transport market in Sub-Saharan Africa presents a strong dichotomy. In southern and East Africa the market is growing: three strong hubs and three major African carriers dominate international and domestic markets, which are becoming increasingly concentrated. In contrast, in Central and West Africa the sector is stagnating, with the vacuum created by the collapse of Côte d'Ivoire and the demise of several regional airlines, including Air Afrique, still unfilled. Throughout, there are many unviable small state-owned operations that depend on subsidies and have a monopoly over the domestic market. There are also some promising signs: growth in air traffic has been buoyant, the number of routes and the size of aircraft are being adapted to the market, and a number of large carriers are viable and expanding. But in spite of this, overall connectivity has been declining. As oil prices rise, the role of air transportation will be looked at even more critically. Africa is a poor continent, and some countries face the potential of further isolation as the cost of flying increases.

Infrastructure is not at the heart of the sector's problems. The number of airports is stable and there are enough runways to handle traffic in the near future with better scheduling and relatively modest investment in parallel taxiways and some terminal facilities. The safety problem is more one of pilot capability and safety administration than unsafe aircraft, though air traffic control facilities are admittedly poor. Revenues from airports and air traffic are probably high enough to finance the necessary investments, but are not currently captured by the sector.

At a time when Africa's infrastructure requirements are being widely debated, a more complete inventory of air transport capabilities is sought. This report will focus on industry organization within Africa; overall accessibility; and the quality of oversight and infrastructure installations countrywide and at selected airports with various capacities.

Beyond data collected from questionnaires sent directly to the civil aviation authorities (CAAs) in each country, this report relies on data collected through a variety of other sources, especially from the providers of flight schedules to global reservation systems, for an independent analysis of trends.

Figure A Overall traffic, measured in seat kilometers, in Africa.



Source: Boeing Commercial Aircraft.

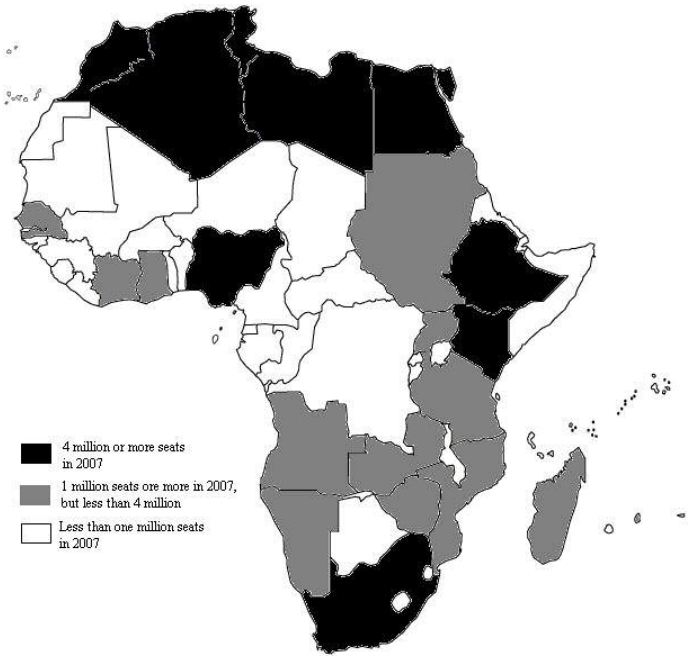
A continental divide in air traffic

Following a significant global decline in 2001, Africa's air transport industry grew at a healthy 5.76 percent per year between 2001 and 2007. The decline is clearly visible in Figure A, which shows traffic as measured in seat kilometers between 1997 and 2006. Growth between 2004 and 2007 rose 10.68 percent, to roughly 123

million seats annually. The aggregated figures for Africa, as measured in seats offered, show growth in all types of scheduled air travel: intercontinental traffic, international traffic within Africa, and domestic travel (figure C).

The countries' markets can be categories by size, with those above four million passengers being the largest, those with one million or more (but less than four million) being in the middle, and those very thin markets with less than one million seats being at the low end. Figure B shows a graphic representation of these markets. A clear swath of nations becomes visible, from the upper west (Mauritania) to the Democratic Republic of Congo. This continent-wide pattern reappears in the discussion on regional growth zones in international traffic, the quality of safety oversight, and even somewhat in the nature of airline ownership.

Figure B Markets segmented by size, as measured in seats available in 2007. Cape Verde, not on the map, falls in the middle tier. Pronounced is the swath of countries with small markets visible from Western Sahara/Mauritania to the Congo DRC.

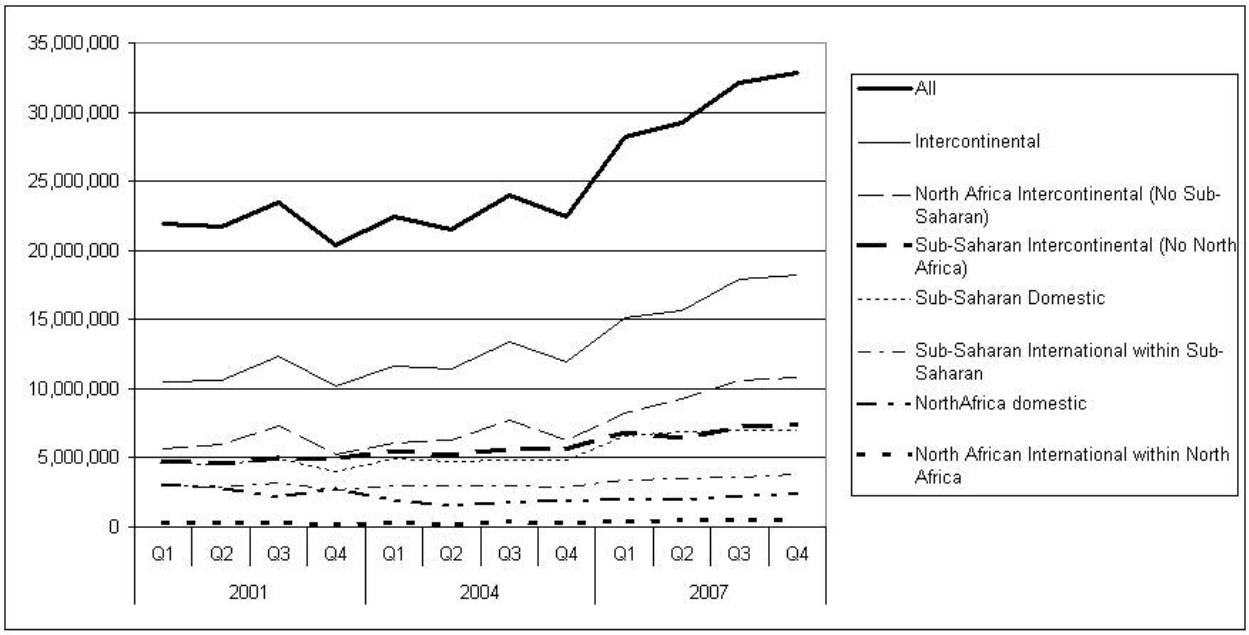


Source: Analysis on data provided by Seabury ADG.

Intercontinental traffic in the region relies heavily on the three major hubs of Johannesburg, Nairobi, and Addis Ababa. It has grown at an annual average rate of 6.2 percent between 2001 and 2007. While the South Africa routes to the United Kingdom and Germany are still the most heavily trafficked, the most notable feature of this growth is the significant rise in service through the Middle East from all of the main hubs. North African intercontinental traffic grew 8.3 percent during the same period, with the most dominant routes being between France and Morocco, Algeria, and Tunisia. Egypt serves as another important entry point from Germany, the Russian Federation, and the Middle East.

International traffic within Sub-Saharan Africa grew more rapidly, at an average of 6.5 percent between 2001 and 2007, with traffic between the region and North Africa growing at 25 percent per year. The same three major hubs handle 36 percent of this international traffic (figure D). In each case the inter-Sub-Saharan Africa traffic of these hubs is dominated by the national airline. South African Airways, Kenya Airlines, and Ethiopian Airlines provide 33 percent, 70 percent, and 83 percent, respectively, of the international traffics through their hubs. Both Kenya Airways and Ethiopian Airlines are active in developing new routes on which they are the sole carrier, while most of the South African international routes have more than one carrier in competition.

Figure C Overall traffic, measured in seat kilometers, in Africa.



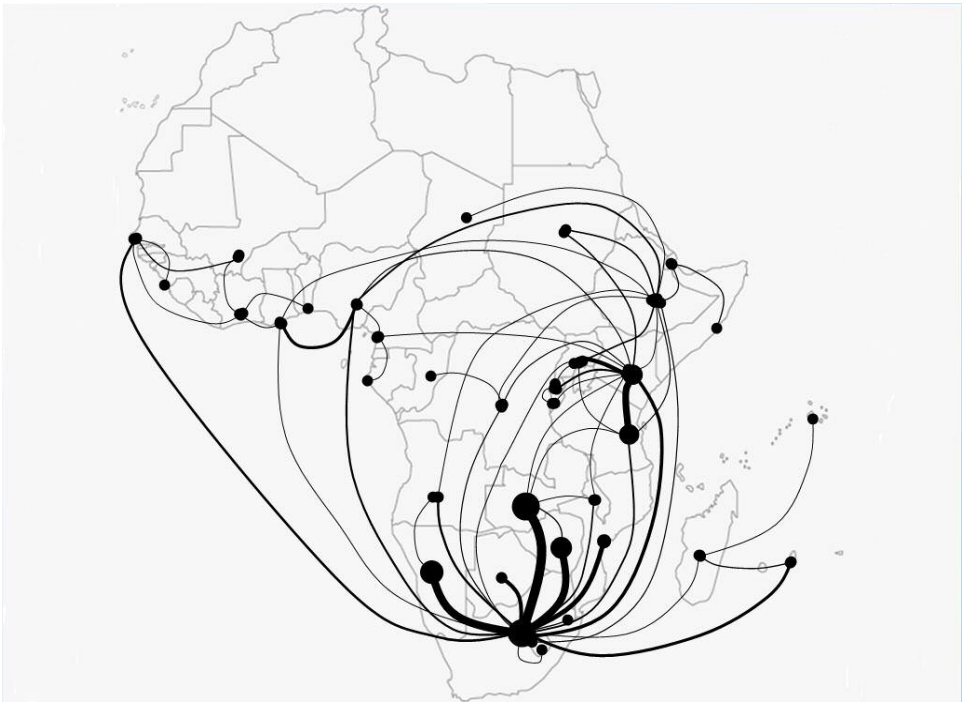
Source: Analysis on data provided by Seabury ADG.

East Africa has the more developed network. In West and Central Africa only Nigeria has a significant number of connections, both intercontinentally and internationally. With the collapse of national and regional carriers, the region recently suffered an absolute decline in service. North African international travel showed some of the most significant gains of over 9.5 percent per year between 2001 and 2007.

Notwithstanding the growth in traffic, the number of city pairs served in Sub-Saharan Africa has dropped by 229 between 2001 and 2007, and if South Africa, Nigeria, and Mozambique are excluded there has been an average annual decline of 1 percent per year and a loss of 137 routes between 2004 and 2007.

The impact of the Yamoussoukro Decision (YD) of 1999, an effort to liberalize international air travel within Africa, is best measured by the amount of fifth freedom and beyond traffic within Africa. The percentage of international flights conducted by carriers not part of either country being served is highest in countries where the implementation score of the YD is highest (table A). Except for the Arab Maghreb Union (AMU), which is not a party to the YD, all countries have shown an increased market proportion of these airlines between 2004 and 2007.

Figure D. Top 60 international routes in Sub-Saharan Africa



Source: Analysis on data provided by Seabury ADG.

Table A. Percentage of flights between countries by airlines that are not based in either

	AMU (%)	BAG (%)	CEMAC (%)	COMESA (%)	EAC (%)	SADC (%)	WAEMU (%)
Seats 2001	7.6	45.3	38.0	25.4	33.0	18.7	47.7
Seats 2004	8.3	36.3	11.8	9.9	12.2	2.3	43.7
Seats 2007	4.1	43.3	28.5	14.1	16.4	5.7	43.8
YD score	1	4	5	3	3	2	5

Source: Analysis on data provided by Seabury ADG.

Note: YD = Yamoussoukro Decision of 1999; AMU = Arab Maghreb Union; BAG = Banjul Accord Group; CEMAC = Economic and Monetary Community of Central Africa; COMESA = Common Market of Eastern and Southern Africa; EAC = East African Community; SADC = Southern Africa Development Community; WAEMU = West African Economic and Monetary Union.

Domestic Sub-Saharan African traffic grew at the fastest rate of all Sub-Saharan African traffic—over 12 percent per year between 2001 and 2007. On the one hand, Nigeria has experienced annual growth in domestic traffic as high as 67 percent in Nigeria. On the other hand, about half of the countries studied experienced an absolute decline in domestic air transport. Domestic air transport varies strongly from country to country, and is dependent on many factors, including topology, income per capita, and types of services available. Ethiopia, home to one of the most important airlines in Africa, has relatively little domestic air transport. The growth of Nigeria's domestic travel is so significant that they skew the overall growth figures for West and Central Africa. North African domestic traffic declined nearly 4 percent.

With some notable exceptions, domestic travel in most countries is serviced by the country's flag carrier and features high market concentration.

Overall, a striking dichotomy emerges between the eastern and western sides of the continent. East and southern Africa, on the one hand, have developed major hubs and are home to the three most important airlines in Sub-Saharan Africa. These airlines are an engine of growth, with the denser network of Sub-Saharan traffic. West and Central Africa, which went through very strong declines shortly after 2001, experienced smaller, in some cases negative, growth and development since and are characterized by a less-developed hub system.

The uneven growth patterns in Sub-Saharan Africa are caused in part by the decline and collapse of major carriers in the western portion, most notably Air Afrique, Air Gabon, Ghana Airways, and Nigerian Airways. The drop in capacity is slowly being rebuilt by the major carriers in the south and the east. Ethiopian Airlines and Kenya Airways are expanding toward the declined routes and east-west traffic is slowly growing. The shock of the collapse of the traditional carriers in the region, and the expansion of South African Airways, Ethiopian Airlines, and Kenya Airways, is leading toward much needed consolidation of the industry in Sub-Saharan Africa.

Contrary to what is often reported in the public media, Africa's fleet of aircraft used for advertised scheduled services is being renewed, and is adjusted for the types of markets served. In nearly all regions wide-bodied aircraft have been replaced with newer, smaller jets such as the Boeing 737. These aircraft are more efficient for short- to medium-haul distances. Though the accident rates involving older, often Russian-built aircraft is the highest in the world, the portion of the seat kilometers flown in these aircraft on regularly schedules services is now very small.

Air travel within Africa is considerably more expensive per mile flown than intercontinental travel, especially on routes of less than 4,000 kilometers (figure E). This reflects larger markets and higher competitiveness among intercontinental routes. Domestic pricing is most likely skewed by subsidized or fixed pricing on some routes, keeping fares artificially low. Another recent study by Intervistas for International Air Transport Association (IATA) concludes that the price elasticity of air transport within Africa is relatively high.

Airside versus landside infrastructure

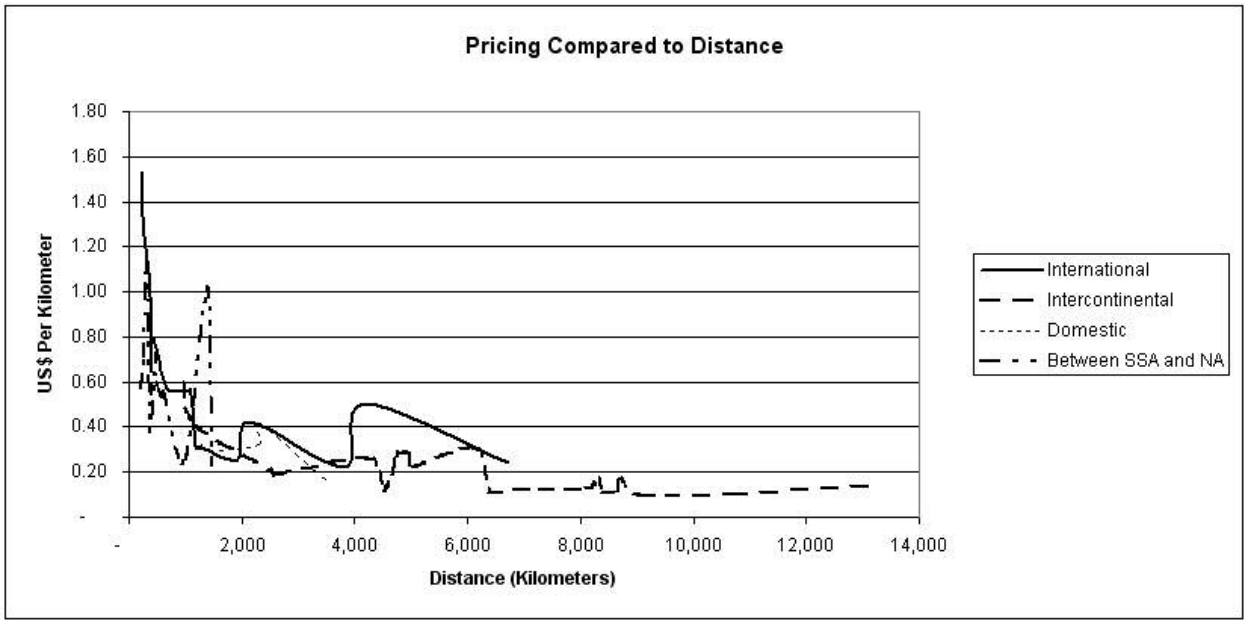
As of November 2007, of an estimated 2,900 airports in Africa, there are 280 airports receiving regularly scheduled services. There are two massive gateways (Egypt and South Africa) and six additional important entry points (Morocco, Algeria, Tunisia, Senegal, Ethiopia, and Kenya). The number of available runways and their general condition does not seem to be a constraint in traffic at current levels, though the condition of the airport infrastructure varies widely. An informal analysis of runway conditions using commonly available satellite images (table B) was conducted. Fortunately the 27 percent of runways in marginal or poor condition only handle an estimated 4 percent of Sub-Saharan traffic.

Table B. Runway quality in Africa

Rating	North Africa		Sub-Saharan Africa	
	Airports	%	Airports	%
Excellent	28	60	31	17
Very good	17	36	51	28
Fair	2	4	52	29
Marginal	–	–	8	4
Poor	–	–	37	21
Totals	47	100	179	100

Source: Analysis on data collected by the World Bank: Totals include double counting for in-region travel.

Figure E. Air fares on African routes [[see spelling of what should be "intercontinental" in key; also, capitalization of axes labels]]



Source: Analysis on data collected by the World Bank.
Note: Includes North Africa.

Runway capacity in Africa is not a limiting factor for traffic. Limiting factors for traffic include the ability to enter or leave the runway via taxiways, the amount of apron space for parking, and the amount of terminal space for processing passengers. North African countries planned and developed their airports for expected increases in passenger traffic, with capacities now well capable of handling current and future numbers of travelers. Sub-Saharan airports show clear constraints even at main airports such as John Kenyatta International Airport in Nairobi, Kenya. The landside infrastructure of airports in Sub-Saharan Africa shows signs of needing large capital investments.

Evidence suggests that larger airports in general in Africa are financially sustainable, with excess revenues going either to airports in the system that are not self-sufficient, or to nonairport related budgets. The revenue stream for airports is somewhat different from those found in the West. Car rental booths and other concessions supply the larger portion of revenues in much of the system in the United States, whereas Africa's airports rely heavily on passenger charges. Overall the airport charges in are by necessity higher but vary considerable. In some cases excessive charges may be levied in order to finance a new airport rather than upgrading existing facilities at a much lower overall investment cost.

Private sector participation in airports is limited throughout Africa, though some interesting examples, such as the airports company in South Africa, do exist. In most cases, private sector involvement has been limited to some concessions and management contracts, usually involving small investments.

Air navigation services and air traffic control throughout Sub-Saharan Africa is spotty and concentrated in a few centers. South Africa and Kenya have several radar installations and are able to actively monitor traffic. Ethiopia, the third most important airport in Sub-Saharan Africa, has no air traffic surveillance technology.

The most important airports feature instrument landing systems (ILSs) and basic traditional navigation aids. Away from the centers, navigation aids, as well as communication stations, become rare or nonexistent. African airspace and airports may not necessarily be in need of radio-based navigation and surveillance infrastructure such as very high frequency (VHF) Omni-directional Radio Range (VOR) or radar technology, but will be in need of investments in the less-costly, satellite-based replacements such as Global Navigation Satellite System (GNSS) approaches and Automatic Dependent Surveillance-Broadcast (ADS-B) technologies.

Institutions and Oversight

Sub-Saharan Africa's CAAs are generally underfunded on a per country basis. They cannot fulfill their duty as safety regulators because of lacking capacity, especially safety inspectors. There is anecdotal evidence that political influence has hampered those authorities that were not established as autonomous. In many cases, revenues received by the CAAs, such as overflight charges, are handed to the state treasury. This causes the authority to rely on state allocations for financing.

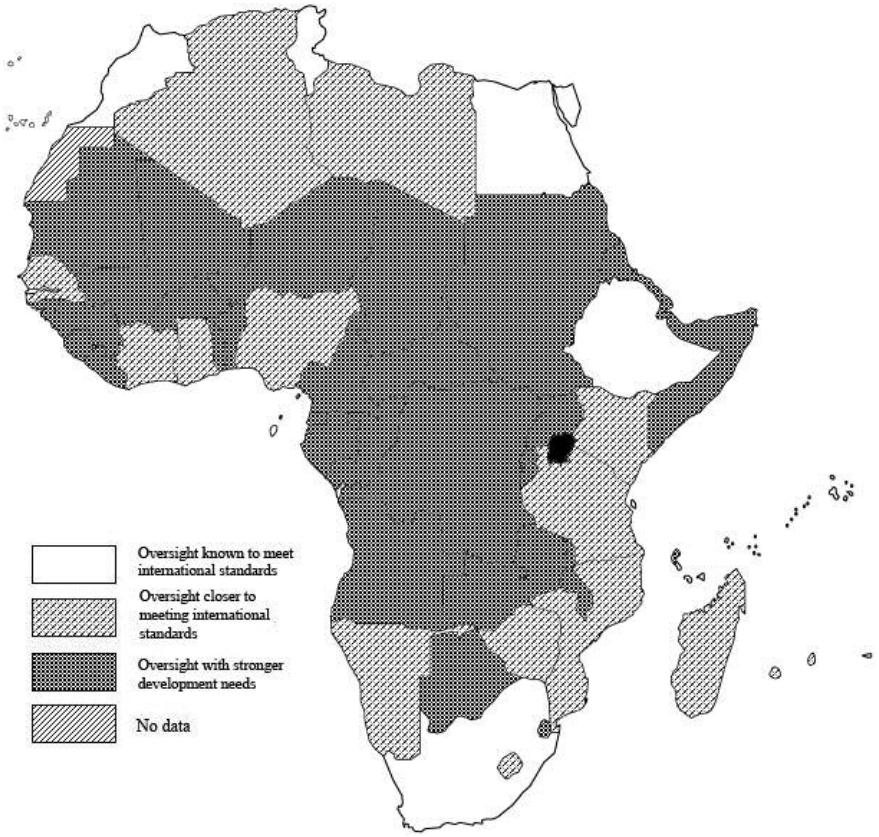
Current accident rates in Africa reflect this lack of capacity. Africa has the highest accident rate of Eastern-built aircraft. It also has the highest accident rate of Western jets outside the former Soviet Union (figure F). The accidents are due to lack of training, and the unknowing or willful lack of following procedures, and rarely can be chalked up to equipment failure alone. A recent accident involved a plane that was less than a year old.[1]

Figure G shows a rating of the quality of oversight according to several criteria. Only a handful of countries are rated as having good oversight—Egypt, Ethiopia, Morocco, South Africa, and Tunisia. As many as 24 countries are rated as having poor oversight.

[1] The validity of the calculations behind the rate for the former Soviet Union is a matter of controversy. It is commonly accepted that Africa is still the least safe continent.

To introduce better oversight, various programs such as Cooperative Development of Operational Safety and Continuing Airworthiness Projects (COSCAPS) are being proposed and implemented. Regional organizations that pool resources from individual countries and oversight agencies can train and share qualified technical personnel, such as flight inspectors. Because these efforts are in the beginning stages, the effectiveness of these programs for oversight in Africa is not known. Similar programs have been highly effective in other regions, such as Latin America.

Figure G. Quality of African safety oversight



Note: Since this map was produced, Gabon has been added to the list of countries with serious concerns about oversight. Cape Verde, not shown, carries the FAA category 1 rating for good oversight and adhering to international standards.

Policy Recommendations

Five general policy recommendations are

1. Increase safety oversight by pooling resources and sharing them regionally
2. Invest in existing airport infrastructure, not new airports.
3. Move away from state-owned non-sustainable flag carriers
4. Develop new-technology based air traffic control systems and optimize air space design for improved fuel efficiency and lower environmental footprint
5. Continue the process of liberalization as set fourth in the Yamoussoukro decision
6. Develop and strengthen capacity in sector data collection

A Note on the research Methodology Used in this Report

African scheduled air transport—data sources

Traffic analysis is highly data intensive. Unfortunately, due to the extreme limitations in both budget and capacities, those countries most in need of development aid are also those with the most difficulties in collecting and reporting vital data. This is as true in air transport as in other sectors, and applies especially to Africa.

The standard data sources for traffic, both collected by airlines and airports, would be the International Civil Aviation Organization (ICAO). But the actual passenger counts, often kept on paper ledgers with no computerization, are in many cases never submitted to ICAO, leaving exceptionally large data holes in any time series. In fact, for many African countries the data holes can be as large as five years or more, with only sporadic monthly reporting. In other words, alternative sources of data must be tapped.

An excellent *approximation* of actual traffic would be the capacity offered. Under the assumption that no airline would, over time, fly an aircraft not filled highly enough to make the flight economically feasible, one could hypothesize that at any given point in time 50 percent to 70 percent of the actual seat capacity offered on a route would closely approximate the actual traffic. In addition, one could hypothesize that even with changes in load factor, the overall trending in time of seat capacity would approximate actual traffic trends.

As such, data published by airlines in reservation systems, a necessary tool for marketing capacity, could substitute for actual travel data. In fact, this data is readily available, is highly granular, and provides a wealth of information not just on the actual seats, but also they type of aircraft, the frequency of the routes, and the actual scheduled times of the flight.

Today there are two main sources of this data—The Official Airline Guide (OAG), and Seabury's Airline Data Group (ADG). Both sources depend on airlines reporting their routes, and both have captured 99 percent of the scheduled airline data, with about 900 to 1,000 airlines participating. OAG used to be the only provider of this data, and had enjoyed a monopoly in the market until the creation of the ADG data collection beginning around the year 2000. Though OAG is the more established collector, both companies enjoy and excellent industry reputation, and are endorsed by the International Air Transport Association (IATA).

For the studies on Africa undertaken by the World Bank, ADG's data was used. A total of twelve snapshots in time where assembled, four each for the years 2001, 2004, and 2007. In order to assure the capture of seasonal trends, the four samples for each year consisted of data for one week in the months of February, May, August, and November. For the annualization of these figures the total sum of the four observations for a year were multiplied by thirteen.[2]

[2] Since this is weekly data, 4*13–52 weeks, and is more precise than 4*12=48.

The data consists of one record of each flight occurring during the sampled week, with relevant entries as to the origin and destination airports, the changeover airport in the case of one-intermittent-stop flights, the number of kilometers for the flight, the duration of the flight, the number of seats available on the flight, the number of times the flight occurred during the week, which weekdays the flight was scheduled, the aircraft type, both an entry for the marketing operator as well as the actual operator, and various flags.

Using Microsoft Access, the data was normalized and linked to other relevant tables, some of them from other sources, in order to develop a relational database for extensive summarization and querying. In addition, one important adjustment was made: Flights going from one airport to another final destination with a stop in between had their capacity allocated with even proportions to each leg. This implies that a flight from Airport A to Airport C via Airport B would only have half the capacity to go from Airport A to C, while the other half would deplane at Airport B. This allocation was made for each leg, that is, if a flight had four legs, each of the destination airports would have one-fourth of the capacity allocated. Though the even distribution of the legs is an assumption, overall this methodology prevents double-counting of capacity for multilegged flights. The overall impact of these calculations produced a roughly 10 percent adjustment in capacities.

In order to provide safeguards and "sanity checks," some of the airport aggregates were compared to actual data where available from ICAO. The ration of seats versus reported traffic hint at a load factor of about 65 to 69 percent for those routes tested—a solid and reliable figure, further supporting the credibility of the data. Other, rougher summaries hint at a load factor of 50 percent to 60 percent; but these are large aggregates measured against each other, most likely also having significant assumptions in the index measured against.

The data is particularly helpful in capturing trends in city and country pairs, fleet renewal (in most cases the type of aircraft is provided down to the series number, such as Boeing 737-100 versus 737-800), and airline market share. But it must be kept in mind that the data reflects only *scheduled* and *advertised* services. An "informal" airline with no reservation system, issuing paper tickets at the airport, and providing only a chalkboard or a printed flyer as to their schedule, would not be captured. For example, the ADG data shows virtually no older, Easter-block built aircraft operating in Africa, yet we have anecdotal evidence of such operations, as well as accident statistics. But the overall portion of this market is suspected to be relatively small, though it carries a high profile regarding incidents and accidents.

Other data sources

Since central data collection in Africa is still in a development stage, much had to be drawn from diverse sources. A questionnaire was sent to all 54 African countries, with extensive details on such things as civil aviation budgets, airport charges, and the number of employees within the civil aviation authority. Twenty countries returned the questionnaires, with various levels of completion as their resources allowed. When and if a true comparative sample set was derived from the questionnaires, it has been applied in this report. However, since the questionnaire was large, and many different sections where completed by the Civil Aviation Authorities (CAAs) while others were not, the actual sample size per answer often remained very small.

In terms of air navigation and air traffic control infrastructure, ICAO reports provided by the Air Navigation Bureau of ICAO provided the most comprehensive inventory, and spot checks with actual data returned from the questionnaires showed both in agreement.

Airport infrastructure was gleaned from various sources. In terms of overall airport and runway condition, a satellite image from a commonly available satellite image service was examined, with the whole population of all airports receiving scheduled services, as derived from the ADG data, being surveyed, and roughly 66 percent having images of enough quality for drawing conclusions. Of those 66, expert, on the ground observational inputs confirmed the general conclusions on a sample of 23. Additional information for each airport was researched using common data sources, including Jeppensen's.

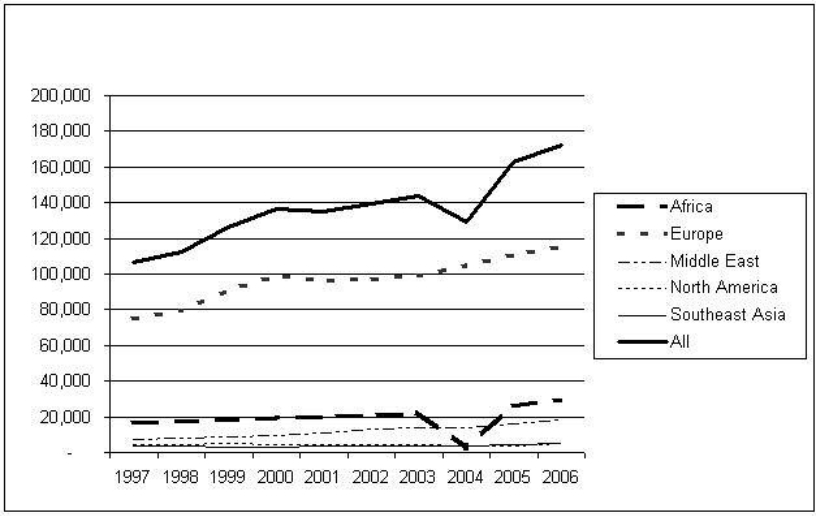
In terms of finding airport terminal capacity, since ICAO does not keep a central database, data collected by www.azworldairports.com, a publisher in the United Kingdom was used. This provided self-reported information from the largest of the African airports.

1. Airlines and routes

Overview of overall traffic and intercontinental capacities

Africa, though overall the smallest player in air transport (with less than 3.7 percent of the global market) in 2007, has seen significant growth, especially more recently between 2001 and 2004. This growth is found primarily in intercontinental traffic, in certain regions in international traffic, and in certain countries, such as Nigeria, in domestic traffic. As seen in figure 1.1, traffic as measured in revenue passenger kilometers (RPKs) grew steadily between 1997 and 2001, until a mild downturn as a result of September 11, 2001. 2002 and 2003 both were years of growth, until the collapse of several African airlines, which bought about significant reduction in intra-African traffic in 2004. However, as new capacity entered the marketplace between 2005 and 2006 traffic continued to grow, even beyond the losses of 2004. Additional overall traffic figures using estimated seats as an estimation of passenger numbers are summarized in the first row of table 1.1. The current market consists of roughly 122.5 million passenger seats, and has grown annually at 5.8 percent between 2001 and 2007. This rate masks the much lower growth rate between 2001 and 2004, and conversely a much higher growth rate of 10.7 percent between 2004 and 2007. Table 1.1 also shows that growth has been seen in all aggregated figures for Africa in intercontinental, international travel within Africa, and domestic travel. Figure 1.2 provides a graphic representation of various annual growth rates in various markets between 2004 and 2007. A graphic representation of the table, also showing seasonal swings, is found in figure 1.3.

Figure 1.1 African Revenue Passenger Kilometers (RPKs), in millions, from 1997 to 2006, by selected segments. Some markets not included due to missing data.



Source: Analysis on data provided by Boeing.

Forecasts are also more difficult to make because of the recent changes in fuel prices and the nature of the global economic crisis. 2008 saw fuel the price of oil go to the $150 range per barrel, causing much damage to the airline industry. Since then prices have declined by nearly 2/3, however, as fuel costs for the industry has declined, so has overall demand due to the global recession. The industry has not had time to recover from the oil shock, and now faces declining demand. The uncertainty of the timing of a global economic recovery, and unpredictability of oil markets, especially during increased demand on fuel during a recovery, adds much uncertainty to global air traffic.

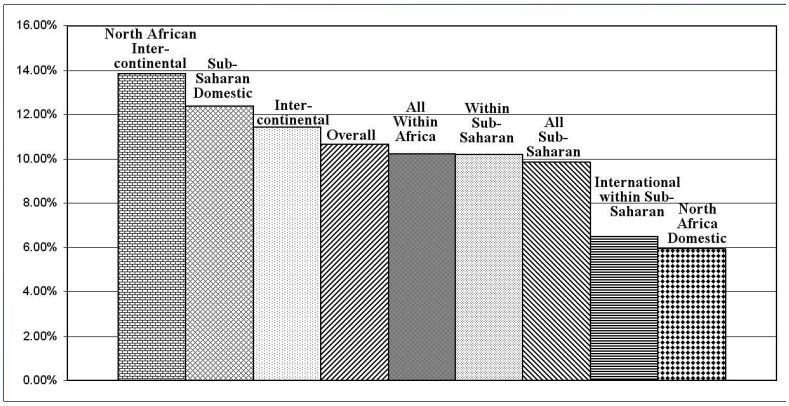
Preliminary data for 2008 (not shown) for Africa has a more pronounced downturn in estimated capacity for the last quarter. The overall figures for the year, though, seem to indicate a continuation of the growth seen between 2004 and 2007. There is speculation that even in a downturn there is still some expected growth in parts of the developing world, with perhaps those having shown the highest rates experiencing a decline in growth rather than an overall decline. It is too early to conclude if this will hold true for Africa.

Table 1.1 Estimated seats and growth rates in African air transport markets. Since these markets overlap, totals of the different submarkets add up to more than the overall total shown in the first line. ADDD

Market	Estimated seats 2001 (millions)	Estimated seats 2004 (millions)	Estimated seats 2007 (millions)	Growth 2001–4 (%)	Growth 2004–7 (%)	Growth 2001–7 (%)
All markets	87.5	90.3	122.4	1.1	10.7	5.8
Intercontinental	43.7	48.4	66.9	3.5	11.4	7.4
All just Sub-Saharan	50.4	54.5	72.3	2.7	9.9	6.2
All within Africa	42.8	40.9	54.7	-1.5	10.2	4.2
Sub-Saharan domestic	18.2	19.4	27.5	2.1	12.4	7.1
North African international within North Africa	1.1	1.3	2.0	3.2	16.6	9.7
Sub-Saharan international within Sub-Saharan	11.8	11.9	14.3	0.3	6.5	3.4
North Africa domestic	10.7	7.1	8.4	-12.9	6.0	-3.9
Sub-Saharan intercontinental (No North Africa)	19.5	22.1	28.1	4.1	8.4	6.2
North Africa intercontinental (No Sub-Saharan)	24.1	26.3	38.8	2.9	13.9	8.3
Between North Africa and Sub-Saharan Africa	0.9	1.3	2.5	11.1	24.8	17.8
Other	1.0	1.1	0.8	1.2	-9.6	-4.3

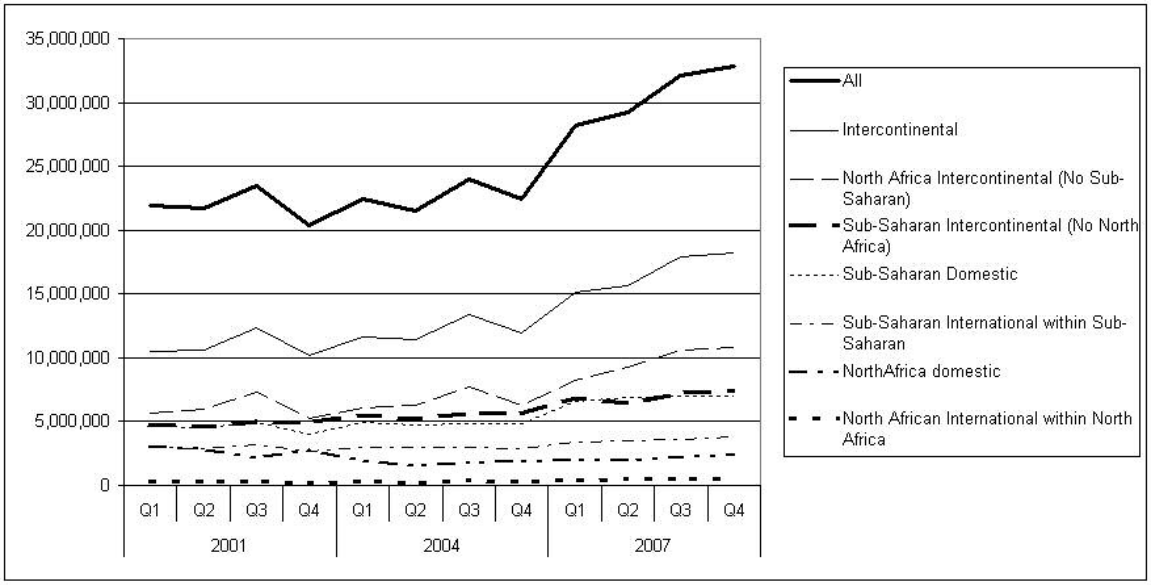
Source: Analysis on data provided by Seabury ADG.

Figure 1.2 Annualized growth rates in seat capacity by travel type, 2004–7. Growth in Sub-Saharan domestic travel nearly rivals that of intercontinental travel in North Africa.



Source: Analysis on data provided by Seabury ADG.

Figure 1.3 Traffic according to markets, measured in estimated seats. The greatest seasonality can be seen in intercontinental travel, with particular peaks in late summer (July–September). But, recent overall growth in intercontinental travel has masked the phenomena.



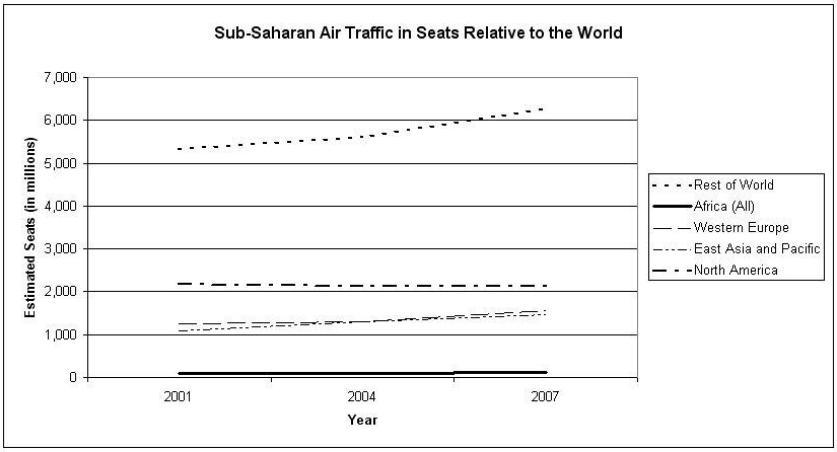
Source: Analysis on data provided by Seabury ADG.

Box 1.1 A Comparison of African Air Transport with Examples from the Rest of the World

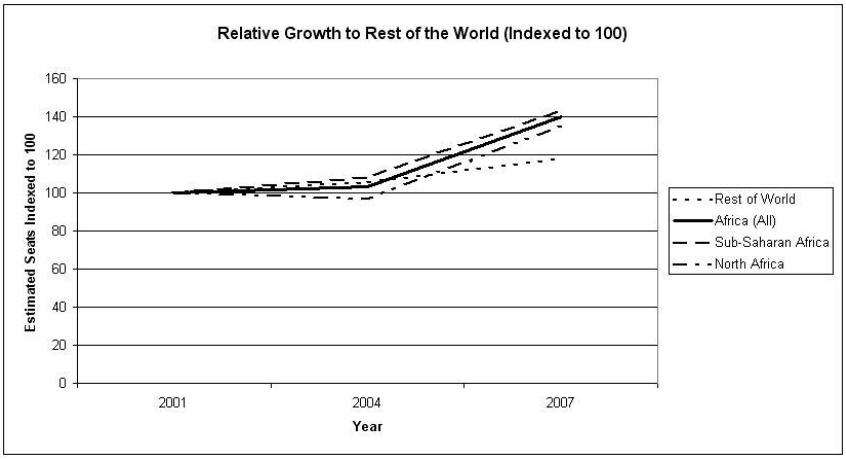
Much can be said about how thin the African air transport markets really are. Though this section of the report is focused on the distribution of various kinds of traffic within the continent, it is useful to put these numbers into some perspective:

The traffic for all of Sub-Saharan Africa (roughly 72.3 million seats in 2007) is just ahead of the air traffic related to the Spanish capital Madrid (est. 68.5 million in 2007). The combined domestic traffic for all of Sub-Saharan Africa (27.5 million) is just over twice the overall traffic for the French city of Nice (13.1 million in 2007). All markets combined in both North and Sub-Saharan Africa have about 122.4 million seats, while Atlanta alone, in the United States, was at roughly 103.9 million in 2007. John F. Kennedy International Airport in New York overall traffic alone has exceeded all intercontinental traffic in all of Africa for both 2001 and 2004.

However, if one looks at growth rates, Africa has outpaced the rest of the world. While the rest of the world had an overall traffic growth of 18% between 2001 and 2007, total African traffic has actually gained nearly 40%, and Sub-Saharan traffic even as much as 46.5%. The two charts below demonstrate the overall size of African markets versus the rest of the world, and the related growth.



Source: Analysis on data provided by Seabury ADG

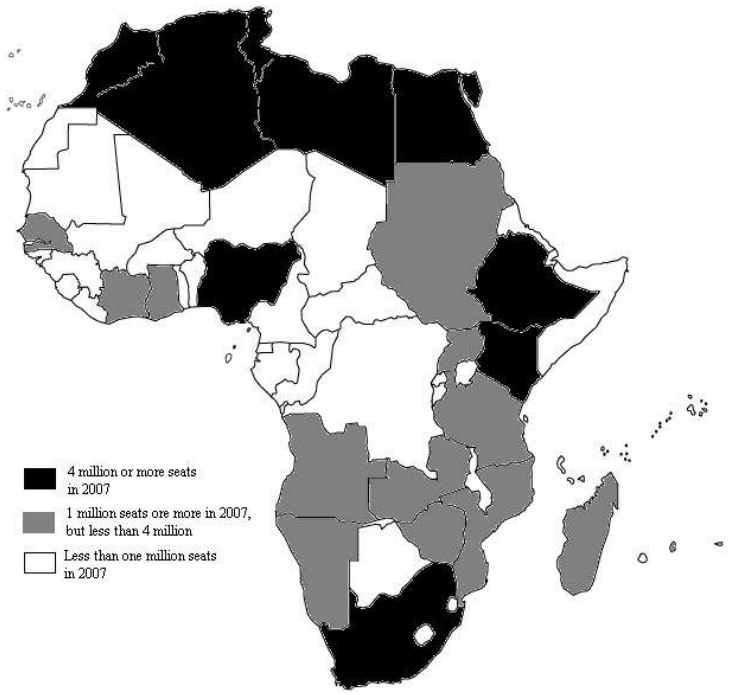


Source: Analysis on data provided by Seabury ADG

The growth has, however large, been highly uneven in Sub-Saharan Africa. In fact, the distribution of traffic is so concentrated that by some measures the combined traffic for Egypt and South Africa represent about 50% of the entire traffic in Africa[3]. West and Central Africa went through a significant decline after the collapse of several significant airlines including Air Afrique, and have not yet fully recovered, while East Africa and southern Africa have benefited from the growth and development of a significant network by three key players: South African Airways, Ethiopian Airlines, and Kenya Airways. One of the weakest points in connectivity lies between the better-developed network in the east and countries in West and Central Africa. Slowly this gap is being filled by the major carriers from the East as liberalization takes a foothold throughout Africa.

The African market can be split into three general categories – those with 4 million or more seats in 2007, those with 1 million or more seats yet smaller than 4 million seats, and those less than 1 million seats. The breakout is visually represented in figure 1.4. With the exception of Nigeria, the countries with the largest markets are found in the north and south of the continent, with medium-sized markets mainly concentrated on in the east, but for the exceptions of Ghana, Ivory coast, and Senegal. Out of 15 land-locked countries, almost three quarters amongst those are of the bottom third in market size – nearly twice the proportion as the non-landlocked countries, where 50% fall into the smallest market category. The geographic pattern shown by the swath of countries with small markets will reappear with variations in later discussions concerning regional growth and safety oversight.

Figure 1.4 Markets segmented by size, as measured in seats available in 2007. Cape Verde, not on the map, falls in the middle tier. Pronounced is the swath of countries with small markets visible from Western Sahara/Mauritania to the Congo DRC.



Source: Analysis on data provided by Seabury ADG.

Today, 15 airlines constitute 59.1 percent of the total market share of all seats in Africa, down from a combined total of over 63.9 percent in 2001. Noticeable in particular is the loss of market share by South African Airways from roughly 16 percent in 2001 to 14 percent as of November 2007, as well as the decline in British Airways. Meanwhile, Ethiopian Airlines and Qatar Airways are growing at a healthy rate. The most significant growth in capacity, however, is shown by Emirates, which increased more than threefold from 960,000 seats to over 3.6 million between 2001 and 2004, and now comprises almost 3 percent of the entire market. South African's Comair, an old and established airline with franchise agreements with British Airways, has also

[3] Airports Council International, ACI Airport Economics Survey 2007, pp 4

shown significant growth. Table 1.2 shows the top 15 carriers with their respective overall share in a market with a seat capacity of 130 million seats and 319 billion seat kilometers as of 2007. The overall market is split roughly 50-50 between African and non-African carriers.[4]

Table 1.2 Top 15 airlines in the overall African passenger air transport market. The total scheduled seat capacity offered by an estimated 168 airlines is roughly 130 million for 2007, flying a total of 295.6 billion seat kilometers.

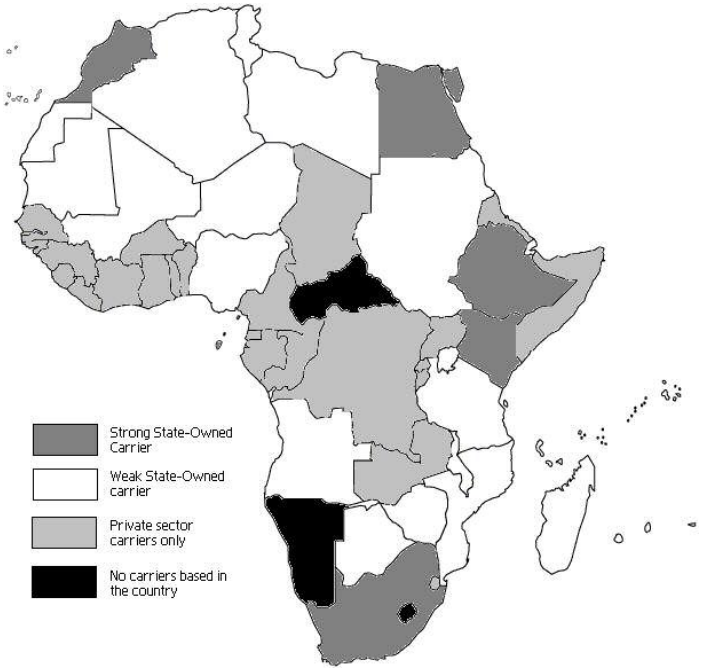
Rank	Airline	Estimated total seat kilometers 2007 (millions)	Market share 2001 (%)	Market share 2007 (%)
1	South African Airways	34,112	15.7	13.8
2	Air France	22,707	7.7	7.6
3	Egyptair	21,636	7.0	5.4
4	British Airways P.L.C.	17,150	9.7	4.4
5	Emirates	14,504	1.1	4.1
6	Royal Air Maroc	13,772	3.4	4.0
7	Ethiopian Airlines Enterprise	12,493	2.1	3.9
8	Kenya Airways	11,602	2.4	2.9
9	KLM	10,688	3.4	2.8
10	Air Mauritius	8,598	3.3	2.5
11	Deutsche Lufthansa AG	7,676	2.5	1.8
12	Air Algerie	5,851	2.1	1.7
13	Virgin Atlantic Airways Limited	5,171	1.4	1.5
14	Tunisair	5,035	1.9	1.4
15	Qatar Airways (W.L.L.)	4,623	0.2	1.3

Source: Analysis on data provided by Seabury ADG.

[4] See market totals in table 6 and table 7 in Appendix V.

Of the 53 African states discussed, 25 have a national airline with at least 51 percent state ownership. The financial conditions and operating abilities of the majority of these, mostly small, airlines are a cause of great concern. In most cases they are subsidized operations with large losses. Direct operating costs are higher in Africa, in part because of higher fuel cost, higher maintenance costs, and also higher insurance costs. In all too many cases these airlines are not able to negotiate these difficulties while serving very limited markets.

Figure 1.5 Countries with flag carriers. Cape Verde (not shown) belongs to those countries with a weak state-owned carrier.



Source: Analysis based on data found in The Implementation of the Yamoussoukro Decision, Charles. E. Schlumberger, McGill Institute of Aerospace Law, 2008, pp 287-288. Though not marked as such, Tunisia's flag carrier, a smaller niche operator, is considered relatively sound.

The state or "flag" carriers can be divided into two main groups – strong dominant or healthy players, of which there are only five or six on the continent (Royal Air Moroc, Kenyan Airways, South African Airways, Ethiopian Airways, Egypt Air, and perhaps Air Tunisia) , and the remainder, often carriers running large operating deficits. Though there are successful private airlines, and their role may be growing, it is important to note that the behemoths of the region are all in effect state-owned carriers, though they may run as separate corporate units. This makes the arguments against state carriers overall more difficult, since by recommending the elimination of unsustainable flag carriers inevitably one hears the defense that the notion of a state flag carrier in itself is not at fault, as proven by the successful ones, but rather the unfairness of prevailing market conditions.

The question becomes one of market size versus being able to have sustainable operations. One typical set of questions would be the ambitiousness of the flag carrier, the wisdom of the choice of the fleet, and the employment level per aircraft. Though a thorough study of these three themes is beyond the scope of this report, in general it can be stated that these airlines serve small domestic markets and try to subsidize the markets with international routes. At times this leads to "route experimentation" that leads to financial disaster, where in fact international routes can be served by the existing large airlines, and the smaller markets could be served by small, private, regional airlines. Attempting to at privatizing instead of liquidating flag carriers often leads to even larger sustained losses (see Box 1.2).

Figure 1.5 shows the geographic distribution of flag carriers in Africa. The common distribution of the smaller markets identified earlier is not as clearly identifiable at having inefficient flag carriers, though some of the larger countries in west and central Africa still show. Listing and of the countries and the types of ownerships of air carriers can be found in Appendix 9.

It is particularly challenging to acknowledge the fallacy of the belief that a flag carrier will eventually produce income for a government because in fact many of the truly successful airlines are indeed state owned. But, these success stories are a small minority in the overall population of airlines worldwide.

Box 1.2 Flag carriers—a pattern in attempting privatization

Not only in Africa but in much of the developing world, the national flag carrier plays a visible role, though often with questionable economics. Often the story goes as such: A flag carrier was established decades ago, owned and run by the government of the given state. The carrier grows at first, in part because of market protection—competition is simply not allowed on given routes. Over time, service quality declines, and losses mount, until a change in government forces a rethinking on the policy of having a national carrier. The arguments for maintaining the carrier could often then be summarized as follows: (1) If the carrier went away, thin, subsidized domestic routes would be dropped, causing regional isolation; (2) the carrier can create revenues for the government, especially if there are foreigners traveling within the country; and (3) national pride dictates the need for a carrier with the country's flag.

But, as losses mount, advisers now recommend the sale of the airline. In order to attract potential private sector buyers, the airline must first be "restructured" and made viable again. In the process of restructuring it often is deemed that routes are only profitable if the airline remains a state-sanctioned monopoly. Furthermore, it is discovered that the aircraft in use do not really meet the demands of the public. In addition, new potential routes are identified for expansion.

With additional investment from the government, new aircraft are purchased, and new routes are brought into service, while competition on the current routes is still being restricted. Over time, it becomes apparent that the new aircraft are too expensive to operate on the routes for which they were purchased, the new routes have too low of a load factor to be profitable, and losses are of staggering proportions. The private sector is even less interested in the airline now, and, barring liquidation, the process starts all over again. At the same time, in the effort to "salvage" the flag carrier, new entrants are not allowed, giving the public a poor choice in transport.

In many cases, instead selling the flag carrier, the best solution would be to completely liquidate the carrier and have a successful outside operator provide international service. This could include a successful flag carrier from another country. Compromises could be made, such as having one of the assigned operator's aircraft be painted in the former flag carrier's colors, and the crew for passenger services hired in the country where service would be provided. For the domestic markets, it would make sense to let small, local operators develop from the private sector.

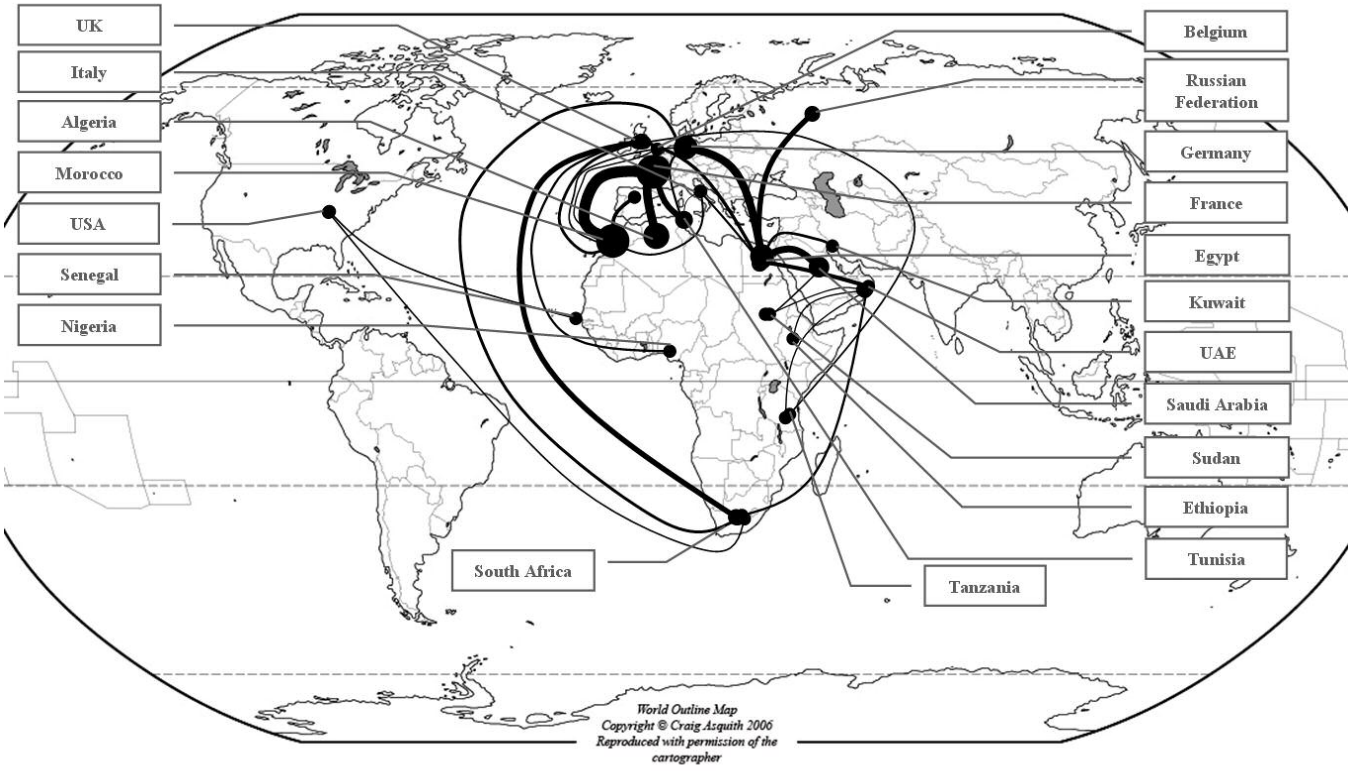
Intercontinental traffic

The overall intercontinental traffic in Africa is dominated by the entry points in the north (Morocco, Algeria, and Tunisia), mainly by flights from France. In fact, the North African intercontinental traffic so much leads the traffic figures for the entire continent that it is best to analyze traffic patterns in Sub-Saharan Africa independent of North African traffic (see figure 1.6 and figure 1.7). But, intercontinental growth has been strong in both North and Sub-Saharan Africa. Overall African intercontinental capacity increased by 10.7 percent annually between 2004 and 2007, and, in spite of the September 11 effects, the overall growth between 2001 and 2007 has been 56 percent, with an estimated 67 million seats. The most dominant intercontinental route between Algeria and France has now been topped by France's route to Morocco. Egypt plays an important role as a gateway to the Middle East, and the Egypt–Germany route is also one of the dominant European connections.

Though not as strong as the overall African growth, Sub-Saharan Africa's intercontinental capacity has managed to grow 43.6 percent from 2001 to 2007, with an annualized growth rate of 6.2 percent between 2001 and 2007. Sub-Saharan intercontinental traffic relies heavily on the three major hubs of Johannesburg, Nairobi, and Addis Ababa, with the U.K.–Johannesburg route the most heavily traveled. Senegal also operates as an important stop in West Africa.[5] Between 2001 and 2007 the continent saw a significant rise in service provided by the Middle East. The United Arab Emirates (UAE) was in only two of the top 30 country pairs in 2001, yet by 2007 had five of the top routes. In addition, traffic to East Asia and the Pacific regions has nearly doubled between 2004 and 2007 to 1.6 million seats.

[5] South African Airways flies the U.S.–South African route generally nonstop coming from the United States. But, due to predominant high-altitude winds, it makes a fifth-freedom stop in Senegal[5] on the South Africa–U.S. route. The U.S. carrier Delta Airlines is now flying to both Johannesburg and Cape Town via Senegal, with new flights being added via the same stop to Nairobi, Kenya in early 2009.

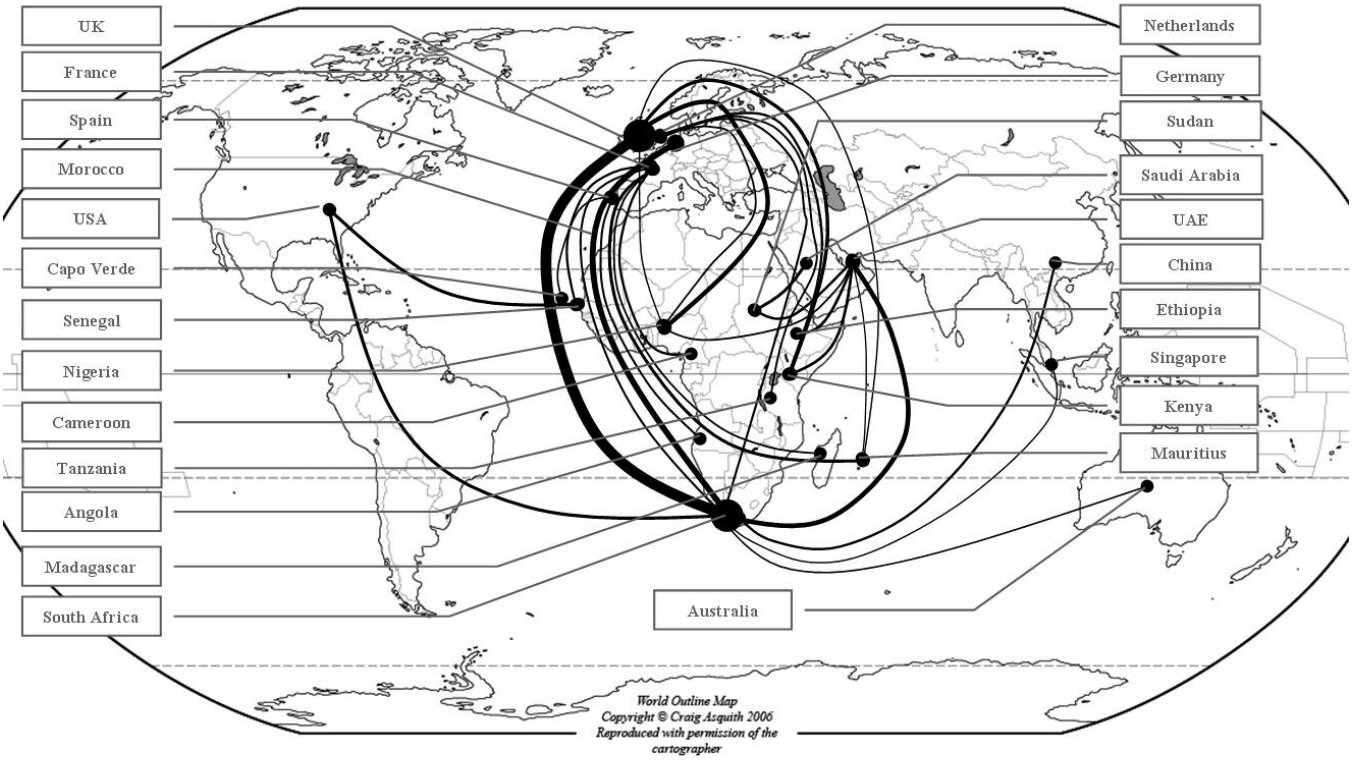
Figure 1.6 Top 30 intercontinental routes for Africa as of November 2007, measured using seats available per week



Source: Analysis on data provided by Seabury ADG.

Note: The routes are displayed as country pairs, though there often is more than one airport served in a country, with the thickness of the connecting lines being in proportion to volume. The most important routes are the north African countries Morocco, Algeria, and Tunisia connecting with France. The most important Sub-Saharan route is between the United Kingdom and South Africa. Cairo is both important as an entry point for Europe (mainly Germany) and the Middle East.

Figure 1.7 Top 30 intercontinental routes for Sub-Saharan Africa as of November 2007, with the North African traffic subtracted



Source: Analysis on data provided by Seabury ADG.

Note: Johannesburg serves as the most important entry point, with the three largest partners (excluding North Africa) being the United Kingdom, Germany, and the UAE.

Intercontinental access would naturally seem more competitive if the traveler has the flexibility in choosing their entry point into Africa. The competitiveness, however, is also considerably higher per given route: In the top 20 intercontinental markets there are an average of 3.45 competing airlines in 2007, with a total of 158 carriers providing intercontinental services. The growth is healthy, and the turnover in airlines also seems healthy—between 2001 and 2007, 50 have left the market, while over 80 new entrants have nearly doubled the capacity provided of those that have left. The most dramatic loss in capacity was caused by Air Afrique, Swissair, and Ghana Airways.

The highest growth rates on major routes can be found on routes with the Middle East, specifically South Africa and Egypt with the UAE, and in the traffic between France and Morocco. The only routes showing decline between 2001 and 2004 are between the Unites States and South Africa, and between Morocco and France.

Table 1.3 in Appendix I summarizes the main intercontinental country pair routes, presenting figures on both growth in the routes and competitiveness in terms of number of airlines. Table 1.4 provides a view as to who the actual airlines serving Africa intercontinentally are, ranked by overall market share in 2007.While there are outliers in the data (e.g. the route between South Africa and the UAE), a broad

conclusion can be made that the routes with the highest growth rates were served by more carriers (i.e. showed more competition). Over 30 percent of market share is held by the top five airlines—South African Airways, Air France, British Airways, EgyptAir, and Emirates. In total, there are eight African carriers (including South Africa) in the top 20 airlines.

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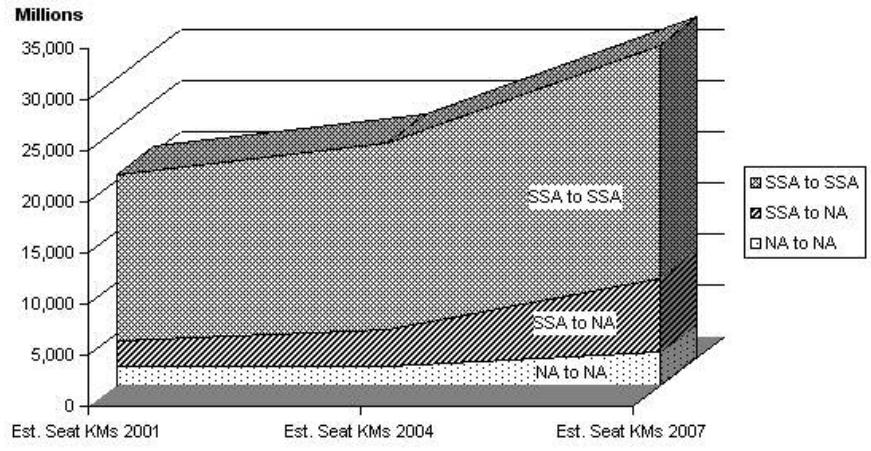
International capacity within Africa

International capacity within Africa also grew between 2004 and 2007 at a rate of 9 percent annually. The highest growth was found in capacity between Sub-Saharan Africa and North Africa (25 percent), followed by the much smaller in proportion international traffic within North Africa (17 percent). International travel within Sub-Saharan Africa, the bulk of intra-African international travel, grew at 6.5 percent. Figure 1.8 shows the overall capacity over time, and table 1.5 provides further details.

Figure 1.8 Estimated international passenger capacity between 2001 and 2007, as measured in seat kilometers. Though travel between North African countries presents a small portion (about 10% of total international travel within Africa), it has nearly doubled.



Source: Analysis on data provided by Seabury ADG

The North African international markets have shown significant growth, especially in routes involving Libya and Morocco. There are 10 country pairs in North Africa served, with no significant change in city pairs for many years. Competitiveness in the top routes, however, has somewhat declined, with the exception of the route between Egypt and Libya. There are only five leading carriers: EgyptAir (the leader with 627,000 seats in 2007), Royal Air Maroc (578,000 seats), Jamahiryan Libyan Arab Airlines (440,000 seats), TunisAir (310,000 seats), and Air Algerie (35,000 seats). Though competitiveness overall has declined in these markets, no airline enjoys a monopoly on any route. The market can be best summarized as shown in table 1.5 in Appendix I. The overall quality of airlines in North Africa is deemed to generally be the best in Africa, with a well-developed network, and established, stable carriers.

At the same time, however, connectivity points to a much deeper concern (having reduced within Sub-Saharan Africa) with the number of country pairs served declining from 218 to 190 in the same period, a net loss of 28 pairs. The collapse of several airlines, including Air Afrique and Nigeria Airways,

can be attributed as the cause.[6] North Africa held steady at 10 country pairs, with a 6.5 percent growth rate between 2004 and 2007.

Table 1.5 International travel within Africa. Though there has been growth, the drop in city pairs served in Sub-Saharan Africa is significant.

International Travel With	Est. Seat KMs 2001 (millions)	Est. Seat KMs 2004 (millions)	Est. Seat KMs 2007 (millions)	Country Pairs Feb 01	Country Pairs Nov 07	Net Change Pairs	Overall Growth	Annualized Growth 2001-2007	Annualized Growth 2004-2007
within SSA	16,265.7	18,271.6	22,925.9	218	190	-28	40.9%	5.9%	7.9%
within NA	1,757.3	1,876.7	3,182.9	10	10	0	81.1%	10.4%	19.3%
SSA with NA	2,643.4	3,610.7	7,226.9	30	45	15	173.4%	18.2%	26.0%
Total	**20,666.4**	**23,759.1**	**33,335.7**	**258**	**245**	**-13**	**61.3%**	**8.3%**	**12.0%**

Source: Analysis on data provided by Seabury ADG

[6] Air Transport in Western and Central Africa—Fact and Issues (Interim Version 1.0), Michel Iches, 2003, p. 16. **[["Interim Version 1.0" OK?]]** In addition, research for this infrastructure study report has identified the collapse of Air Gabon, and the Ghana Airways Corporation, as additional carriers that have ceased operations. Overall, 31 airlines have been identified as having ceased operations between 2001 and 2007 in Sub-Saharan Africa, with a total capacity of nearly 8 million seats, while there have been 34 new market entrants, with a total estimated capacity of nearly twice as many seats (15 million). North Africa's numbers are less drastic, but do also show an influx of double the capacity of what had been lost, from 660,000 seats lost to 1.4 million added.

Figure 1.9 shows the top 60 international routes within Sub-Saharan Africa. The east clearly has the more developed network, anchored in South Africa, Kenya, and Ethiopia. West and Central Africa have significant gaps created by the loss of capacity from failed carriers between 2001 and 2004.

The main hubs today are Johannesburg, South Africa, Nairobi, Kenya, and Addis Ababa, Ethiopia. These airports comprise 36 percent of all international traffic within Africa (see table 1.6 for further details). As with Western hub systems, these airports exist with a dominant airline residing at each of the hubs—South African Airways, Kenya Airways, and Ethiopian Airlines respectively. These airlines provide 33 percent, 70 percent, and 83 percent of international traffic related to these airports.

Table 1.6 Top 15 airports in Sub-Saharan Africa serving international travel within Sub-Saharan Africa. Over 40 percent of the capacity is concentrated among four airports.

Country	City/airport	Airport ID	Estimated seats 2007 ('000)	Overall percent
South Africa	Johannesburg	JNB	5,742	20.0
Kenya	Nairobi	NBO	2,901	10.1
Ethiopia	Addis Ababa	ADD	1,706	6.0
Nigeria	Lagos	LOS	1,157	4.0
Senegal	Dakar	DKR	986	3.4
Zambia	Lusaka	LUN	959	3.4
Uganda	Entebbe	EBB	954	3.3
Zimbabwe	Harare	HRE	828	2.9
Ghana	Accra	ACC	813	2.8
Namibia	Windhoek	WDH	791	2.8
Tanzania	Dar Es Salaam	DAR	749	2.6
Côte d'Ivoire	Abidjan	ABJ	717	2.5
Mauritius	Mauritius	MRU	544	1.9
Angola	Luanda	LAD	484	1.7

Source: Analysis on data provided by Seabury ADG

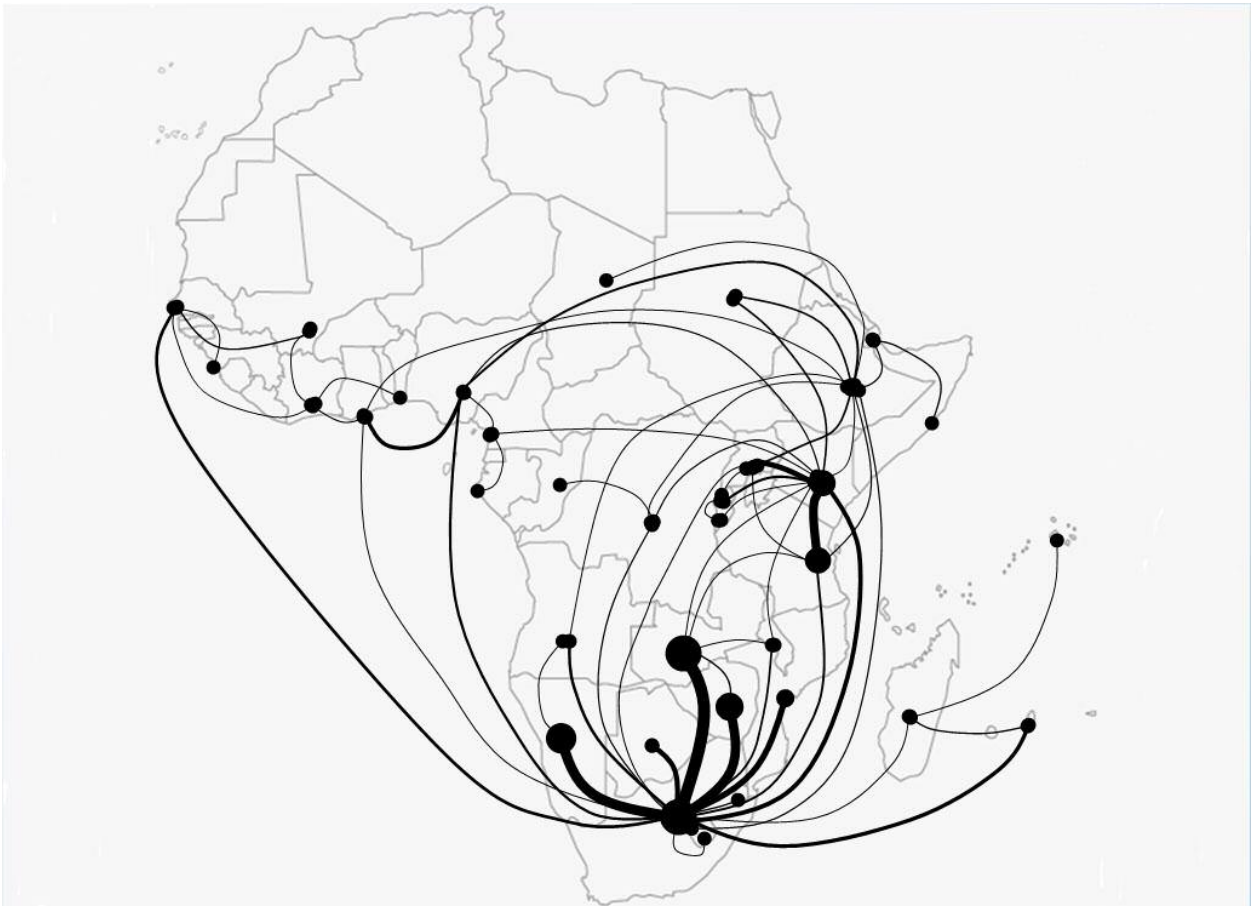
Box 1.3 Air Afrique

Air Afrique was formed in 1961 as an African carrier headquartered in Abidjan, Côte d'Ivoire, owned by 12 West African countries, Air France, the Union Aéromaritime de Transport (UAT), and the Société pour le Développement du Transport Aérien en Afrique (SODETRAF). The airline went from piston-engined propeller operations to wide bodies such as the Airbus 310 in the eighties.

Just as with flag carriers, the airline became a regional symbol of pride and independence. But, quality of service was sometimes compromised even in the best of times, when, for example, reservation systems collapsed, making seat assignments impossible. In the last days, passengers were faced with increased strandings. Claims are that prioritization of seating had often been given out to nonrevenue passengers of importance, and that schedule integrity had diminished. Efforts by the airline's president to restructure the airline in 2001 through cutting jobs were vehemently opposed by its employees, who at one point refused to fly an airplane with the president on board. The airline collapsed in 2001 after being sold to private investors and Air France for $69 million, with debts of $ 500 million. Much of the debt was accumulated when the CFA Franc collapsed in the 1990s. Governance issues are also commonly cited as a cause for the fall. When the airline finally ceased operating, there were a reported 4,200 employees, with only seven aircraft flying.

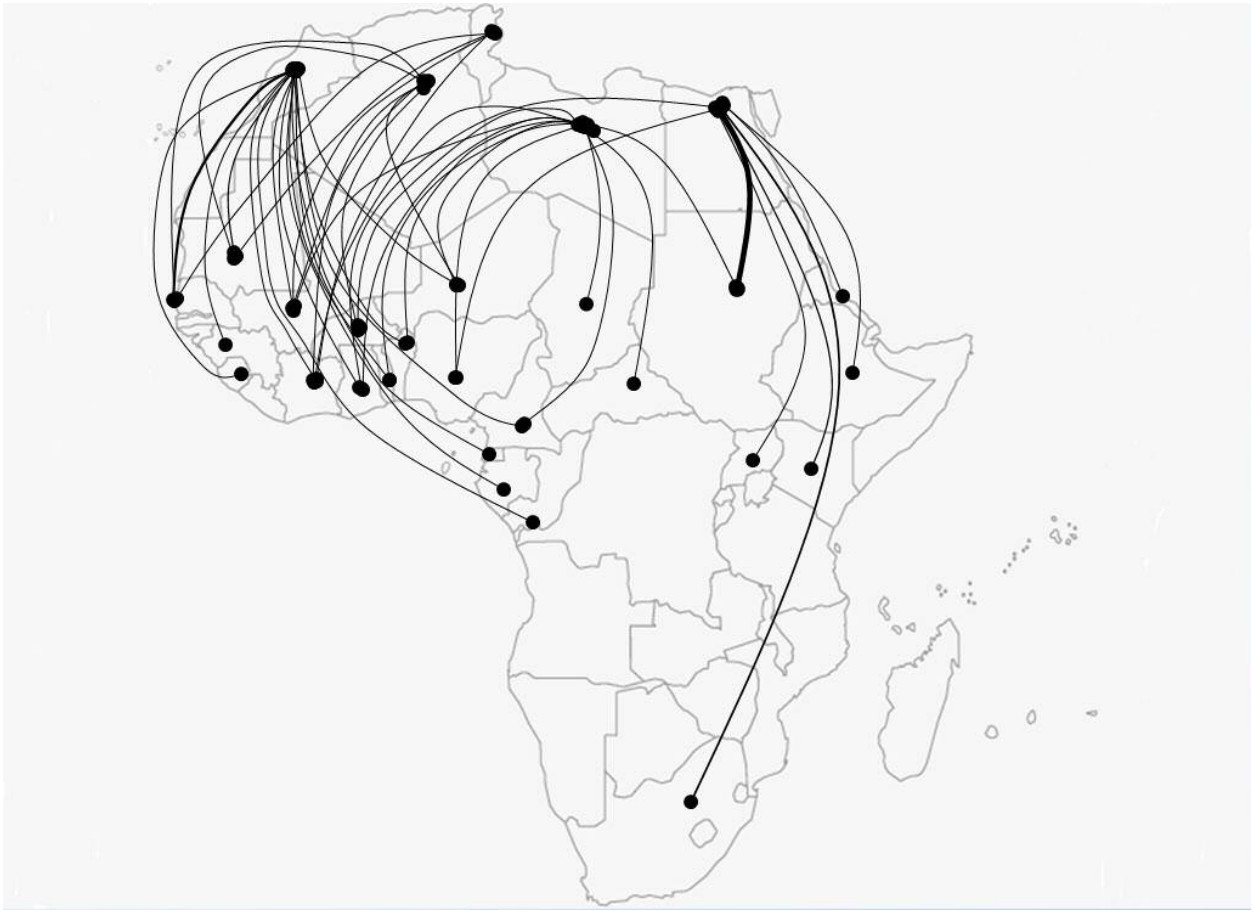
Beside African destinations the airline also flew to the Middle East, Europe, and the United States. Air Afrique's collapse removed a capacity of nearly 5 billion seat kilometers as measured for 2001, which is similar in magnitude to a carrier such as Kenya Airways suddenly disappearing.

Figure 1.9 Top 60 international routes within Sub-Saharan Africa



Source: Analysis on data provided by Seabury ADG
Note: The highest activity is in the East.

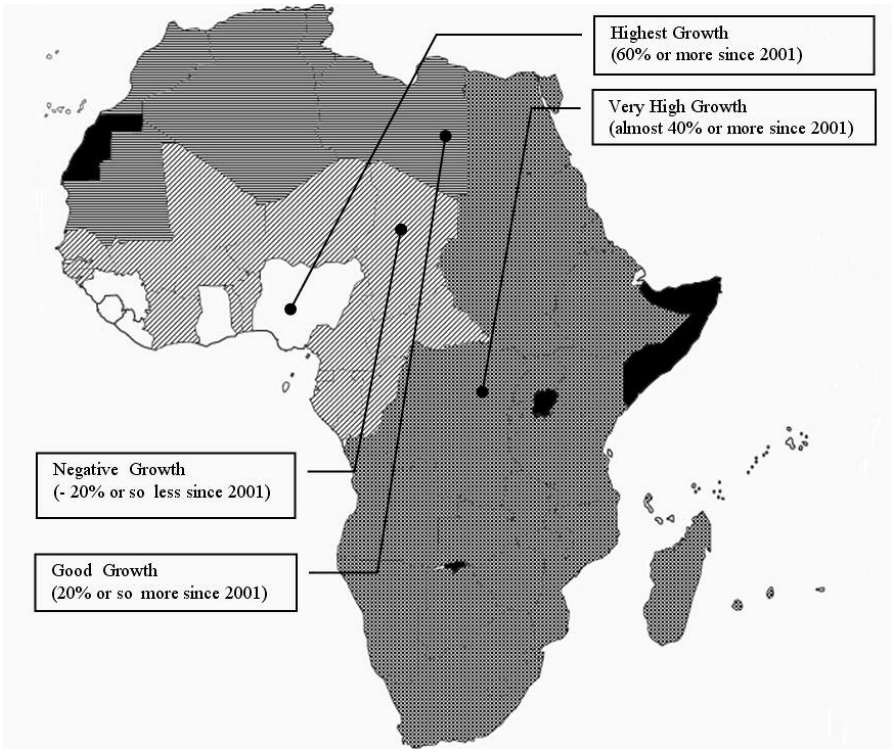
Figure 1.10 Top international routes between Sub-Saharan Africa and North Africa



Source: Analysis on data provided by Seabury ADG

Figure 1.11 shows a geographic breakdown of growth areas in intra-African international travel. The BAG countries, including Nigeria, have shown the highest growth, followed by the more developed yet well-growing regions of East and southern Africa, and North Africa. Due to the collapse of the before-mentioned airlines a swath of nations surrounding the BAG countries has experienced negative growth. It is the lack of development in those countries that raises the most concern regarding the air transport industry in Africa, and makes them the largest block in the swath of countries to be below 1 million passengers per year, as shown earlier in figure 1.4.

Figure 1.11 Regional growth zones in seats offered, all travel. The Banjul Accord Group (BAG) countries have seen the highest increase, surrounded by neighbors with very little, if not negative, growth. East Africa and North Africa both showed high, if not very high, growth.



Source: Analysis on data provided by Seabury ADG

The total number of carriers providing international service within Sub-Saharan Africa has been fluctuating between 67 and 78 in the last six years, with 76 being the number for 2007, serving roughly 206 county pairs (down from 238 country pairs in 2001). The decline in country pairs served follows hand-in-hand with an increase in market concentration by dominant players; 16 of the top 60 routes today are served by only one carrier, up from 10 in 2001. The remainder of the market has seen an even further concentration; 50 of those have a complete monopoly with one carrier, up from 24 in 2001. On the positive note, 25 of those routes are new routes that did not exist in 2001, where an airline has decided to take a risk and start serving a country pair not served before. Dominant in these new markets are Ethiopian Airlines and Kenya Airways.

Of the total estimated 14.3 million seats[7] flown within the 206 country pairs, 80 percent of the seats are in the top 60 city pairs. Of these top 60 routes, 30 are again dominated by the three major carriers—

[7] In this section, when the aim is to establish the capacity and choices offered between country pairs, markets are being measured by number of seats rather than seat kilometers. When the relative strength of airlines is discussed, seat kilometers are presented.

South African Airways, Kenya Airways, and Ethiopian Airlines. The remaining markets have smaller and more scattered carriers as the leader. The fastest growing markets include links to South Africa. But, the growth of travel with Sudan is significant, as well as travel to and from Nigeria.

In terms of overall competitive standings between airlines, 15 airlines provide over 82 percent of all international travel within Sub-Saharan Africa, with the top three (South African, Ethiopian, and Kenyan) providing over 57 percent (see table 7).

Table 1.7 The top 15 airlines providing international service within Sub-Saharan Africa. Of an estimated 1.8 billion seat kilometers flown, these airlines comprise over 82 percent of the market. Among the major airlines, Ethiopian is showing the highest growth. Among the smaller segments, Zambian Airways is growing the fastest.

Airline	Seat kilometers 2001 (million)	Seat kilometers 2004 (million)	Seat kilometers 2007 (million)	Annual growth 2001 - 7	Annual growth 2004 - 7
South African Airways	4,113	5,292	4,784	2.6%	-1.7%
Ethiopian Airlines Enterprise	1,335	2,119	4,235	21.2%	12.2%
Kenya Airways	1,780	2,366	4,163	15.2%	9.9%
Air Mauritius	488	545	730	6.9%	5.0%
Delta Air Lines, Inc.	-	-	639	-	-
Virgin Nigeria	-	-	598	-	-
Air Namibia	336	523	564	9.0%	1.3%
Zambian Airways	63	14	559	44.0%	85.3%
Air Senegal International	131	417	442	22.5%	1.0%
SA Airlink d/b/a South African Airlink		201	406		12.4%
TAAG Angola Airlines	368	391	405	1.6%	0.6%
Bellview Airlines Ltd.	87	220	399	28.8%	10.4%
Air Zimbabwe (PVT) Ltd.	402	175	383	-0.8%	13.9%
Comair Ltd.		291	366		3.9%
Nationwide Airlines (Pty) Ltd.	31	117	263	43.1%	14.4%

Source: Analysis on data provided by Seabury ADG

In terms of routes with only one carrier, the total number of seats has only increased by 6 percent annually—a reasonable rate. But, today one carrier stands out—45 percent of all seats in markets having only one carrier are served by Ethiopian Airlines, with nearly 1.2 million seats. Kenya Airways, with 22 percent, is a distant second. South African Airways, by comparison, has only about 1 percent of the sole-carrier market. One could conclude from the data that Ethiopian Airlines is intentionally seeking markets where it can dominate significantly. Indeed the 1.2 million seats mentioned above have grown from 327,400 in 2001 to 1.2 million, at an annual rate of 27 percent. Ethiopian's monopolies are not necessarily new routes. Of the 21 country pairs where Ethiopian has a monopoly, only six are new routes that did not exist in 2001. Two are routes that a competitor left, and the remainder are routes that already were monopolies. Kenyan has followed a similar strategy with even higher growth rates, albeit at lower numbers, often by beating out existing competitors. Table 1.8 in Appendix I summarizes the airlines in sole-carrier markets.

Using traditional methods of measure market concentration, intercountry pairs tend to be oligopolistic, as would be expected in less-dense markets. For example, using the Hirfendahl index, any market with a measured value of 1,800 (computed by summing the squares of the percentage of each market participant) would indicate concentrated market raising competitiveness concerns. In the case of the international markets in Sub-Saharan Africa, excluding the monopolies, the index in general fluctuates between 2,000 and 5,000, indicating very tight concentration.

Liberalization and breakdown of international traffic within economic regions

The Yamoussoukro Declaration (YD) of 1988 and following Decision of 1999 sought to bring about the liberalization of international air transport within Africa. The Banjul Accord further affirmed the declaration with a plan for accelerating implementation in 1997, and with the subsequent signing of the Multilateral Air Services Agreement between the seven states in 2004, the main focus of liberalization was free pricing, the lifting of capacity and frequency restraints, and the ability to fly fifth-freedom routes.

Implementation has varied significantly between the regions, as detailed in table 1.9, though it is now considered a success, being applied to two thirds of the countries in Africa. The highest level of implementation is in the regions hardest hit by the swath of airline failures, the Economic and Monetary Community of Central Africa (CEMAC), and the West African Economic and Monetary Union (WAEMU). Table 1.10 summarizes the international traffic within the individual regions.

An analysis was made to establish the impact of liberalization. Determining a before and after scenario is difficult because of the varying degrees of implementation and the various external shocks between 2001 and 2004. But, upon examining the nationality of carriers flying international routes within a region it was found that a significant percentage of the routes in regions implementing the YD had *carriers serving country pairs where the carrier was not based in either country*. This proves a minimum of fifth-freedom operations and additional seventh-freedom operations—beyond even the ambitions of the YD decision. Table 1.11 shows the dramatic impact this has had in carrier origin when providing international services within a region. Further analysis has shown that the capacity replacing that of the lost carriers is often being replaced by extraregional African carriers (such as an East African carrier traveling between two countries within WAEMU), while European carriers once flying similar routes (for example, Air France) have almost completely disappeared. This suggests that these markets are becoming more concentrated, with service being consolidated by the larger, healthier carriers. Though there are reports of fares for third and fourth freedom operations declining as a result of Yamoussoukro, no analysis of historic fares is readily available for this report to present this as a certain conclusion.

Resistance to implementing Yamoussoukro, as with most air transport liberalization efforts, comes from countries wishing to protect usually unhealthy flag carriers. The general theme is similar in Africa as it is in other regions: One or two very larger carriers exist that, regardless of the type of ownership, dominate the region. Smaller national carriers, in Africa sometimes consisting of less than three aircraft, are flying the only profitable routes between their country and outside hubs, while sustaining an otherwise unprofitable network. As liberalization is implemented, competition in those profitable routes increases, usually with the entry of the much more competitive, dominating carrier based in the regional hub. The overall network of the flag carrier now becomes completely unsustainable. However, the efforts to protect a flag carrier by not liberalizing deprive the flying public of choice, and usually result in decreased level of service and higher prices.

Table 1.9 Grading of the level of the implementation of the

Community	General status of YD implementation	Status of air services liberalization	Overall implementation score
AMU	No implementation.	No liberalization within AMU initiated, but need is recognized.	1
BAG	Principles of YD agreed upon in a multilateral air service agreement.	Up to fifth freedom granted, tariffs are free, and capacity/frequency is open.	4
CEMAC	Principles of YD agreed upon in an air transport program. Some minor restrictions remain.	Up to fifth freedom granted, tariffs are free, and capacity/frequency is open. Maximum two carriers per state may participate.	5
COMESA	Full liberalization decided ("legal Notice No. 2"), but application and implementation remain pending until a Joint Competition Authority is established.	Pending. Once applied, operators may be able to serve any destination (all freedoms), tariffs and capacity /frequency will be free.	3
EAC	EAC Council issued a directive to amend bilaterals among EAC states to conform with YD.	Air services are not liberalized, as the amendments of bilaterals remain pending.	3
SADC	No steps toward implementation done, despite the fact that Civil Aviation Policy includes gradual liberalization of air services within SADC.	No liberalization within SADC initiated.	2
WAEMU	Within WAEMU the YD is fully implemented.	All freedoms, including cabotage, granted. Tariffs are liberalized.	5

Source: Analysis on data provided by Seabury ADG .

Note: The implementation score goes from lowest form of implementation (1) to the highest (5). *Grading provided by Charles E. Schlumbeger.*

AMU = Arab Maghreb Union; BAG = Banjul Accord Group; CEMAC = Economic and Monetary Community of Central Africa; COMESA = Common Market of Eastern and Southern Africa; EAC = East African Community; SADC = Southern Africa Development Community; WAEMU = West African Economic and Monetary Union.

Table 1.10 International travel capacity within regional communities. CEMAC and WAEMU show both a strong decline in estimated seats, and CEMAC shows a 50 percent drop in connectivity as measured in city pairs and country pairs served. Most others show consistent growth, and the BAG managed a positive turnaround.

	AMU	BAG	CEMAC	COMESA	EAC	SADC	WAEMU
Seats 2001 (%)	7.6	45.3	38.0	25.4	33.0	18.7	47.7
Seats 2004 (%)	8.3	36.3	11.8	9.9	12.2	2.3	43.7
Seats 2007 (%)	4.1	43.3	28.5	14.1	16.4	5.7	43.8
YD score	1	4	5	3	3	2	5

Source: Analysis on data provided by Seabury ADG

Table 1.11 Percentage of flights being served between country pairs by airlines that are not based in either country of the country pair. The flights are international flights within each region. Except for AMU, which is not part of the YD, all countries have shown an increased market proportion of these airlines between 2004 and 2007. The data for 2001 is skewed because several regional airlines with large market shares, such as Air Afrique, have collapsed. The bottom YD score shows a clear relationship between the levels of implementation and the proportion of fifth- and seventh-freedom flights within the regions.

	Seats	Country pairs	City pairs

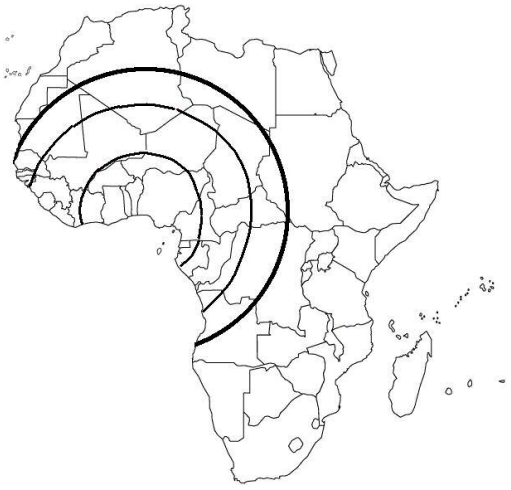
Community	Total 2007	Annual growth 2001–7 (%)	Annual growth 2004–7 (%)	As of November 2007	Net change from February 2001	As of November 2007	Net change from February 2001
AMU	1,294,189	4.55	8.65	9	–	14	2
BAG	568,306	0.32	13.87	13	–	15	1
CEMAC	152,984	-18.88	-35.58	6	(6)	9	(9)
COMESA	4,484,675	7.12	17.66	49	(4)	71	(3)
EAC	1,751,811	2.02	5.81	9	1	18	(2)
SADC	5,663,632	4.27	10.00	34	(4)	72	5
WAEMU	763,472	-5.42	-5.56	20	(2)	21	(3)

Source: Analysis on data provided by Seabury ADG

The State of Low-Volume Countries in West and Central Africa

Much discussion has been centered around the international connectivity of countries with less than I million passengers per year, especially in west and central Africa, where a large band of these countries surround Nigeria and the smaller markets of Cote d'Ivoire and Ghana. It is their plight that stands in stark contrast to the more developed regions in the east and the south. In most cases, air transport in these countries is below sustainability, yet is vital for obtaining any growth potential in the global economy. All too often these countries have flag carriers with mis-matched fleets for their purpose, and networks that may be at hoc and not optimized. One issue of interest in particular has been the relationship between fleets, frequencies, and routing.

Figure 1.12 Countries potentiall served by commuter style turboprop aircraft using a hub in Lagos. The inner circle presents the range of an ATR 42-300, about 1,100 km. The middle range of roughly 2,000 km represents the range of a standard Fokker 50, while the outer ring, with a radius of 2,500 km, shows the range of a newer Bombardier Dash-8 Q400.



Source: Author

Evidence has shown a slight increase in the use of commuter propeller aircraft on international routes in these markets, though there is still a high reliance on Boeing 737-type jets. For western Africa, one suggestion has been in exploring the development of a hub in Lagos, with commuter propeller aircraft, such as the Fokker 50 or ATRs developing the network around the hub. This proposal is indeed feasible, though reportedly much investment would need to be made at the terminal facilities in Lagos. Northern Africa, eastern Africa, and southern Africa are all served by their own regional hub serving as a gateway to intercontinental travel – west Africa is lacking such a facility.

Figure 1.12 shows the range of countries that could be served by Lagos with the standard version of the Fokker 50, the ATR 42-300, and the Bombardier Dash-8 Q400, three turboprop type transport aircraft. Senegal and The Gambia may still be out of range, though available longer-range turboprop aircraft would put these countries into the market. With the Fokker 50, the southern range of the hub would include Luanda, Angola. Even with the shorter range ATR, at least eight countries would be serviceable.

Beyond creating a central gateway, the advantage of such a system would be the increase in per aircraft load factors towards sustainability in regional travel. There would perhaps even be an increase in frequencies to the countries with very little traffic, since repeating multi-legged flights out of Lagos could serve several countries in one circular route.

The implementation of the Yamoussoukro decision is a vital step towards such a system, allowing for 5th and 6th feedom operations. Expereince has shown private operators to be particularly successful in developing shorter routes with turboprop aircraft, such as Precision Air in Tanzania.

Travel between Sub-Saharan Africa and North Africa

81 percent of the travel between Sub-Saharan Africa and North Africa is dominated by two airlines: Royal Air Maroc and the slightly larger EgyptAir. Another set of three airlines, Air Afrigiya, Air Algier, and TunisAir, provide the remaining 19 percent of the service, with Libyan's Afrigiya being the strongest. The distribution follows a clean geographic layout: Egypt is dominant with traffic along the east side of the continent (with some exceptions, such as the Egypt–Nigeria route), and Morocco's role is on the western side. The top routes with North Africa include Sudan, Senegal, South Africa, Kenya, Mauritania, Côte d'Ivoire, Mali, Nigeria, Ethiopia, and Gabon. These routes have been growing drastically, with some increasing over 26 percent annually between 2001 and 2007, and even above 44 percent annually between 2004 and 2007 (see table 1.5 above for actual figures). The overall growth rate of traffic between North

Africa and the lower part of the continent was over 18 percent annually between 2001 and 2007, and in more recent years almost 26 percent annually (between 2004 and 2007). Seventeen country pairs have been added since 2001, bringing the country pair total to 45. The new routes primarily include travel with Morocco and Libya. 41 of the 45 routes have a single-carrier monopoly, including all of the new ones.

Figure 1.10 suggests that Morocco serves as an important hub not just for international travel between North Africa and Sub-Saharan Africa, but for travel within Sub-Saharan Africa. Indeed, the most recent routes added are ones served by Royal Air Maroc, with Air Afrigiya, the relatively new Libyan market entrant, creating a similar network. EgyptAir distorts the image due to the strong route with Sudan, which comprises nearly a fifth of all north–south travel, but beyond these markets EgyptAir does not play the same role as Royal Air Maroc. If viewed with reference to figure 1.6 earlier in this report, it becomes apparent the vacuum created by the absence of a strong Sub-Saharan carrier on the west side of the continent is being filled by a developing hub system in North Africa.

Domestic air transport

Though very small, Sub-Saharan domestic air travel has shown significant growth at above 12 percent annually between 2001 and 2004. North African domestic air travel, however, has declined by over 3 percent in the same period. The North African domestic market size is about one-fifth that of Sub-Saharan Africa as measured in seat kilometers.[8] Interestingly, in both cases the number of city pairs has been declining, hinting at a consolidation of traffic among key routes, and that other locations have been dropped from the domestic network. Table 1.13 in Appendix 1 shows the markets and their related city pairs; however, the drop in city pairs between 2001 and 2007 is even more dramatic than between 2004 and 2007, with an overall loss of 229 routes in Sub-Saharan Africa and an actual loss of 32 in North Africa. Many of these losses are, once again, attributable to the collapse of major regional carriers.

North Africa's market is much more mature, and therefore less dynamic. Here too the state flag carrier plays the major role. In Algeria, Air Algerie, the national flag carrier, enjoys a monopoly on all published routes. Egypt, Libya, and Morocco have new entrants, but with very small percentage of market share. Morocco has seen the rise of Regional Air Lines, a private sector airline providing service to 13 city pairs, in some cases having completely replaced the 100 percent dominance of Royal Air Maroc. A summary of the number of airlines providing scheduled domestic service in North Africa can be found in table 1.12 in Appendix 1.

The growth in South Africa, Nigeria, and Mozambique is skewing the overall growth in Sub-Saharan Africa, and indeed with those countries removed the overall growth in Sub-Saharan Africa was nearly neutral at a negative .84 percent, with a net loss of 137 routes between 2004 and 2007. South Africa's and Nigeria's portion of the overall domestic market cannot be overlooked. The two countries combined

[8] Some caution must be applied when using reservation and scheduling systems data for domestic travel in developing countries, because domestic travel is much more likely to also include scheduled airlines that are not part of an electronic reservation system. For example, in Tanzania Coastal Air is an important carrier for domestic travel, using Cessna Caravans that seat up to 15 passengers. The airline issues paper tickets and is not found in any scheduling or reservation dataset such as OAG or Seabury APG.

comprise over 83 percent of all known scheduled domestic services, with South Africa alone comprising 72.5 percent.

The state of these markets highlights the variance of the conditions between the individual countries, showing once again that it is impossible to make blanket statements about Africa. For example, regardless of population, just by necessity island nations such as Madagascar, Cape Verde, Comoros, and the Seychelles will have scheduled domestic service. While Ethiopia has an extensive airline, domestic travel is much less, and has not shown much recent growth. The conditions driving a domestic market are related to topology, population density, per capita gross national income (GNI), and in many cases (but not always) also tourism.

In general, domestic air services are also highly concentrated in Sub-Saharan Africa. Of the 286 routes with service in 2007, only 54 had more than one service provider. Usually the service provider is the state carrier, though there are anecdotal examples of flag carriers subcontracting out thinner routes to private operators.[9] Standing out among the larger countries for allowing competition in the sector are two countries in particular—South Africa (not surprisingly, having the most advanced air transport industry in Sub-Saharan Africa) and Tanzania. In South Africa competition exists only on the heaviest routes. Tanzania, by contrast, as of 2007 has more than one service provider on every one of its 17 domestic routes[10].

Island nations are heavily dependent on air transport, both because of the physical nature of their geography and also because they often have a thriving tourism industry. As such, Cape Verde features a marginally more competitive system, though Transportes Aereos de Cabo Verde (TACV) still dominates at rates of 80 percent or above on all routes.

A summary of domestic routes in Sub-Saharan Africa can be found in table 1.13 in Appendix 1.

Pricing and connectivity

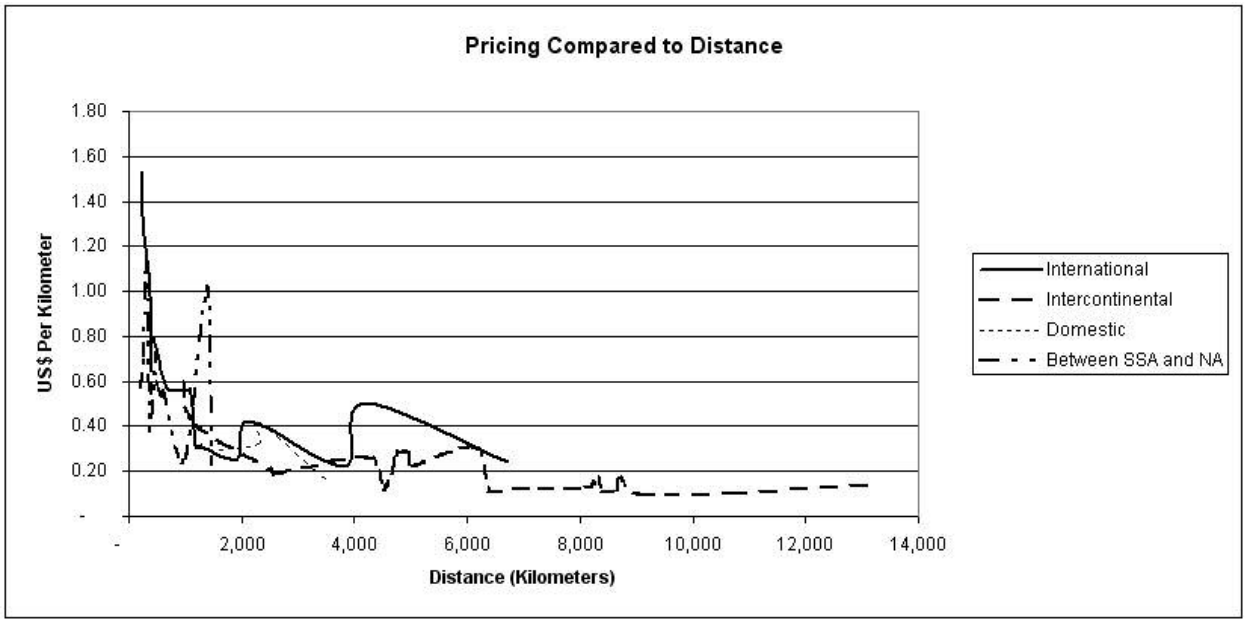
Pricing of flights in Africa has been sampled both with respect to international travel within Africa, intercontinental traffic, and domestic traffic. Within Africa 23 international routes were chosen of various lengths and densities, along with 29 routes between Africa and the rest of the world, and 21 domestic routes. Thirteen price points were found for the domestic routes. The lowest cost flight was then determined using standard booking Web sites such as Expedia.com and opodo.com. Figure 1.13 plots the per nautical mile price of tickets at various distances using these samples. Air travel within Africa seems to be considerably more expensive (per mile flown) than intercontinental travel, especially on routes of less than 4,000 kilometers. This would make sense considering the higher competitiveness among intercontinental routes. Domestic pricing proved more difficult to sample, since many routes are not as well advertised through standard channels, though are being served. Pricing samples for the study can be found in Appendix 3**.**

[9] For example, in Malawi, Air Malawi, which has scheduled flights on the Lilongwe–Blantyre route, will at times use a small operator, using single-engine aircraft, to fill in for low-load factor flights.

[10] The competitiveness of Tanzania's domestic routes may now be strongly affected by the the health of the flag carrier, Air Tanzania.

Another recent study by Intervistas for International Air Transport Association (IATA) concludes that the price elasticity of air transport within Africa is relatively high, attributed to the fact that those who can travel are considerably better off than those who do not, and are more immune to higher tariffs.[11]

Figure 1.13 Pricing of flights within Africa versus intercontinental flights, kilometers flown



Source: Analysis on data collected by the World Bank.

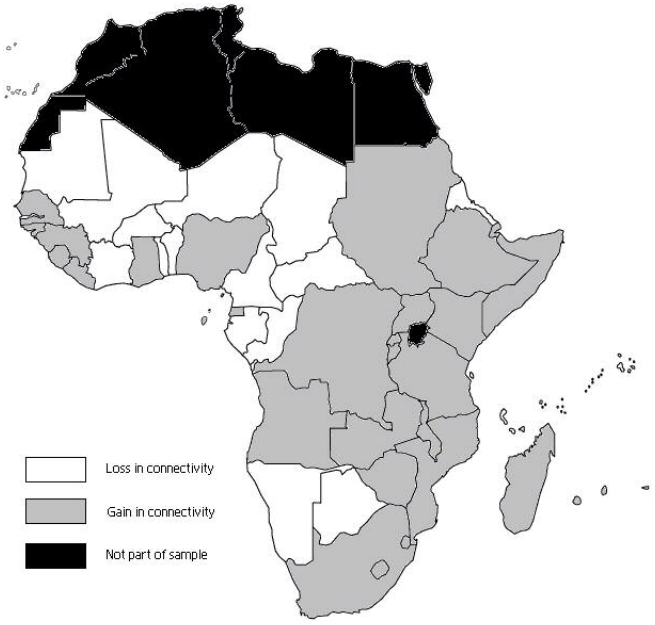
Note: The higher prices over lower distances reflect higher fixed costs that in longer flights are spread over more kilometers. Domestic pricing is most likely skewed by subsidized or fixed pricing on some routes, keeping costs artificially low.

A common complaint is that often travel from one African country to another too often requires a connection through Europe. An easy way to measure this is to establish a matrix of connectivity between the African countries, as shown in Appendix 4, based on flights per week. A further analysis reveals some countries going through significant declines in connectivity with other countries, literally dropping out of the network. Most worrisome would be the Central Africa Republic (only 1 flight per week in November 2007), Mauritania, Chad, Eritrea, and the Seychelles. Not only are those four countries minimally connected, but their connectivity has declined drastically between 2004 and 2007. Throughout West and Central Africa the story is similar—overall low connectivity for many, though not all, countries has shown worsening rather than improvement over the last four years.

Figure 1.14 shows that, compared to figure 1.4 on market overall market sizes, much of the same swath of countries can be seen in the group losing international connectivity. A clear line of countries can be seen including all the land-locked countries from Mail to the Central African Republic, and including many of the other smaller market coastal countries in the region, such as The Gambia, Benin and neighboring Togo, Cameroin, Congo Brazzaville, and Gabon.

[11] Estimating air travel demand elasticities.

Figure 1.14 Gainers and losers in international connectivity in Sub-Saharan Africa. Cape Verde, not shown, belongs in the latter category. The same swath of countries shown in figure 4 depicting market sizes, including the landlocked countries ranging from Mali to the Central African Republic, are visible here, indicating an area of clear decline.



Source: Analysis on data provided by Seabury ADG

Airline fleet composition in Africa

In terms of seat kilometers flown, the two significant trends for both North African and Sub-Saharan African air transport have been the downsizing of aircraft toward the city-jet size (such as Boeing 737 or Airbus 319) and, contrary to many accounts, the overall renewal of the fleet. These observations apply to international as well as domestic travel within Africa. Yet many complaints are still being raised about the aging fleet in Africa—and indeed, there has been cause for concern. But, this must be placed into perspective.

Because the Seabury/ADG scheduling data used for market analysis in this report included the type of aircraft for each given flight, a breakdown of aircraft with their approximate age and size could be made (table 1.16). Figures 1.15 and 1.16 summarize the overall findings. The overall trend is quite visible, and has been confirmed by examining state registration changes in aircraft fleets using JP Fleets data.

Domestic travel, which has also experienced this downsizing of aircraft, has also seen a doubling of the seat kilometers flown in older Western aircraft, from 2 percent of the overall seat kilometers to 4 percent. Perhaps this occurred because capacity needed to be brought on line quickly and inexpensively to keep up with growth. This increased use of older Western aircraft may well have led to the more critical views on the safety of air travel in Africa.

Table 1.16 Breakdown of aircraft age for analysis

Age rating	Aircraft
Western very old vintage	DC3, and so on. Not really in use in scheduled service any more.
Western very old	1960s–70s, includes 727s, 737-100s, and so on.
Western old	1970s–80s.
Western somewhat recent	1980s–90s (for example, Boeing 757).
Western recent	Group of the newest aircraft, generally from the mid 1990's onwards.
Eastern-built	Not large role overall.

Source: Analysis on data provided by Seabury ADG.

Note: In the subsequent analysis, small subcategories became necessary, such as "Western somewhat recent/Western recent."

Table 1.17 shows the types of aircraft used in international travel within Africa in each country's major airport, measured as numbers of flights. The able is broken down by the country's overall aviation market size, and compares one week in November 2001 to one week in November of 2007. The share of commuter propeller aircraft for international flights has grown from 33% to 40% for the countries with the least overall traffic, and may perhaps be even higher when considering eastern-built aircraft. The changes, once again, hint at an increase of shorter routes, especially since the only aircraft type whose share of the flights has been declining is the widebody.

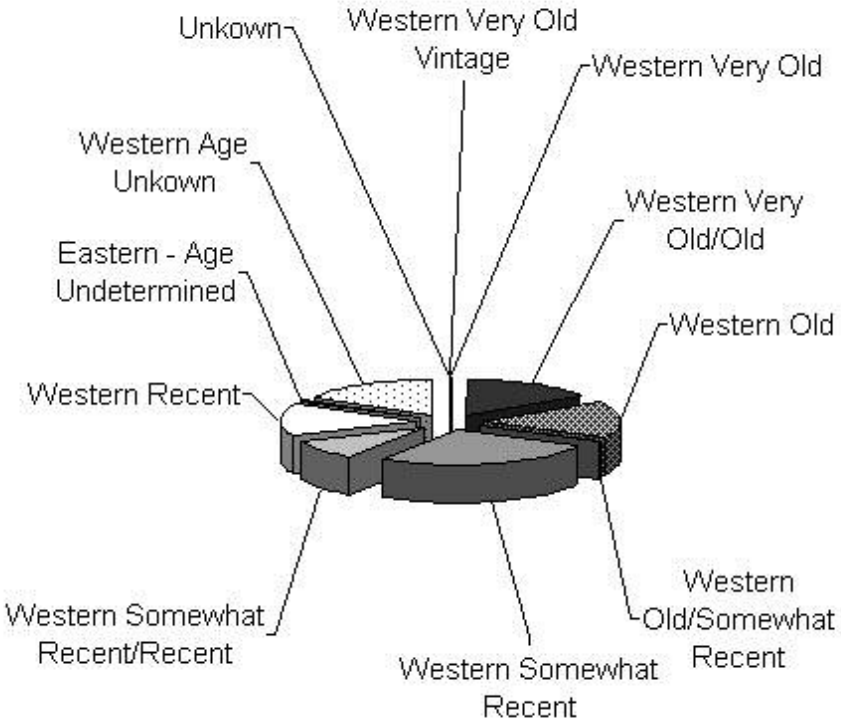
Table 1.17 Breakdown of aircraft age for analysis

Year	Overall Market Size	Intl. Flights 1 Week November	General Aviation	Commuter Prop	Commuter Jet	City Jet	Large Jet	Widebody	Eastern Built - Unknown Type
2001	> 5 million	6,236	-	13%	1%	65%	0%	20%	1%
	> 1 million	2,169	-	27%	1%	34%	5%	34%	1%
	< 1 million	3,081	0.04%	33%	2%	38%	2%	20%	1%
2007	> 5 million	10,638	-	14%	7%	61%	1%	17%	0%
	> 1 million	3,363	-	17%	5%	52%	2%	22%	1%
	< 1 million	3,167	-	40%	3%	39%	3%	11%	4%

Source: Analysis on data provided by Seabury ADG.

Figure 1.15 Overall fleet age in use in Sub-Saharan Africa. The shift from older aircraft, as percentage of overall seat-kilometers flown, to recent aircraft is pronounced. This same shift, in differing magnitude, can be observed throughout different markets in Africa, including domestic markets. This same shift, though even stronger, has taken place in North Africa. Figure 1.11 shows that this shift is part of a trend toward smaller, city-jet sized aircraft in lieu of both wide-bodies and commuter propeller aircraft.

Proportion of Seat-Kilometers flown by Aircraft Age in SSA - 2001



Proportion of Seat-Kilometers flown by Aircraft Age in SSA - 2007

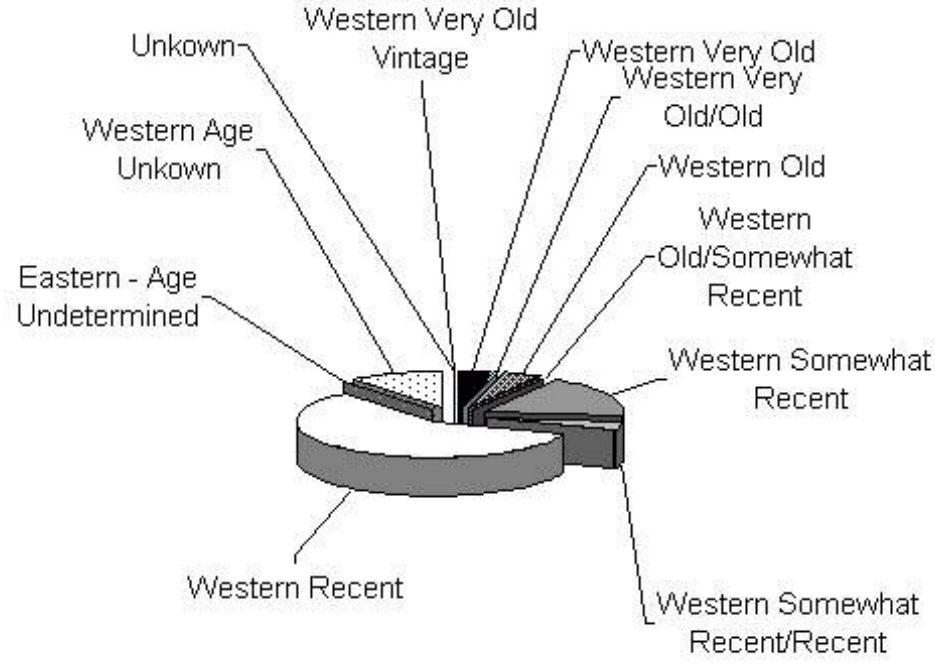
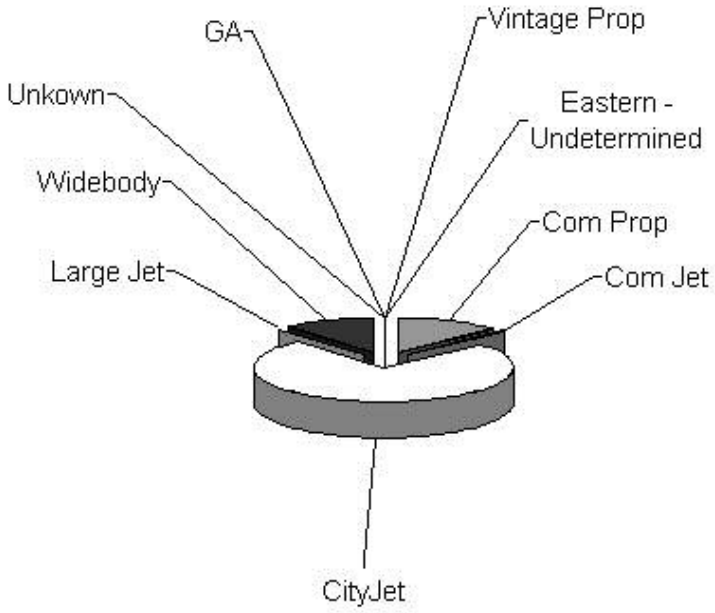
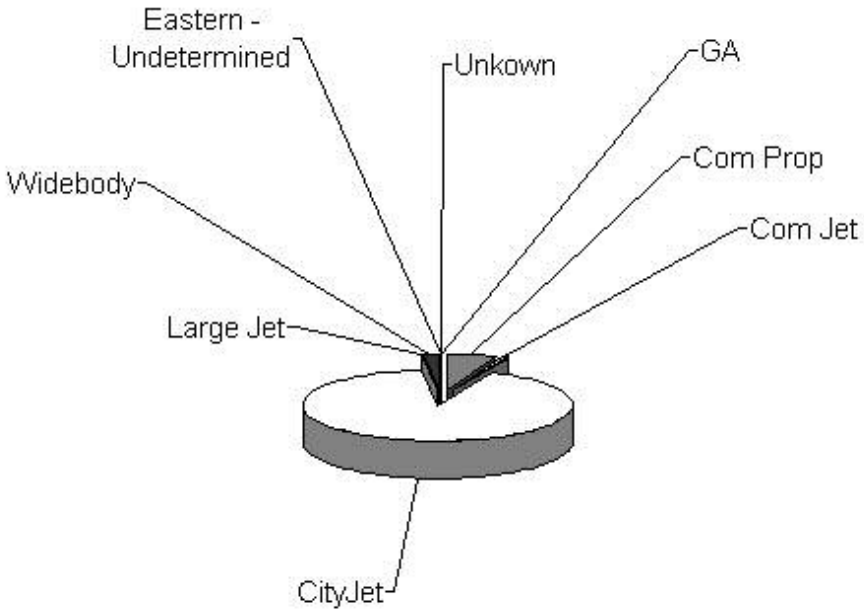


Figure 1.16 Size of aircraft in Sub-Saharan passenger fleets. Capacity has shifted toward Boeing 737 or Airbus 320-sized aircraft, away from both wide-body and commuter propeller aircraft.

Proportion of Seat-Kilometers flown by Aircraft Size In SSA - 2001



Proportion of Seat-Kilometers flown by Aircraft Size in SSA - 2007



Source: Analysis on data provided by Seabury ADG.

2. Airports and airside infrastructure

Airports—overview

Airport infrastructure in Africa varies by the type of traffic the airport receives, and the overall economic circumstances of a particular country. There is a high degree of runway capacity. But, that capacity is effectively diminished by the lack of necessary infrastructure in many instances. The existing necessary infrastructure varies widely.

This study had initially been designed to examine airports with more than 60,000 passengers annually. But, due to the nature of travel in Africa, some elements of this report will span all airports that receive traffic on published schedules.

With the use of various databases, it can be determined that there are at least 2,900 airports in Africa.[12] The number of these airports receiving scheduled services fluctuates, in part due to seasonality. In November 2007, an estimated 280 airports throughout Africa received scheduled services (see figure 2.1). The variance of airports with scheduled traffic within a year is so great, however, that if one adds up all airports that have had any scheduled service at any point throughout the year, the totals are significantly higher than the number given at any point in time.

Table 2.1 Airports receiving scheduled services in Africa for a given year. The annual number is higher than the snapshot number at any given point in time, such as the one for November 2007 in figure 2.1.

Region	2001	2004	2007
North Africa	77	73	70
Sub-Saharan Africa	318	276	261
Total	395	349	331

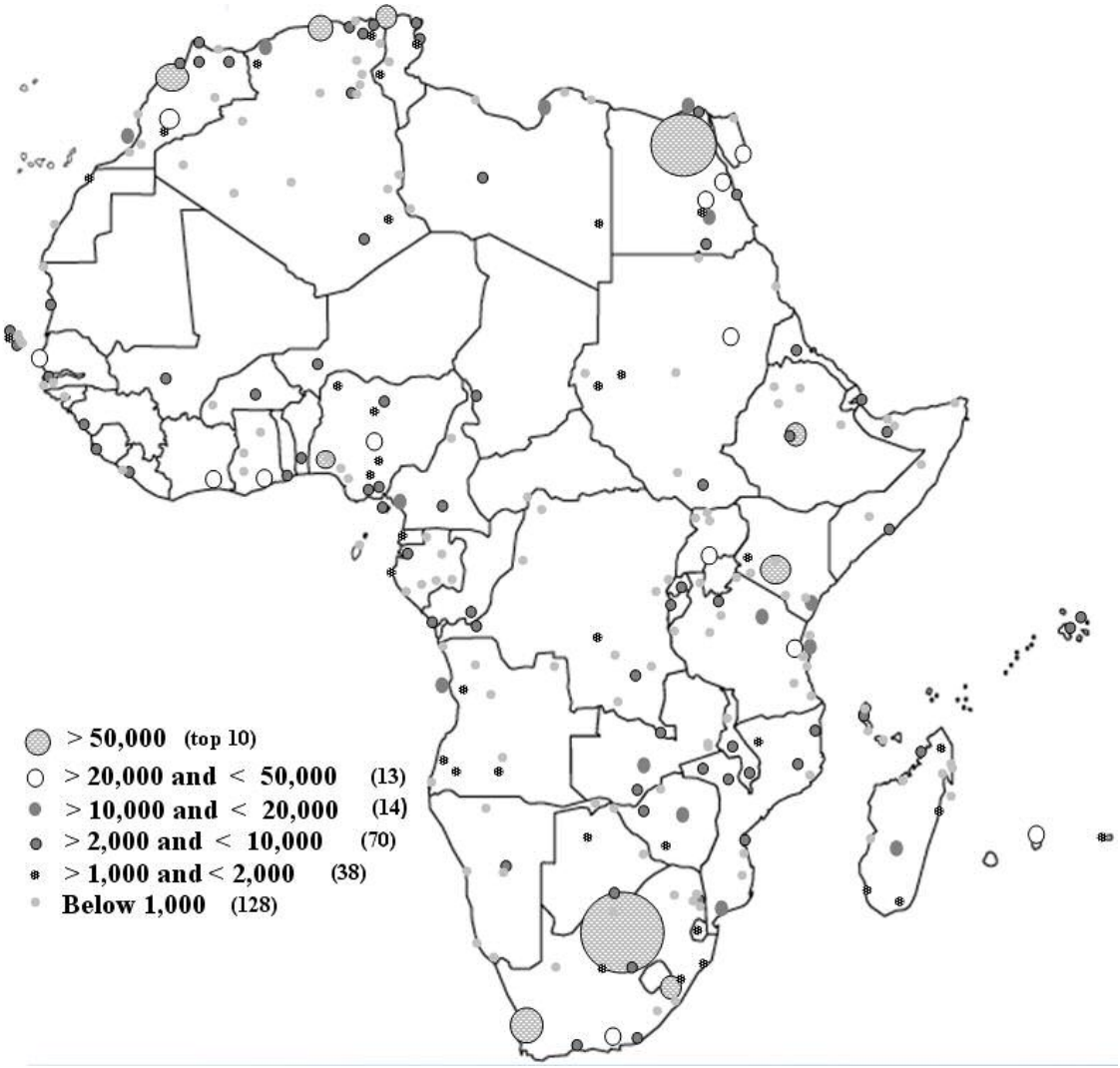
Source: Analysis on data provided by Seabury ADG.

There has been a considerable overall downward trend in the number of airports with scheduled service. With the exception of the Banjul Accord Group (BAG) of countries (Ghana, Nigeria, Cape Verde, Gambia, Liberia, and Sierra Leone), drops in airports with scheduled service varied from 20 to 40 percent between 2001 and 2007. (See table 2.2 for annual totals of airports with scheduled service. Figure 2.2 shows the number of airports receiving scheduled service each given month—the totals are less than the annual count, as explained above.)

Nearly all of the airports with service in November 2007, the last data snapshot in this report, have at least one paved major runway. Surprisingly, only a dozen or so airstrips are not paved, and most of these are in countries that are having or recently have had military conflicts. One exception is the Republic of Tanzania, which has five airports with scheduled service and with alternatively surfaced runways. (The World Bank is currently involved in projects resurfacing these runways.)

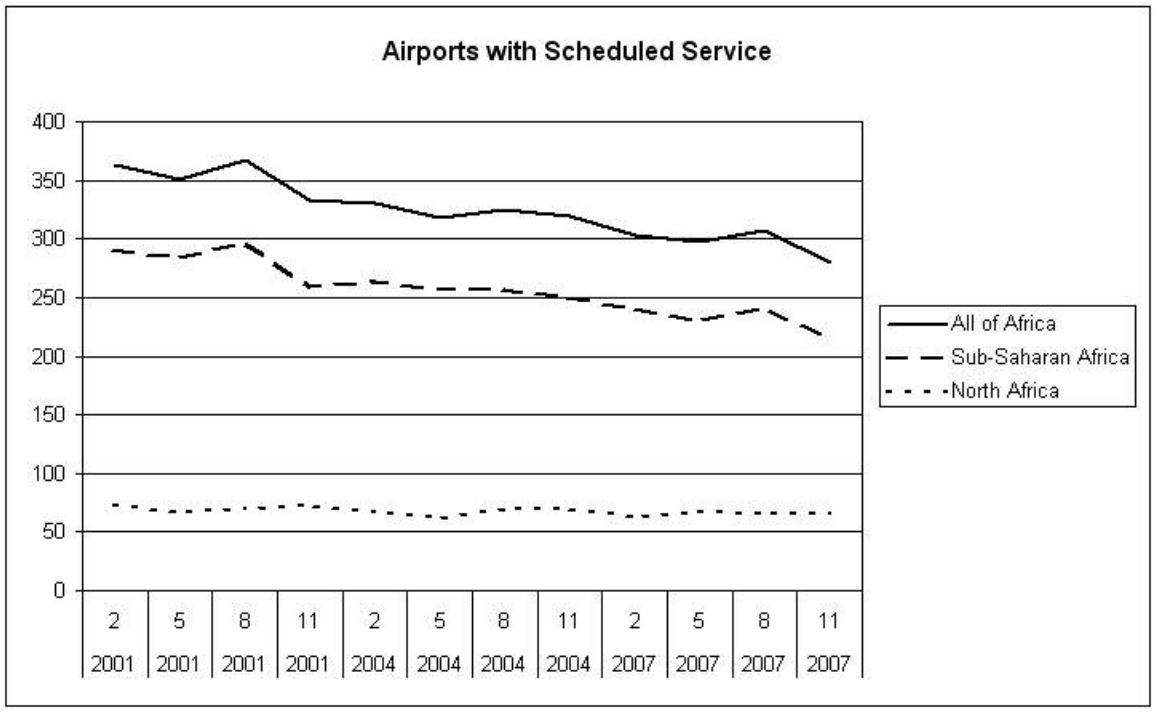
[12] http://www.aircraft-charter-world.com/. A list of airports was composed by combining this Web site's list of airports for every country in Africa.

Figure 2.1 Airports receiving scheduled service in November 2007, sized by their seats per week



Source: Analysis on data provided by Seabury ADG.

Figure 2.2 Airports with scheduled service within Africa



Source: Analysis on data provided by Seabury ADG.

Note: The trend overall is clearly downwards.

When referring to the quality of airport infrastructure, the discussion should include airside and the landside services. Airside services include all issues related to flight, such as runway length and condition, air traffic control, taxiways, and apron space. With landside services, the biggest and most important issue is passenger terminal capacity, and access to the terminal. With the burgeoning growth in air transport, terminal capacity, especially at major hubs, has been a constraint worldwide, and indeed this has shown itself to be an issue in Africa, though statistics are difficult to obtain.

Many public resources exist on airside infrastructure. This is due to the nature of the information – in order to make airports accessible to air travel, the installations need to be listed and published, and thus appear in a country's Aeronautical Information Publication (AIP) and in after-market publications widely distributed especially amongst pilots, such as Jeppenses. However, in reality a distinction needs to be made between the published installations, the installations that are actually operational, and those that have actually been installed and for various reasons never were included in the publication process. The majority of information for this report is based on publicly available information, so an accurate, quantitative assessment of the quality of installations cannot be made without on-site evaluations. For example, it is know anecdotally at the time of this writing that the instrument landing system at Maseru International Airport in Lesotho has become so unreliable that the schedule integrity of the only airline servicing the airport, South African Airlink Express, has been compromised. In other cases, modern GNSS approaches may have been designed and financed, yet for various reasons have not entered the publication process, and are therefore not in the public inventory of airside services and installations.

Overall, though, as would be expected, the higher the volume the better the quality of airside infrastructure. In major hubs such as Johannesburg, Egypt, Morocco, and Nairobi, the overall airside installations are fairly standard in terms of runway length, instrument landing systems (ILSs), and so on, though important differences will be discussed later in this report. But, as soon as the volume drops, significant differences in the quality of the infrastructure become apparent. Though overall volume to airports without paved runways is relatively small, the number of airports with poor runway conditions is fairly high in some countries.

Table 2.2 Evaluating the overall runway quality in Africa

Rating	North Africa		Sub-Saharan Africa	
	Airports	%	Airports	%
Excellent	28	60	31	17
Very Good	17	36	51	28
Fair	2	4	52	29
Marginal	–	–	8	4
Poor	–	–	37	21
Totals	47	100	179	100

Source: Analysis on data collected by the World Bank: Totals include double counting for in-region travel.

Of the 280 airports receiving scheduled service on the African continent, data on 207 of these airports could be collected, which creates a rough estimate of the overall conditions in Africa. The data suggests that of the sample of 47 airports in North Africa, 60 percent could be considered to be in excellent condition, 36 percent in good condition, and 4 percent in fair condition. In Sub-Saharan Africa, however, the picture becomes bleaker. Of the 173 airports, using a precursory glance, 27 percent could be considered to be in marginal or poor condition, with a dramatic *21 percent in poor condition* (see table 2.3)! Fortunately, as seen in table 2.4, only about 4 percent of the traffic was related to the marginal airports.

These measurements were not made by staff observation, but by examining the airports using commonly available satellite images. The basic criteria were the appearance of the runway and other obviously visible issues, such as serious security deficiencies shown by footpaths over the runway extending beyond the airport perimeter. The summary was made on those airports only with adequate resolution images – of 280 airports, 73 could not be evaluated due to image quality.

ILSs can be found in nearly all airports with an estimated capacity of 1 million seats or more, but drop off rapidly below this figure. In a large number of the smaller, older airports, non-directional beacon (NDB) systems, now very old and outdated, are still prevalent. This does not suggest that new investment is needed in ground-based navigation infrastructure—today satellite technology can easily replace many of the ground-based navigation systems at a much lower cost than the older systems incurred. But, this does suggest that in many cases either no plans have been made, or no funding obtained, for the replacement of increasingly obsolete technologies.

Table 2.3 Seat capacity by runway rating. Fortunately, the overall seat volume related to marginal or poor runways is only 4% of the Sub-Saharan African total.

Rating	North Africa		Sub-Saharan Africa	
	Seats ('000)	%	Seats ('000)	%
Excellent	53,963,169	90	69,666,792	63
Very good	5,686,311	10	26,574,283	24
Fair	15,392.00	0	9,285,100	8
Marginal	–	–	2,291,844	2
Poor	–	–	2,419,054	2
Totals	59,664,872	100	110,237,072	100

Source: Analysis on data collected by the World Bank: Totals include double counting for in-region travel.

Passenger capacity and constraints

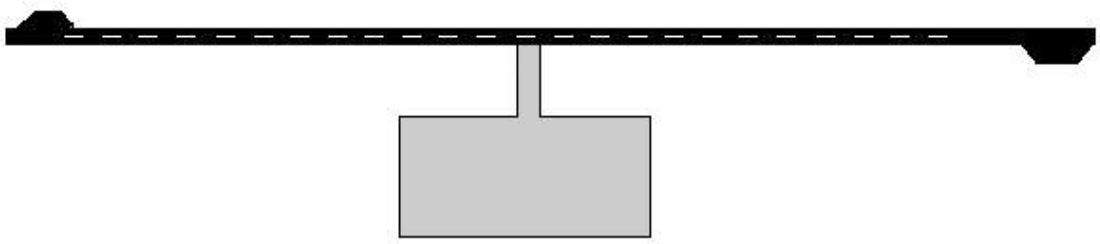
The overall growth in air transport has put a strain on overall airport capacity worldwide. In fact, the increase of passengers recent years has been of concern to airport planners, and Airport Council International has raised this issue in recent meetings and conferences. The potential constraints, however, may be mitigated by the global economic slowdown, and clear signs of global drops in passenger traffic are now apparent. As mentioned earlier, this may not necessarily, however, apply to the whole of the African continent.

Runways

Traffic in Africa does not appear to have runway capacity constraints. To illustrate, if one provided five-minute separation between flights on the same runway, an airport could accommodate 144 flights in a 12-hour period—equivalent to over 1,000 flights a week, or, with an average passenger load of 120, over 17,000 passengers a day! Even at 20-minute separations, the passenger numbers would be over 4,300 a day. The implication is that, looking at traffic *per airport*, there is no current need of new airports in Africa, but rather the need to optimize existing facilities. In fact, the costs of building new airports to replace current ones far exceed the benefits at the volumes and growth rates currently seen, especially since much less costly alternatives can alleviate many of the particular problems experienced by an individual facility. For example, the construction of a new airport with minimal facilities and a 3,000 meter runway can run well in excess of US$ 100 million, whereas upgrading a facility by adding a parallel taxiway, resurfacing the entire existing runway (assuming asphalt), and extending the same existing runway from, for example, 2,000 meters to 3,000 meters, would only total roughly a third of those costs (see Appendix 3 for a simple model showing the cost differences).

Capacity constraints on airports, however, can and do show up on taxiways, aprons, and jetways. Runway capacity, for example, depends heavily on how quickly an aircraft can leave or enter the runway. Many African airports deploy a low-cost design as shown in figure 2.3. Instead of the aircraft leaving the runway via a turnoff after landing, the aircraft must taxi to the turning bay, turn around, and taxi toward the access to the apron usually found in the center of the runway. This is perfectly acceptable in an airport where there is enough time between departing and arriving aircraft to do so, but high-volume airports require parallel taxiways with multiple turnoff ramps from the runway. In addition, if parking space on the apron is limited, an airport can quickly come to a standstill.

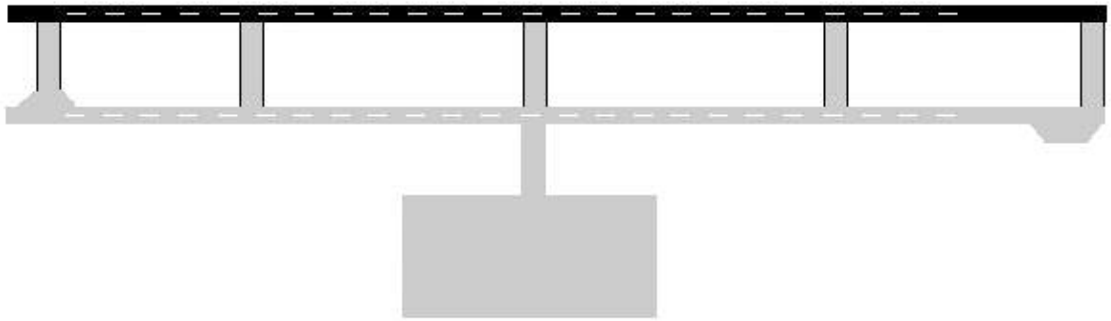
Figure 2.3 Abstract of a typical airport design commonly found in Africa. The runway will feature turning bays, with a central apron for the terminal and parking. Many airports of this design exist, with different variants.



Source: Author

One common, and sensible, solution for airports with the turning bay configuration is to construct a parallel taxiway. In fact, constructing a new parallel runway and using the old runway as a parallel taxiway is a common solution, particularly in North Africa, and now also being adapted elsewhere. Figure 2.4 shows the new configuration. During construction, the runway continues service without interruption. Once the new runway is in service, the old runway serves as a parallel taxiway. If maintenance is to be performed on the new runway, the old runway can resume its duty as a nonparallel taxiway runway.

Figure 2.4 A common variant of the typical layout. The old runway remains, but a new parallel runaway has been added. The old runway now serves as a parallel taxiway or as a spare if the new runway is out of service.



Source: Author

Terminals

There is repeated evidence of passenger terminal capacity running out. Though data overall is not easy to come by (International Civil Aviation Organization, ICAO, for example, does not have an inventory of passenger terminal capacity), table 2.4, assembled using the azworldairports.com database,[13] shows the estimated capacity of some of Africa's larger airports, with relevant passenger figures. The

[13] www.azworldairports.com. This database is compiled by the publisher of the Web site. Discussions with the publisher revealed that data was provided through individual contact with the relevant airports, such as no central reference source was available.

table, beyond showing the vast gaps in passenger figure reporting, also shows many Sub-Saharan terminals at or above capacity, while North African terminals seem to have already been expanded anticipating future passenger figures.

In some cases, remedies to the capacity issues are already being implemented. For example, Nairobi's passenger terminal is going through an extensive upgrade allowing over 9 million passengers. In other cases, further examination of the actual circumstances of the airport must be made. Beyond new terminals, rescheduling of flights in a manner that does not have too many flights arrive at the same time may be in order. At other airports, capacity issues should be looked at carefully. Malawi's airport in Lilongwe, for example, though clearly in need of some upgrades, is not a limiting factor in passenger capacity.

The overall assessment needs to be made on a case-by-case basis. One industry general assumption in airport planning is a terminal surface of 20 square meters per international traveler, or applying a ratio of 0.007 to 0.01 to the overall annual passenger number. Formulaic statements such as this would lead one to assume that by applying these constants to known sizes of terminals and passenger numbers one could conclude the overall terminal capacity. However, this assumption cannot be made since there are too many variances and different forms of bottlenecks in terminal design. If complaints about terminal constraints are raised on an individual basis, though, an easily quantifiable measurement would be the balancing of the terminal usage over time. In looking at the distribution of arriving and departing flights for November of 2007 at the primary airport of each of the 53 countries examined, it becomes clear that generally, the lower the maximum flights per hour, they less well distributed the scheduling becomes. For example, a higher density airport such as in Addis Ababa will show a better (more even) balancing of flights than, for example, Cotonou, Benin, where the highest number of flights per hour was observed at four, eight times the average over the week. Appendix 8 shows a list of the main airports per country, with a general grading on the balance of scheduling after examining flights and seats with regards to peak hour usage for one week in November 2007. In at least 26 of the 53 airports examined, the schedule of arriving and departing flights could be re-examined in order balance the usage of the airport. At 12 airports traffic never exceeded two flights per hour, generally making the distribution analysis a moot issue. However, it must be cautioned that arrivals and departures are treated equally in this analysis, though different operational areas of the airports would be involved. This implies that, for example, two flights per hour may represent one departing and one arriving flight, only one flight being handled at the same time in the respective terminal area.

One unknown factor in Africa is if there will indeed be a contraction, rather than growth, in the air transport industry as fuel prices perhaps rise again or the world economy contracts. Many projections in recent months have been becoming gloomier as fuel costs were soaring, and though this crisis has eased, the impact of the economic slowdown will still have a significant impact..[14] However, evidence for 2008 still has shown continued growth for the year.

[14] At the height of the fuel crisis fuel costs accounted for about 50 percent of the cost of a ticket.

Table 2.4 Terminal capacity at given airports versus reported passengers and estimated seats

Country	City	Airport	Reported capacity (million)	Reported passengers (million)						2007 Estimated seats (million)
				2000	2003	2004	2005	2006	2007	
South Africa	Johannesburg	JNB	11.9						19	25.3
Morocco	Casablanca	CMN	7.0					5.7		8.8
Kenya	Nairobi	NBO	2.5				4.3			6.3
Algeria	Algiers	AGL	10.0							6.1
Tunisia	Tunis	TUN	4.5			3.4				5.2
Mauritius	Mauritius	MRU	1.5					2.2		3.0
Senegal	Dakar	DKR	1.0							2.5
Tanzania	Dar es Salaam	DAR	1.5							1.9
Egypt	Sharm el Sheik	SSH	8.0				5.0			1.9
Zambia	Lusaka	LUN	0.4					0.6		1.3
Kenya	Mombasa	MBA	0.9					1.0		1.1
Zimbabwe	Harare	HRE	0.5							1.1
Morocco	Agadir	AGA	3.0					1.4		1.0
Seychelles	Mahe Island	SEZ	0.4		0.3					0.9
Tunisia	Djerba	DJE	4.0			2.2				0.8
Mali	Barmako	BKO	0.4					0.5		0.7
Tunisia	Monastir	MIR	3.5				4.1			0.6
Djbouti	Djibouti	JIB	0.5				0.1			0.6
Morocco	Tangier	TNG	0.8					0.3		0.5
Morocco	Fez	FEZ	0.5					0.2		0.5
Rwanda	Kigali	KGL	4.4	0.1						0.5
Nigeria	Kano	KAN	0.5	0.3						0.4
Morocco	Oujda	OUD	0.3					0.2		0.4
Morocco	Rabat	RBA	0.7				0.2			0.4
Malawi	Lilongwe	LLW	0.2			0.2				0.4
Seychelles	Praslin Island	PRI	0.4			0.3				0.4

Source: various, including www.azworldairports.com, and findings by World Bank.

Topological Distribution

Though the findings of this report conclude that the number of individual runway facilities in existence today are adequate capacity-wise for the traffic they are serving, one could argue that this does not address the issue of airport distribution. If one analyzed population centers throughout Africa, grew the populations in these centers at predicted rates, and assigned a minimum runway length per population center according to its size, the needs for future investments in new runways and airports would grow significantly. The assumption is binary in that each population center would be assigned a local airport according to its size, regardless of the expected frequency of flights either in or out of the airport. Using this type of modeling, assuming a base line of the current distribution of airports being adequate, it can be determined that, at an urban population growth rate of 4 percent, the annual investments needed in the sector between 2005 and 2015 are close to US$ 800 million for Sub-Sharan Africa. In the model applied

for this calculation, 2 cases are presented: a "base case" that shows the amount that would need to be spent to address the needs as expressed in the model in their entirety, and a "pragmatic" case that tries to incorporate what realistically may be more achievable. The results of this model are shown in table 2.5 below.

Table 2.5 Estimated annual investment needs in US$ millions in runways and terminals in Sub-Saharan Africa for the 10 years between 2005 and 2015. The model assumes an urban growth rate of 4 percent.

Item		Base Case	Pragmatic Cast
Runways	Improvements	25.3	25.3
	Upgrade	22.5	22.5
	New	12.2	12.2
	Maintenance	61.2	49.9
	Runways Total	**121.2**	**109.9**
Terminals	Improvements	5	6.2
	Upgrade	-	-
	New	18.0	9.1
	Maintenance	653.8	102.6
	Terminals Total	**676.8**	**117.9**
	Grand Total	**798.0**	**227.8**

Source: Carruthers and Brinceno-Garmendia.

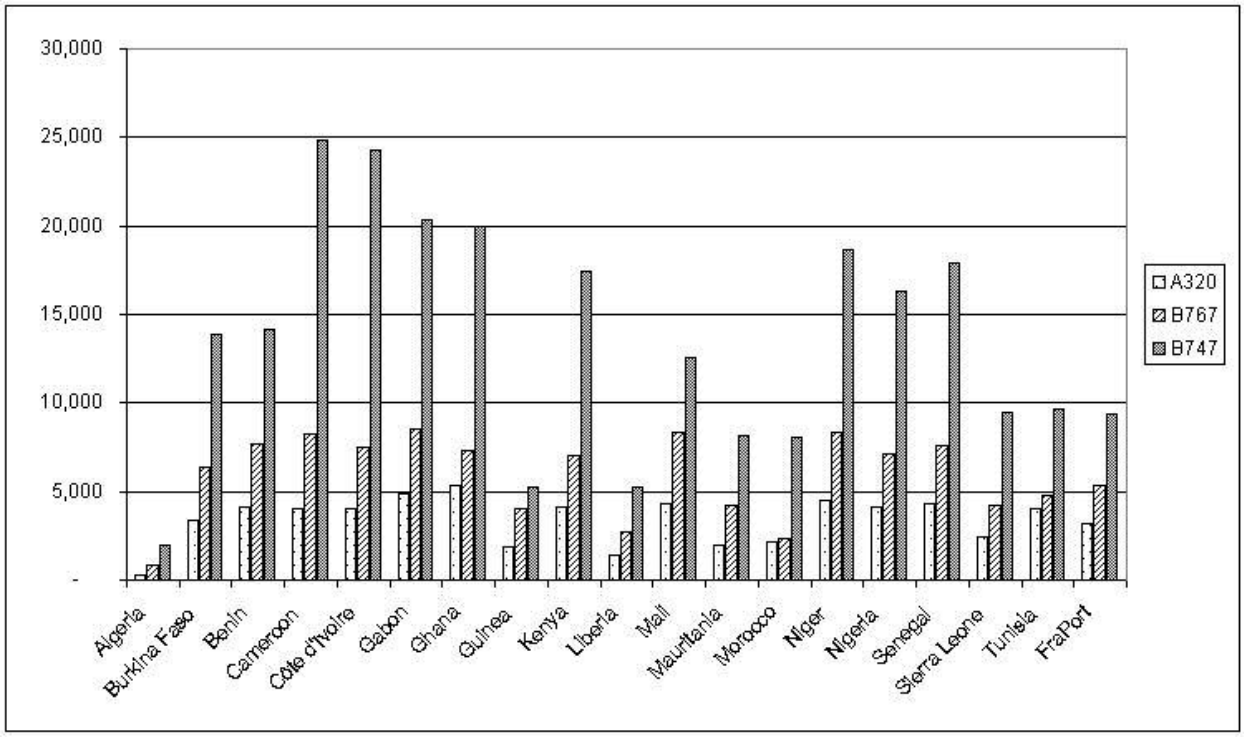
Airport charges and finance

A sample of airport charges, graphically shown in figure 2.4, shows wide variance, with particular high charges overall in Cameroun, Ghana, and Cote d'Ivoire. Airport charges for Frankfurt am Main International Airport were collected separately for the same aircraft using FraPort's online Airport Charges calculator[15] – the average of the charges in the table below is between 30 to 40% higher than FraPort's charges. After adjusting for outliers (Cameroun, Cote d'Ivoire, and Ghana), the charges averaged to 29% higher. It must be cautioned, though, that somewhat higher charges are to be expected, since other revenue streams existing in developed countries are not available to almost all sub-Saharan countries. In the United States, concessions such as car rental stands are one of the most important sources of revenues for airport authorities. Since these opportunities do not exist to the same extent in Africa, revenues are highly dependent on airside and passenger charges. Also, the overall discrepancy Fraport's charges increase dramaticall ywith aircraft size, suggesting that intercontinental travelers are charged more, perhaps because these flights are seen as a source of foreign currency revenues.

Anecdotal evidence is now appearing from two countries in West Africa charging much higher passenger fees, in the $80 and above per passenger range. In one country these charges are imposed to finance a new airport. As mentioned earlier, though, the building of new airports is much more expensive than the expansion of current capacity through runway and taxiway improvements, and in many cases is ill-advised and unnecessary. Evidence for Africa now suggests that at current traffic levels the supply of runways and airports is more than adequate, though their condition may be questionable.

[15] Cite web site here

Figure 2.4 Airport charges overall by aircraft type for 18 sample airports. FraPort's charges for the Frankfurt am Main airport can be found at the right end. On average, the sample airports exhibited charges of 30 – 40% higher than those sampled at FraPort for same type aircraft.



Source: Analysis based on data found in Analyse Economique et Financière des Capacités de Développement des Aéroports du Mali,adpi Architectes & Ingénieurs, October 2008, p. 21, and FraPort.

Table 2.5 Planned and started investments exceeding US$ 500 million n Africa, as of December 2007.)

Location		Project	US$ (bil)
South Africa	Johannesburg	World Cup 2010, A380 preparation	1.180
South Africa	Durban	Completely new airport by 2010	0.932
Sudan	Khartoum	Completely new airport planned	0.750
Senegal	Dakar	Rehabilitation or new airport	0.580
Egypt	Cairo	Terminal 3, third runway	0.554
Tunisia	Enfindha	completely new airport for 7 million annual pax	0.500
		Total for Africa	**4.496**

Source: Airports Council International, ACI Airport Economics Survey 2007, p. 42.

Table 2.6 Worldwide planned and started investments exceeding US$ 500 million, as of December 2007. Africa only has a one percent portion of larger airport investments.

Region	Planned or started (US$ bil.)	Percentage
Europe	79.835	20%
Middle East	39.000	10%
North America	139.724	36%
LAC	7.706	2%
Africa	4.496	1%
AsiaPacific	119.401	31%
Total	**390.162**	

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Source: ICAO.

Private Sector Participation in Airports

Most airports in Africa are not truly sustainable, if examined by volume alone. Revenue streams rely much more on passenger and aircraft charges than in developed countries, where concessions for such items as car rentals make a significant contribution to the airport's bottom line. In addition, there is the "cash cow" syndrome that manifests itself not only in Africa but in poorer countries in other regions as well: Airports are seen as a source of revenues and foreign currency. In some cases, there may be operational surpluses, but needed maintenance and reinvestment does not occur[16]. Generally, the airport is seen as public infrastructure, and even if corporatized (such as with South African's ACSA), still under majority ownership of the state. Though there have been discussions about further private sector participation in airports, there has been little action, except perhaps for the outsourcing of some managerial aspects or certain types of operations[17].

Governments see airports as potentially monopolistic enterprises, and therefore see the need for some form of regulation, and if need be, control. In the developed world, as well as strongly in areas with growing traffic, this argument may be countered by the fact that airports seek airlines to serve them – the World Routes Forum, held every year, for example, is an event in which airports create booths and exhibits to woo airlines into their facilities. It is airports that seek airlines, and not the reverse. Thinner traveled countries, such as many of those in Sub-Saharan Africa, however, usually have only one point of entry, and though this point of entry is barely sustainable, it by nature has a monopoly.

Globally, there has been occasional full privatization of airports. This may only work at airports with very high passenger figures – some estimates are that airports only become financially sustainable at above 1 million passengers a year, and that only the largest are suitable for privatization. And even in those systems, it must not be forgotten that profitable airports are used to subsidize unprofitable ones that are yet seen to fulfill important social needs within a country. One example of full privatization commonly mentioned is the British Airports Authority. Yet even here there are its discontents, arguing that prices have soared while service has declined, all due to the monopolistic nature of airport infrastructure. And a familiar story is emerging – there are complaints about not enough being reinvested in the basic airport infrastructure.[18]

In Africa, the largest scale attempt to follow this model is ACSA – the company that holds 10 of South Africa's airports. Of the US$ 136.5 million privatization package, 20 percent was purchased by Aeroporti di Roma, which again sold its stake in 2005. ACSA, however, is not fully privatized - control of the company still rests with the South African Government, which has stated the company would not be listed on the exchange until 2004. By now, in 2008, it still has not.

The question at hand is if full privatization really is the model to follow. In the United States airports are clearly not in the private sector. In China, which presents its own unique environment, some assessments have come to the conclusion that partial privatization has in fact decreased airport

[16] Aviation Infrastructure Performance A Study in Comparative Political Economy, Clifford Winston, and Gines de Rus, Editors, Brookings Institution Press, Washington, D.C., 2008. The reference is to a chapter written by Kenneth Button, "Airport Privatization in Developing Countries: Privatization and Deregulation", p. 198

[17] Ibid, p. 213

[18] "OFT Proposes To Refer BAA Airports for a Market Investigation", Mondag Business Briefing, Dec. 21 2006, and "BAA face penalties if London airports investment cut", Alistair Osborne, Telegraph Media, Oct. 5 2007

performance as compared to those fully under government control, though this argument is raised in favor of full privatization rather than of full or partial government control.[19] Globally, however, airport privatization overall is being judged as running out of steam, with noticeably fewer transaction occurring in 2007.[20]

The successful concessioning of all aspect of airport management, including infrastructure needs and operations, is dependent on the quality of the initial transaction. Experience has shown in several instances that lack of choosing the right partners, or creating agreements with no effective enforcement mechanism, can result in having an operator control the essential services, and receiving the related revenues, while later not providing for the prior agreed-upon capital investment needs. For example, in one case an airport was handed to a group of investors (which also included the originating government) under the agreement that the purchasing partnership be allowed to operate every aspect of the facility and collect its revenues, with the caveat that required infrastructure investments and maintenance also be completed by the group, such as resurfacing the apron and taxiways. The airport operations themselves, with an estimated number of passenger seats in excess 600,000 in 2007, has generally been hailed as the best run airport in the country's system – yet none of the required infrastructure investment and upkeep has been seen in over 10 years, with conditions deteriorating.

Figure 2.5 Countries with private sector participation in airport. The grey countries are the only countries with recorded deals in the PPIAF database, and span all market sizes.

Source: PPIAF database

Logically splitting the functions, however, between who is providing the services at an airport and who controls and invests in the infrastructure, may provide a more workable solution for private sector participation. In one African country, for example, the operations ranging from cargo handling to check-in counters is farmed out to a company in Europe, which in return hires local employees. And these contractors differ from airport to airport, and go out for bidding in regular cycles.

Overall, there are very few recorded public-private partnership **(**PPP) transactions with airports in Africa. Table 2.8 shows currently documented partnerships. A topological view of these transactions are found in figure 2.5, which shows that attempts at private sector participation has happened in all market sizes – from Cameroun, a thin market with below one million seats a year, to Tanzania, with more than one million seats, and of course South Africa, the largest market in Sub-Saharan Africa.

[19] Winston et al,, p. 159. The source is a chapter by Anming Zhang and Andrew Yuen, "Aiport Policy and Performance in Mainland China and Hong Kong"
[20] Airports Council International, ACI Airport Economics Survey 2007, p. 10

An extensive discussion of PSP models in airports can be found in *Privatization and Regulation of Transport Infrastructure – Guidelines for Policymakers and Regulators*[21]. In a very short summary, there are generally four types of ownership and operations schemes listed: (1) Public Ownership and Public Operations with Commercial Orientation, (2) Regional Ownership and Operations ("regional" referring to regional within a country), Public Ownership with Private Operations (with many different sub-types), and (4) private operations.

The third model, public ownership and private operations, can be split into several sub-types, including joint ventures, partial/majority divestitures, management contracts, and various variants of concession contracts.

The discussion mentions very little about Sub-Saharan Africa. The only airport listed as a 15 year joint management contract involving shared risk between the public and private sector is Cameroun, with a 34 percent stake by Aéroports de Paris, a 24 percent stake by the Government of Cameroun, and the remainder spread among carries and a bank. Since this agreement was put in effect in 1993, the termination date was in 2008. The contract covered seven of 14 airports. The PPIAF database records show, however, that beyond there having been additional transactions as discussed previously, the majority of transactions in Sub-Saharan Africa where of the third type, including divestitures, management contracts, and concessions. In addition, there are probably many more, non-recorded management contracts in airports in terms of allowing private firms offer specific services, such as SwissPorts providing passenger counter services as witnessed in Johannesburg and Dar es Salaam, or private contractors fulfilling cargo handling functions in lesser known airports such as Mwanza in Tanzania. The model of farming out specific functions to private participants, using contracts that regularly go out for public bidding, seems to be one of the most promising.

[21] Chapter 3: Airports, by Ofelia Betancor and Roberto Reindero, in Privatization and Regulation of Transport Infrastructure – Guidelines for Policymakers and regulators, Edited by Antonio Estache and Ginés d Rus, The World Bank, Washington, D.C, 2000, pp. 51-111

Table 2.8 Public-private investments in airports in Sub-Saharan Africa

Country	Financial Closure Year	Project Name	Type Of PPI	Project Status	Location	Contract Period	Term. Year	Multiple Systems	Num. of	Govt Granting Contract	Invest. Year	% Private	Govt Payment Committed	Physical Assets	Capacity Type	Capacity
Algeria	2006	Houari Boumedienne Airport	Management and lease contract	Operational	Algiers	4	2010	No	1	Federal	2006	100%			Population (thousands)	3500
Djibouti	2002	Djibouti International Airport	Management and lease contract	Operational	Djibouti			No	1	..	2002	0%				
Egypt	1998	El Alamein Airport	Greenfield project	Operational	El Alamein	50	2048	No		..	1998	100%		88.5		
Egypt	1998	Marsa Alam Airport	Greenfield project	Operational	Marsa Alam	40	2038	No		..	1998	100%		35.4		
Egypt	2000	Hurghada Airport Passenger Terminal	Greenfield project	Operational	Hurghada	15	2014	No		..	2000	100%		4.4		
Egypt	2001	Borg El Arab Airport	Greenfield project	Operational	..	50	2051	No		..	2001	100%		200		
Egypt	2001	Luxor Airport	Concession	Operational	..	25	2026	No		..	2001			70		
Egypt	2005	Cairo International Airport	Management and lease contract	Operational	Cairo	8	2013	No	1	Federal	2005	100%			Number of runways	3
Egypt	2005	Five Regional Egyptian Airports	Management and lease contract	Operational	Sharm El Sheikh, Hurghada, Luxor, Aswan, Abu Simbel	6	2011	Yes	5	Federal	2005	100%			Number of runways	1
Tunisia	2007	Enfidha and Monastir International Airports	Concession	Operational	Enfidha and Monastir	40	2047	Yes	2	Federal	2007	100%		840		
Cameroon	1993	Aeroports du Cameroon	Concession	Operational	7 airports	15	2008	Yes	7	Federal	1993	71%		30.8		
Côte d'Ivoire	1996	Abidjan International Airport	Concession	Operational	Abidjan	15	2011	No		Federal	1996	100%		28	Number of runways	1
Kenya	1998	Jomo Kenyatta Airport Cargo Terminal	Greenfield project	Operational	Nairobi			No		Federal	1998	100%		21.4		
Madagascar	1991	Aeroports de Madagascar (ADEMA)	Concession	Concluded	12 airports	15	2006	Yes	12	Federal	1991	34%				
Mauritius	1999	Mauritius Airport	Management and lease contract	Concluded	Port Louie	5	2004	No		Federal	1999	100%				
Nigeria	2006	Murtala Muhammed Terminal One	Greenfield project	Construction	Lagos	25	2027	No	1	Federal	2006	100%		200		
South Africa	1998	Airports Company Ltd.	Divestiture	Canceled	Johannesburg, 11 airports		2005	Yes	11	Federal	1998	20%	165.7			
South Africa	2000	Kruger Park Gateway Airport	Divestiture	Operational	Phalaborwa			No		Federal	2000	100%		0.8		
South Africa	2000	Rand Airport	Divestiture	Operational	Gauteng			No		Federal	2000	80%	2.9			
South Africa	2001	Mpumalanga Airport	Greenfield project	Operational	Nelspruit			No		State/Provincial	2001	90%		34	Number of runways	1
Tanzania	1998	Kilimanjaro International Airport	Concession	Operational	Kilimanjaro	25	2023	No		Federal	1998			11.5		

Source: **PPIAF Database, World Bank**

Note: There are more public-private partnerships (PPPs), such as the partial privatization of the airports holding company ADL in Libreville, Gabon, in 1996. But most others are more concentrated on management contracts and specified services, rather than full operations of, and investments in, airports.

Air traffic control surveillance and communications, weather information dissemination

Air traffic control and navigation

Overall there are few air traffic control installations in Africa. The North African countries with heavy traffic—Morocco, Algeria, Tunisia, and Egypt, currently have or have planned radar installations. In Sub-Saharan Africa, the main countries of Kenya and South Africa have the heaviest installations. Also Nigeria, Ghana, Tanzania, Uganda, and Zimbabwe are equipped.[22] The rest of the continent seems without coverage, including Ethiopia, which acts as one of the important hubs. In some countries, such as Malawi, some surveillance coverage existed in the past, but as equipment aged and became too expensive to maintain, it fell into disrepair, and is now no longer salvageable.

Even when the equipment exists, this does not mean that radar separation—where the controller uses radar returns to establish the position of the aircraft, and issues directions and headings based on the image of the radar—are implemented. In Kenya, for example, only Nairobi has full-time radar vectoring, whereas Mombasa only switches to radar procedures if weather conditions so demand. Tanzania, though having a good radar installation in Dar es Salaam, with a secondary radar having an excess of 300 kilometer range, has no radar vectoring due to a lack of radar-certified controllers. Ugandan radar services were provided by the military, only in an advisory manner, using aged technology (a new civilian system has been installed in the last year).

The need for radar coverage in most African countries falls in between vital and not so vital, but "good to have" infrastructure. But, in order to make sense of Africa's needs, some clarifications need to be made.

Radar is only one form of surveillance technology that allows an air traffic control center to locate an aircraft in the center's airspace. Other, newer and more precise techniques include having the aircraft broadcast its position to a ground station, which then relays the information to the air traffic control center. If the position is obtained by the aircraft using modern Global Positioning System (GPS) technology, the inherent errors in radar technology are avoided, and accuracy of the position can be as close as 30 meters. This aids both in separation of aircraft, which is not a constraint in areas that are not very busy, and also in situational awareness for navigation. In some version of this new technology the aircraft does not only broadcast its position to the ground, but also to the aircraft around it, which then, if so equipped, can see the transmitting aircraft on a screen in the cockpit.

The modern trend will away from radar installations to these more advanced satellite-based technologies (one term often used is Automatic Dependent Surveillance-Broadcast, "ADS-B"), at a fraction of the cost of radar, even if aircraft need to be reequipped. Given these developments the term "radar" may well be obsolete when discussing future infrastructure investments. In this sense, the term "surveillance system" would be more appropriate when discussing methods of locating aircraft in the sky,

[22] The radar inventory was compiled using several sources. A prime source was ICAO's Air Navigation Plan for the Africa–Indian Ocean regions of 2003. But, some of the findings were augmented with returns from the questionnaires, and from other sources. The current operation of existing sites has not been verified.

and “ADS-B” would be the terms applied to specifically broadcast-type surveillance, where the aircraft transmits its current position.

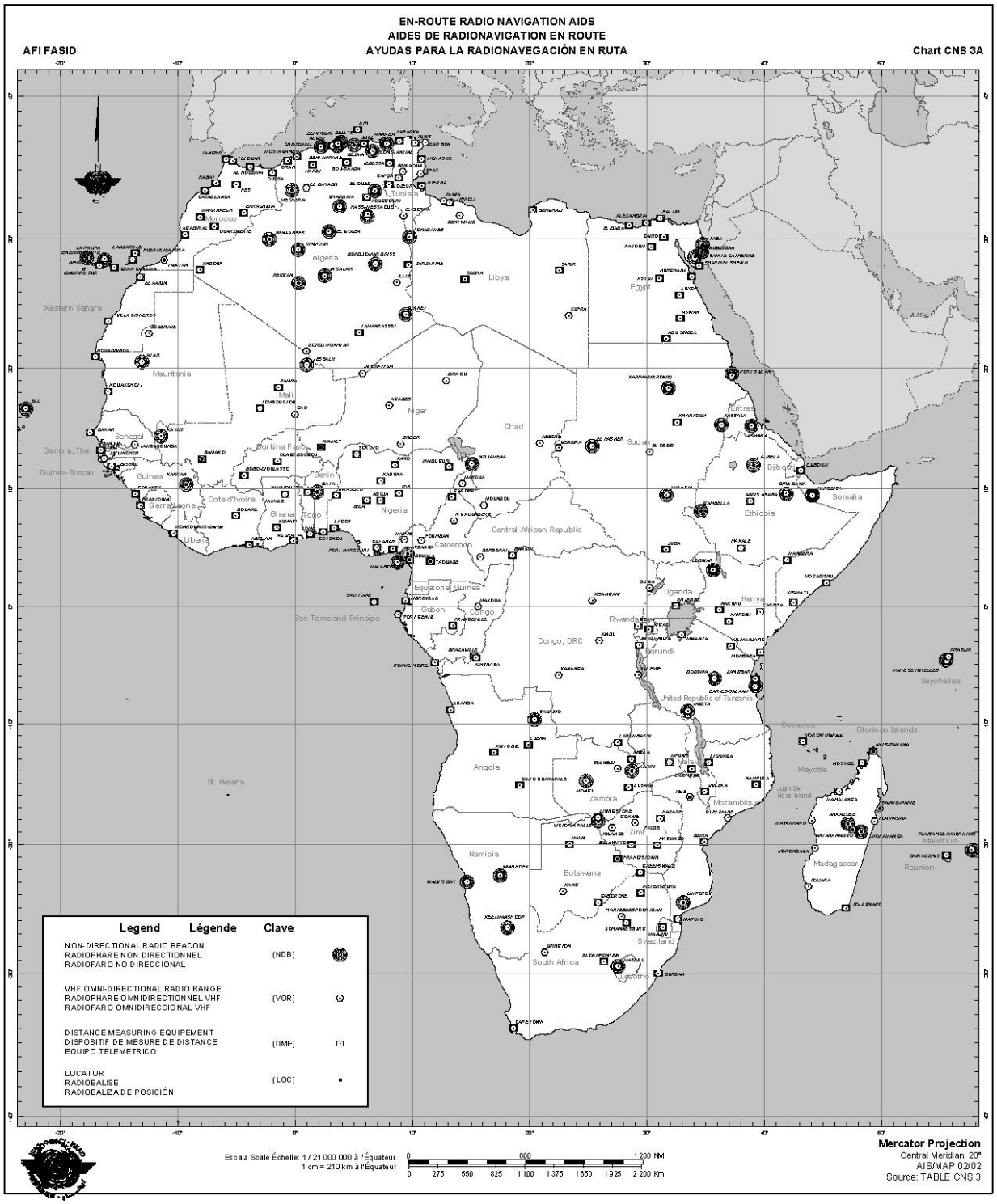
The benefits of a surveillance system, even in less heavily traveled areas, can be listed as follows:

- A surveillance system lets a controller know where an aircraft is at all times, even if that controller is not communicating with the aircraft.
- A precise surveillance system can pinpoint the location of an accident much faster and more accurately than traditional radar.
- A surveillance system allows much tighter separation of traffic (from 80 kilometers to roughly 8 kilometers), giving controllers the freedom to allow aircraft to fly more fuel-efficient paths and approaches.
- A surveillance system becomes a must when flying involves bad weather, such as during the rainy season in many countries.
- In addition, a surveillance system using a specific ADS-B type of technology can let the pilot see other aircraft in the vicinity, as well as information, such as weather updates.

Africa could clearly benefit from additional, low-cost surveillance technology, especially in the areas busy with overflights. Though current traffic in many regions would not justify the expense of purchasing radar systems, which can cost more than four times as much for the same coverage, with very high maintenance costs, the introduction of ADS-B in order to fill surveillance gaps would be a good solution. In fact South Africa is considering incorporating ADS-B in a planned redesign of the airspace over the Southern Africa Development Community (SADC) region.

Navigation installations are also sparse. Figure 2.6 provides a current map of ICAO’s showing existing installations. North Africa is better equipped with radio navigation aids, as is the main corridor along the east stretching from South Africa to Egypt. But, radio navigation aids are also expensive to install and maintain, and do not provide the precision now available with GPS. For navigation in Africa the future lies in GPS, with aircraft carrying their own infrastructure, and airports developing approaches taking advantage of the technology.

Figure 2.6 Installations of ground-based navigational aids in Africa



Source: ICAO.

Note: The more easily visible dots represent nondirection beacons (NDBs), a very old technology. The more faint circles and squares represent more modern installations that are now also becoming less important as the use of satellite-based technology increases.

3. Legal framework and oversight

The air transport regulatory system in most countries of the world consists of the general aviation law establishing and authorizing the regulatory bodies, who then in turn implement the necessary regulations. In many countries, the U.S. Federal Aviation Administration's (FAA) standards are being used. In fact, the FAA offers a set of model laws and regulations available on the Internet designed to be adapted for other countries. The passage of the related civil aviation act and the establishment of the aviation authority (with the usually separate airport authority as a subset of the civil aviation authority, CAA) form the legal framework for the aviation sector.

Box 3.1 The role of the International Civil Aviation Organization (ICAO)

ICAO was established in 1944 as a result of the Chicago Convention, and is located in Montreal, Canada. It is the international UN organization responsible globally for the aviation sector. Currently there are over 180 member states.

The ICAO convention has a set of 18 annexes, most of which are technical in nature, defining some of the generally accepted standards in aviation worldwide. In addition, ICAO issues Standards and Recommended Practices (SARPS), and very detailed Procedures for Air Navigation Services, or PANS. In addition there are Regional Supplementary Procedures (SUPPS) that apply to specific regions and not globally.

ICAO does not function as a regulatory body and has no enforcement role or authority. Instead, the role of ICAO is to set standards and norms, as agreed to by the member states. ICAO does, however, have an important set of audits with relation to safety and security. Safety audits historically have remained confidential; however the recent disparities in the quality of oversight has resulted in the member states bowing to the pressure of publicizing the results of the audits in order to encourage governments to seek stronger compliance. The results of the safety audits, though some not as recent as others, are one of the more important tools in assessing a country's aviation safety.

Generally two organizations are formed—the CAA and some sort of airport operations organization. The CAA typically is responsible for providing, beyond safety oversight, navigation and traffic control services, whereas the airports authority typically handles services that can be, though often are not, provided by the private sector. Documented private sector participation in Africa as shown in the public-private infrastructure (PPI) database has been exclusively in the airport sector, though there are other transactions (and attempted transactions) that have occurred with state carriers. The ownership and managements of airports is discussed in further detail in section II.

In the design of the oversight body two related elements are critical: political autonomy and adequate funding. Much of the poorer safety record in Africa is attributed to a failure in both, and a lack of political will in solidifying oversight.

There are two factors in particular that affect safety. On one hand, there are usually not enough funds to provide competitive salaries for safety inspectors. These inspectors are highly trained professionals who can command a significantly higher premium working for an airline rather than the typical CAA in Africa. There are real-life examples of safety inspectors being trained, funded by donor countries, and then abandoning their oversight career almost immediately for an airline. The other issue is political influence about who is allowed to fly what kind of aircraft. One aspect of safety is only allowing aircraft and operator certificates for airlines and equipment if they meet safety requirements. But, there are very

clear cases of a politically well-connected person deciding to operate an aircraft that would not be allowed to fly in another country, and being given a green light to do so. The autonomy of the authority, and its independence in funding, play as important a role as the capacity of the staff.

CAAs rely on fees to survive. In some cases, where land mass is large and the geographic location is important, significant air navigation charges (exceeding much of the other service charges that CAAs rely on) can be gained from overflights. The reallocation of those charges can become politically contentious. In a truly independent regulatory body, revenues gained from services provided would be reapplied to the sector, that is, rather than going into the state treasury these charges would go into an account held by the authority. In many cases, though, the revenues do end up in the treasury, with the agency having to negotiate for its fair share.

Regional oversight bodies

Regional pooling of resources is now the prescription for addressing some of Africa's shortcomings in oversight. In East Africa a new central East African Civil Aviation Authority has just been formed, with support from the U.S. Department of Transportation's (DOT) Safe Skies for Africa program. Though not yet fully implemented, the organization, now headquartered at the East African Community (EAC) in Arusha, Tanzania, would provide central pooling of expensive resources for all EAC countries. The organization does not replace the existing CAAs in the member countries, but instead augments their resource efforts by sharing capacity with pooled funds. Additionally, two Cooperative Development of Operational Safety and Continuing Airworthiness Projects (COSCAPS) are being planned for the Southern Africa Development Community (SADC) and the Economic and Monetary Community of Central Africa (CEMAC) regions, though the progress on their establishment could not be determined for this report.

An additional regional organization is Agence pour la Sécurité de la Navigation Aérienne en Afrique et à Madagascar (ASECNA), which pools air navigation services and other infrastructure. Founded in 1959, ASECNA has 15 member states.. In addition to navigation infrastructure, the organization also manages eight airports in different countries, though this management is reported to be highly decentralized.

Economic oversight

Two arguments tend to be raised in favor of regulation. The first is that if services become too predatory and competitive after deregulation, poorer, thinner routes that are not really economically supportable will drop out of the system, and parts of a country could become isolated. The other argument is that a country's flag carrier, owned and operated by the government, needs to have the necessary market dominance to be economically feasible. The two arguments are then linked by stating that it is exactly this flag carrier that, by using revenues from more profitable routes, subsidizes and services the poorer routes deemed socially necessary.

The net effect of these regulatory conclusions has been a protected system where each country guards its routes dearly, and only allows airlines from other countries to enter if some similar reciprocity is obtained. Thus CAAs saw as one of their roles the economic analysis of routes.

Much of the world has moved from a regulated air transport industry toward more and more deregulation. In the United States the effects are well known—weaker carriers that have existed for years went away, routes rearranged, and the now very well-known hub and spoke system evolved. In Europe the rise of low-cost carriers has been one of the highly visible effects of deregulation.

The African continent commenced on its own path toward liberalization with the Yamoussoukro decision (YD) of 1988 and following decision of 1999. The main focus of liberalization was free pricing, the lifting of capacity and frequency restraints, and the ability to fly fifth-freedom routes. The implementation process is still ongoing, though the general admission by governments is that they will complete the process, even if their own airline gets harmed. Yet interestingly, this has not translated into tariff reviews. As table 3.1 shows, the oversight of fares is still being carried on alive and well. To what extent this activity has an actual impact on real prices is not known.

In a survey conducted as part of this report questions were asked with respect to the age of the civil aviation laws, the autonomy of the authority, and the funding process. The survey can be found in table 3.1. The general conclusion is that the quality of the regulatory bodies does indeed vary much from country to country.

Table 3.1 Survey responses by civil aviation authorities (CAAs)

Country	Sector reform?	Legislation passed in within the last 10 years?	Independent regulatory body?	Has any entity been corporatized (usually airports or an airline)	Oversight on fares?
Botswana	Yes	Yes	No	Yes	Yes
Burkina Faso	Yes	Yes	No	Yes	No
Burundi	Yes	Yes	No	Yes	Yes
Cameroon	Yes	Yes	Yes	Yes	Yes
Cape Verde	Yes	Yes	Yes	No	No
Comoros	Yes	Yes	No	No	Yes
Ethiopia	Yes	Yes	Yes	No	Yes
Gambia	Yes	Yes	No	Yes	Yes
Kenya	Yes	Yes	Yes	Yes	
Lesotho	No	No	No	Yes	Yes
Madagascar			Yes		
Malawi	No	No	No	No	No
Rwanda	Yes	Yes	No	No	Yes
South Africa	Yes	Yes	Yes	Yes	
Swaziland	No	No	No	Yes	No

Tanzania	Yes	Yes	Yes	Yes	Yes
Uganda	Yes	No	Yes	Yes	Yes
Zambia	Yes		No	Yes	Yes

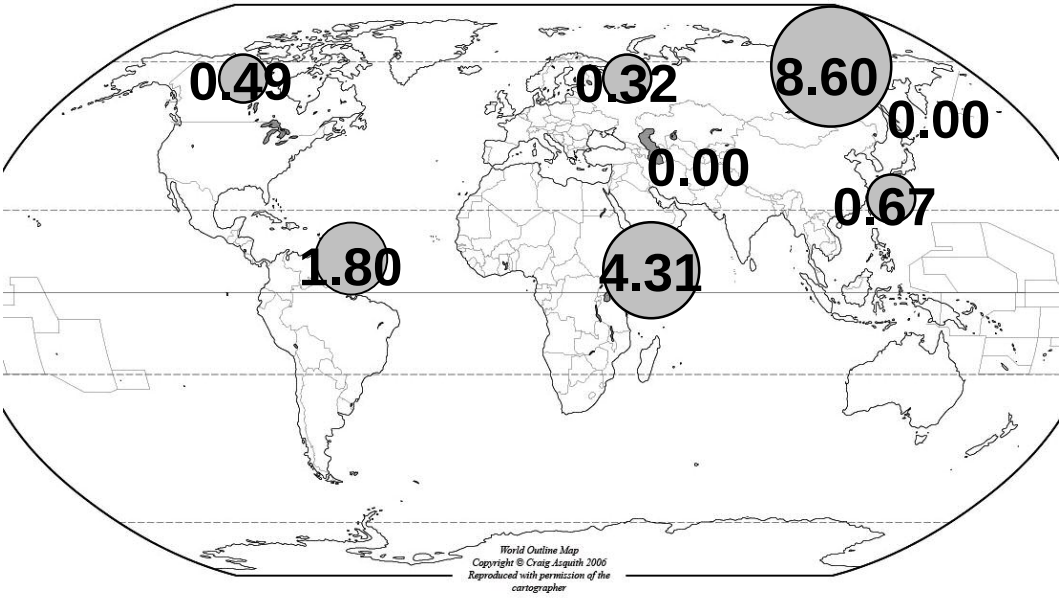
Source: **Analysis of returns from AICD questionnaire**

Note: Though there has been legislative reform of some sort within the last 10 years for most CAAs that responded, the issue of independence, a cornerstone of effective and unbiased oversight, is by the CAA's own response still quite high.

Safety oversight

The final effectiveness of an oversight agency can be measured according to its ability to allow for growth in throughput (that is, passengers) and safety in terms of incidents and accidents. The latter is where Sub-Saharan Africa by many accounts is at the bottom of the scale. The International Air Transport Association (IATA) places Sub-Saharan Africa as the second highest in Western-built jet hull losses, second only to the newly independent states in Central Europe (see figure 3.1 for Africa's ranking amongst the world). This ranking, however, is not necessarily agreed upon by other industry experts, who still see Africa as being in fact the worst.[23]

Figure 3.1 Western-built jet aircraft hull loss rate by operator region in 2006, as analyzed by IATA



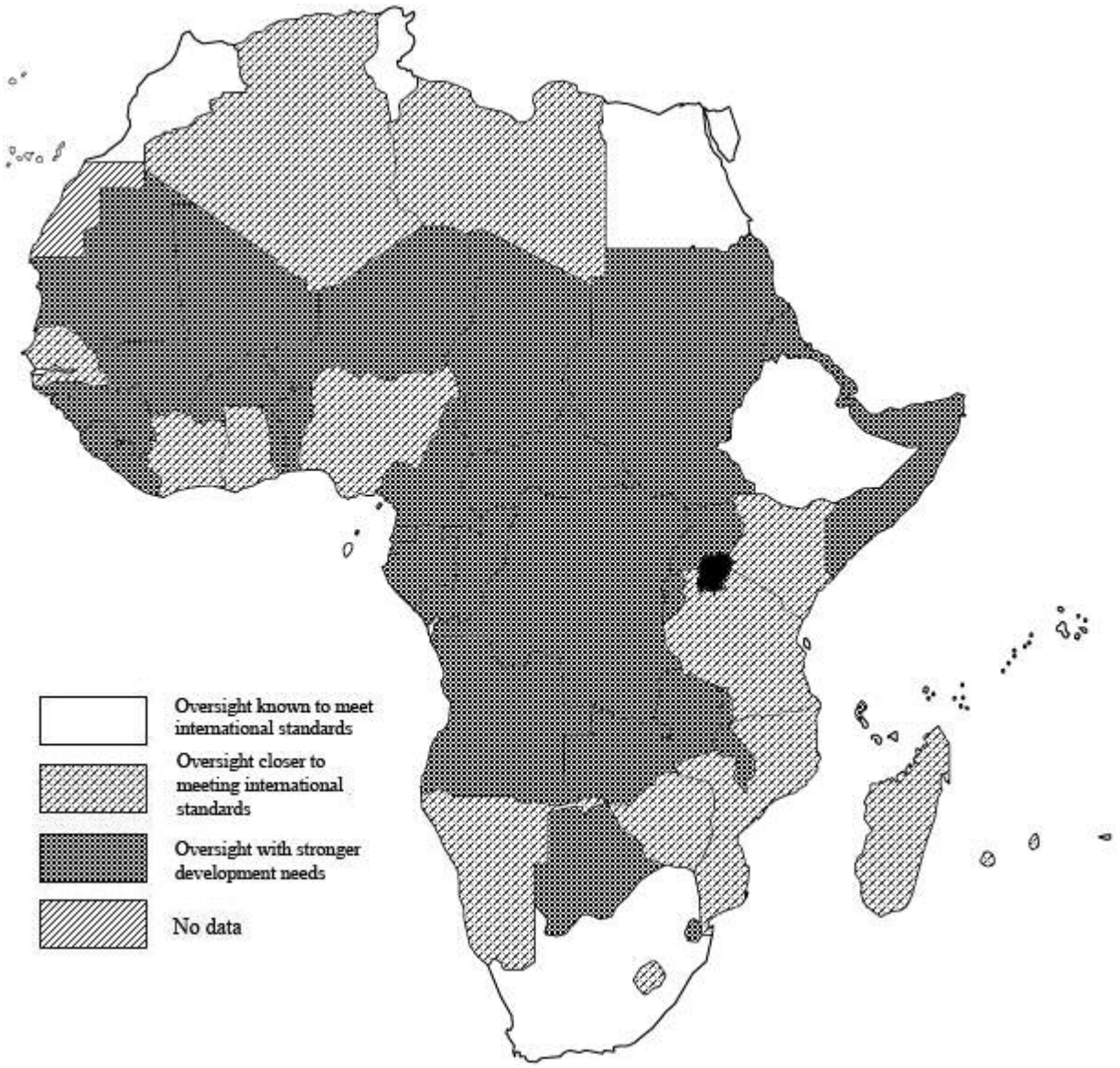
Source: 2006 Safety Report, IATA.

Note: The Commonwealth of Independent States (CIS) has the highest rate according to this map, with Africa being the second highest. But, controversy remains in the industry as to the validity of the calculations regarding the CIS rate, and it is commonly accepted that Africa is still the least-safe continent.

[23] Discussions with one manufacturer of Western jets revealed disagreement with the computation of IATA's 2006 figure, with Africa still being seen as the least safe. Previous reports have consistently ranked the African continent as having the highest hull loss rate. On the other hand, there are also other concerns about using hull loss rates as an indicator of safety, since older aircraft are more likely to be written off as a complete loss, even if relatively lightly damaged, than newer aircraft.

IATA labels the top threat to safety in Africa to be poor regulatory oversight, followed by inadequate safety management systems, and lack of flight crew training and proficiency. The majority of the accidents in 2006 involved Eastern-built turboprop aircraft over 20-years-old. But as figure 3.1, focused on Western-built hulls, shows this is not the only concern.

Figure 3.2 Status of African safety oversight, using several criteria. Cape Verde, which has passed the FAA's IASA audit and is rated category 1 in safety oversight, is not shown on this map.



Source: **Map based on data in [Name of Charles Schlumberger ESW on Yamoussoukro.**

The evidence points toward high levels of institutional weakness. Interestingly in figure 3.2 we note the oversight quality in some countries that act as important links with important airlines, such as Kenya and Senegal, compared with South Africa and Ethiopia. One of the main criteria, though not the only one,

in the figure mentioned above is the overall result of the ICAO audits, which bear a statistically significant correlation to actual accidents.

The general policy conclusion for Sub-Saharan Africa would seem to be that at least as important as hard infrastructure is the creation of an oversight culture that would have the financial ability to share high-skilled inspectors, and have the political autonomy to enforce technical regulations to the point that true operational risks to air safety are mitigated.

Four global safety assessments

Globally, there are four key sources of safety information in use. The most dominant private sector safety rating is provided by IATA, related to individual airlines. IATA provides audits of individual airlines with its IATA International Safety Audit (IOSA) program. Originally designed to eliminate duplicating audits that airlines must complete before joining alliances, this program is now mandatory for all IATA members. But, the audit has grown so much in visibility that even non-IATA members subject themselves to it in order to obtain the credibility of its certification.

Two other audit programs, both targeted toward countries, rather than airlines, are the U.S. FAA's International Aviation Safety Assessment (IASA) audit, and ICAO's Universal Safety Oversight Program (USAOP).

The FAA's IASA program applies to countries with direct flights into the United States. A country with a rating of category I is considered to have a high enough standard in oversight to allow direct flights, while a category II country is not allowed in any way to increase existing capacity (though if flights already exist, they may perhaps continue). 106 countries currently have IASA audits, of which 17 have received the category II rating. Of those 17, six are African countries, of a total of 10 African countries having gone through the audit (table 3.2).

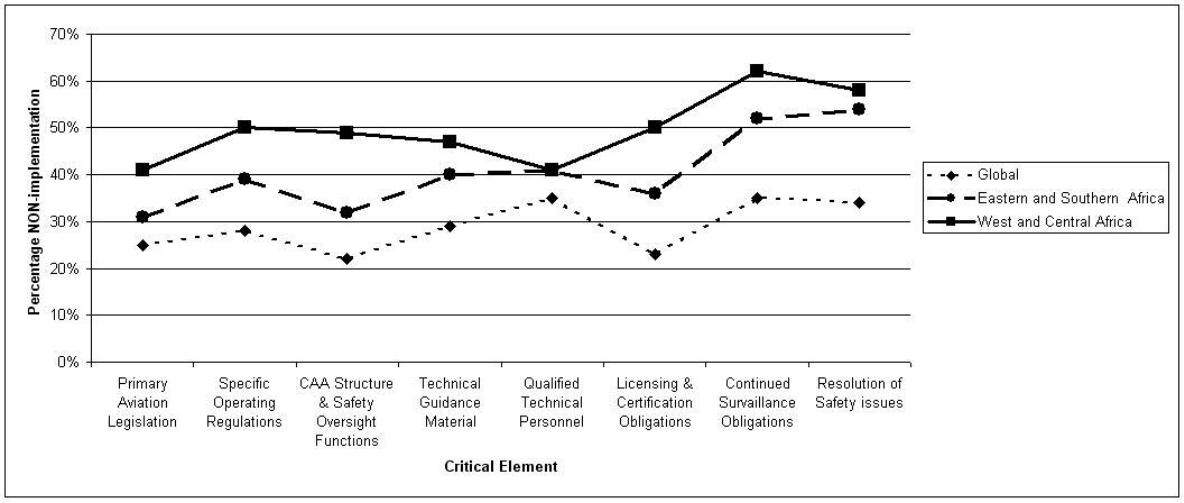
Table 3.2 Current assignment of FAA categories regarding safety for African countries

Country	Category (1 = pass, 2 = fail)
Cape Verde	1
Côte d'Ivoire	2
Congo, Dem. Rep. of	2
Egypt	1
Ethiopia	1
Gambia	2
Ghana	2
South Africa	1
Swaziland	2
Zimbabwe	2

Source: FAA

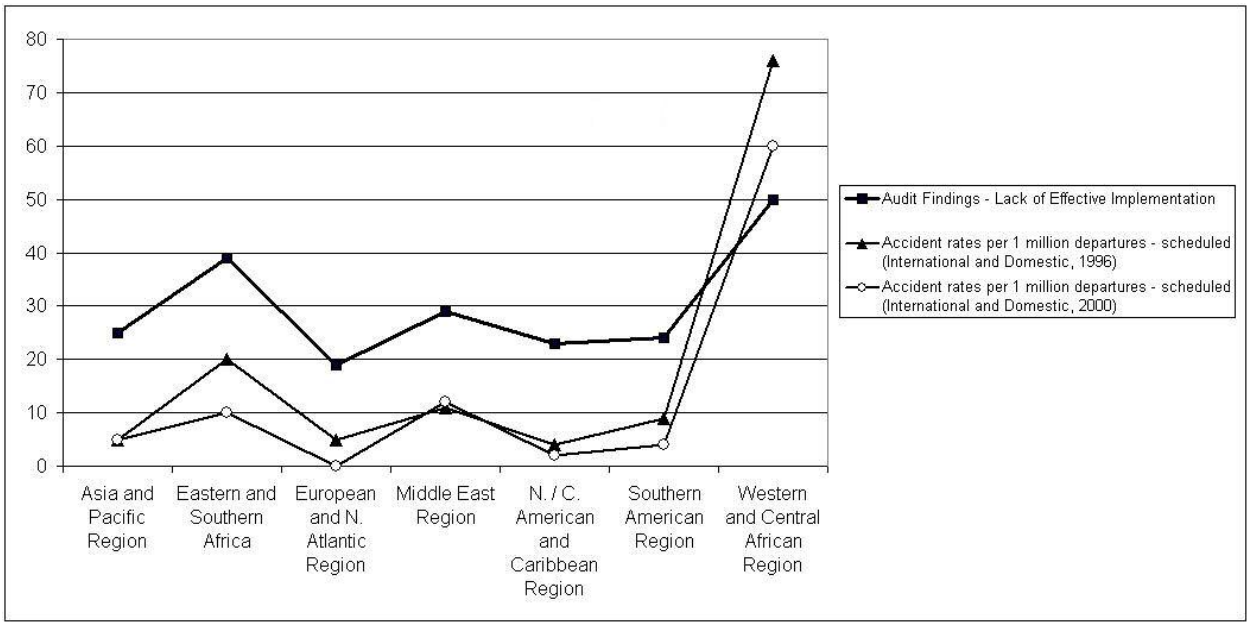
ICAO's USOAP audit theoretically (and by law) runs in three-year cycles, though often there are longer gaps, measuring a country against standards set in the ICAO annexes and SARPS. As figure 3.3 shows, Africa overall lacks a high amount of safety implementation. The chart measures the number of discrepancies from the established norms in safety according to specific technical criteria. If one were to take the inverse of the percentages shown, one would obtain the level of implementation of the safety standards, i.e. a ranking of above 60% in "Continiued Surveillance Obligations" would indicate that the region is less than 40% compliant in implementation of it surveillance. Acceptable limits are at least 75% - 80% in implementation, i.e. Africa's safety oversight overall would not be up to standard until the lack of effective implementation falls in the 20 – 30% band. The audit program's findings as seen in the chart has high reliability in pointing toward weaknesses in safety oversight as measured by accidents - . Figure 3.4 compares audit findings with actual accidents rates, again with west and central Africa, to the right of the chart, having the highest values in audit deficiencies along with the highst actual accident rates.

Figure 3.3 Lack of effective implementation of critical elements in oversight as measured by ICAOS's USOAP audits. This chart is from 2004. The top line applies to West and Central Africa, the second to top line to East and southern Africa. Implementation of oversight standards is lacking significantly on all levels as compared the rest of the world. North Africa is not included in this chart.



Source: ICAO.

Figure 3.4 Accuracy of the audit findings in relationship to actual accident rates, with the related regions. This figure shows a strong relationship between the findings and actual accidents, with Sub-Saharan Africa being the most worrisome globally.



Source: ICAO.

The fourth program relies on measures such as safety ramp checks for aircraft flying into Europe, and is the well-known European Union (EU) Blacklist. The program was chosen as an extreme measure as more and more safety related events and crashes forced the EU to take enforcement into their own hands by simply not letting specific carriers into the Union. The program is somewhat more ambiguous since it targets both airlines and their country of origin, and has created exceptions for certain airplanes in otherwise banned airlines where, for example, maintenance is being performed exclusively in Europe. The list, as of June 18, 2008, is summarized in table 3.3.

Table 3.3 African countries currently on the EU blacklist

Country	Airlines
Sudan	1
Rwanda	1
Angola	1
Congo, Dem. Rep. of	All, with specific mention of 51
Equatorial Guinea	All, with specific mention of 7
Liberia	All
Sierra Leone	All, with specific mention of 8
Swaziland	All, with specific mention of 6

Source: **European Union.**

Note: Other countries found on the blacklist are North Korea, Afghanistan, Iran, Ukraine, Indonesia, and the Kyrgyz Republic.

Box 3.2 Example in West and Central Africa: Nigeria and safety oversight

With more than 5 million passengers yearly, Nigeria aviation market is second only to South Africa in Sub Saharan Africa. Following the demise of Nigeria Airways, the country experienced a significant increase in the number of its registered commercial carriers up to a peak of more than 40 in 2005. Unfortunately, this rapid increase in the number of operators was not followed by a parallel improvement of the Nigerian Civil Aviation Authority's (NCAA) capacity to regulate efficiently their safety and security standards. The consequence of this disconnect became painfully visible following three fatal domestic flight crashes in 2005 and 2006 which cost the lives of more than 300 passengers. In each case, pilot error linked to inadequate NCAA's oversight was partially to blame.

Since then, the Nigerian Government has taken a number of measures to strengthen NCAA's oversight over air transport operators and tighten operators' technical requirements. These are:

- NCAA's overall financial and administrative autonomy has been comforted following an amendment of the Civil Aviation Act in late 2006 which makes the 5 year appointment of NCAA's Director General a parliamentary act;
- Minimum capital required for domestic and international airlines has been increased, respectively, by 25 and 100 times in order to weed out undercapitalized airlines. At the end of 2008, the number of commercial operators had dropped to less than 15 versus more than 40 in 2006; and
- NCAA has started through Government and Donors' funding to implement a massive retraining program for its technical oversight personnel; and
- An institutional and operational review of NCAA's modus operandi has been launched.

In spite of the progresses made, Nigerian aviation sector still faces major challenges, the most important of which are:

- Long term sustainability of NCAA's technical oversight capacity – with more than 90% of its annual revenues absorbs by more than 650 staff, NCAA cannot generate enough revenues from users' fees to finance its long term training and equipment needs. Unless its recurring costs are lowered, its future oversight capacity will continue to rely on erratic Government budgetary support; and
- NCAA is still struggling to enforce quality safety and security standards on Federal agencies operating the airport and airspace systems in Nigeria.

Programs to improve safety in Africa

The growth in air traffic in Africa, and the associated high accident rate, has caught the attention of donor countries, development institutions, and industry-related associations and organizations. There are numerous safety programs, such as the U.S. DOT's Safe Skies for Africa program, the Industry Safety Strategy Group ("ISSG", formed by Boeing, Airbus, and several associations), AviAssist from the Netherlands, the French Civil Aviation Authority, not to mention the World Bank's own recent lending via the Regional air transport safety project for West and Central Africa. Many of these programs have their own specific areas of activities and goals. For example, the Safe Skies for Africa program has been actively helping East Africa create its new regional safety oversight organization. ICAO is helping create three COSCAPs for the West African Economic and Monetary Union (WAEMU), CEMAC, and Banjul Accord Group (BAG) countries, which may eventually lead to additional regional flight safety oversight agencies. Also the African regional communities themselves are attempting to pool resources in their efforts to address safety, with such bodies as the African and Malgache Civil Aviation Authorities (AMCAA), which was set up in 2001.

One of the more serious challenges in these efforts is keeping an overall policy perspective as what is to be accomplished. The ISSG's program includes the coordination of donor and other aid activity via an

overall set of goals and objectives in specific areas found deficient. ICAO, with assistance from the World Bank, is creating a central repository and database for projects related to air transport, which will then again be mapped to other metrics such as the ISSG's program.

Though progress from these combined efforts cannot yet be discerned through accident statistics, certain accomplishments overall can be listed, such as the creation of a more independent CAA in Nigeria. The continued work on improving Sub-Saharan African's aviation safety is crucial for the health of the industry and its effect on the economy, especially as other pressures, such as the current global recession, and the potential of once again rising costs of fuel in a recovery, are poised to limit growth in the sector.

4. Policy Recommendations

A detailed policy analysis is beyond the scope of this report, and, with one of the main messages being that countries and regions do significantly differ throughout the African continent, one must be careful not to reach overarching assumptions.

There are, however, several recommendations that can be made, given the nature of the continent and the overall economic circumstances. Below are very general recommendations, placed in order of importance.

Priority 1: Improve Safety Oversight

Africa suffers the worst overall long-term safety record. There are many causes for this, however the key common component in good air safety is oversight, which in many African nations still requires strong development. In some cases there may be lack of political will. Often, however, budget constraints are mentioned, and there are very real examples of safety oversight inspectors having been trained, only to immediate join an airline at a much higher salary than the civil servant pay grades allow in the country.

Pooled or regional safety oversight organizations, however, would be able to hire a staff of technical personnel at more competitive salary rates, and then share them throughout the region. This would, however, require the budgetary commitment of member governments.

In addition, *the autonomy of the national safety oversight organization is vital*. There are examples of undue influence by Government officials in the affairs of the Civil Aviation Authority. One typical scenario would be a foreign company trying to establish an operator's certificate, only to allow a fleet of aircraft not allowed in many other countries, to operate. Undue political influence by such operators may force the civil aviation authority to turn a blind eye, to the detriment of safety in the entire system, even outside the country in question.

Priority 2: Investment in airports should focus on maintenance of existing facilities rather than new ones.

In general, Africa's current runways are meeting or by far exceeding their current demand, and investment in building new airports replacing current ones, especially in Sub-Saharan Africa, must be discouraged. The argument for building new airports can only be made in conjunction with planning new connectivity, i.e. new facilities should only be considered in regions where demand exists but that not currently being served by an airport. However, investment in existing infrastructure should be taken seriously – the upkeep of runways, expansion of taxiways and aprons where needed, condition of terminals, and, also of importance, the land-side access to airports. Many of the air-side investments will, over time, become "smarter" and less expensive. For example, expensive radar technology, is rapidly becoming outdated with the advances in ADS-B satellite based technologies, which are becoming available at a fraction of the system-wide price of radar. By the same token, much land-side navigational infrastructure is becoming obsolete – again, satellite based technologies are not only considerably less

expensive, but more reliable and accurate. Land-side investments, if possible, should be made in conjunction with private sector participation. In particular, land-side service provision, such as check-in, baggage handling, and even cargo terminal operations, could be effectively outsourced to specialized firms.

Priority 3: Stop spending valuable state funds to develop unprofitable flag Air Carriers

State carriers in general are highly unprofitable operations, with a few outstanding exceptions. Most small, struggling state carriers work with such constraints that without protected routes they would be completely unsustainable, and even with protectionism are fiscal liabilities. In the end this becomes a detriment both in terms of the service provided to the flying public (increased costs, schedule integrity issues, etc), and in terms of safety. In addition, since flag carriers are generally owned by the same governments owning the airport infrastructure, the collection of normally attributable fees, such as landing and parking fees, becomes unreliable. This hurts overall airport and airline economics, as costs are no longer properly allocated.

In many cases, plans are made to the privatization of unsustainable flag carriers. However, nearly always these plans run afoul – usually by the mere fact that these airlines truly are unsustainable. In addition, there may be a form of "governmental entrepreneurship": Someone may believe that if everything where done right, the correct routes were chosen, and the operations were handled in a more efficient way, the airline could in fact make money for the government. The fact, unfortunately, generally bear otherwise.

The best policy, in general, is to *liquidate the losing carrier completely*. Through active liberalization, those routes that are of importance can and will be served operators. *Domestic routes that are non-sustainable could be handed to the private sector with subsidies.*

Priority 4: Air Traffic Control Infrastructure and Airspace Design

Africa has a significant lack of air traffic control infrastructure. The impact of the lack of capacity is not only an issue of safety (many accidents involving smaller aircraft are caused by controlled flight into terrain – accidents that can be minimized with modern technology), but also one of operational efficiency and environmental concern.

The distances involving navigational aids have the effect of creating inefficient point-to-point routes. Since much of Africa has no form of aircraft traffic surveillance, flying point-to-point rather than great circle routes becomes a necessity under procedural (non-radar) control. Newer, less expensive technologies using satellite-based surveillance allow the much more efficient routing of flights across the continent, lowering both fuel consumption and greenhouse gas emission.

Priority 5: Liberalization

Moving forward on the implementation of the Yamoussoukro decision is listed lower as a priority from the rest above only because the implementation already is moving forward, and has helped provide new service to those countries that have lost carriers in the last four years. This can be seen especially in the increased 5th and 6th freedom operations conducted by airlines such as Ethiopian, Kenyan, and South African. Overall, this indicates the provision of more sustainable, better, and even perhaps more cost effective service.

Bucking the trend are countries that, as mentioned in the previous recommendation, seek to protect a weak carrier. In this sense the policy recommendation of no longer developing or supporting weak flag carriers and the recommendation of moving forward with the implementation of the Yamoussoukro decision are intertwined. The overall state of the implementation of the Yamoussoukro decision is discussed in much further detail in other studies[24], even with more specific policy recommendations. But in general it must be pointed out that *progress in the implementation is vital for the health of the industry overall*.

Priority 5: Data Collection

As part of being a charter country with ICAO, one responsibility is the collection and submission of data to ICAO. There are various types of data that fall under this mandate, including such things as airline and airport financials. Many of the more complicated data submission are simply not done by many countries, even in the developed world. However, core passenger data, perhaps even just per airport if not by routes, is generally a necessity to create and informed assessment of the sector. The lack of data submission by African countries is so overwhelming that other sources for estimating passenger travel, such as seats, had to be used for this analysis.

The weakness in overall data submission can easily be explained. In many countries, the budget for personnel, as well as simple computerized equipment, does not exist. Often daily passenger figures are kept in hand-written records, since no other means of recording exists. Yet data collection is essential. No measurement of the health of the overall air transport system can be made for a country, let alone a region, without these submissions.

One policy recommendation would be to *implement systems, be they simply managerial, that on a regular and timely basis report the most vital data to ICAO*.

[24] See The Implementation of the Yamoussoukro Decision, Charles. E. Schlumberger, McGill Institute of Aerospace Law, 2008,

Appendix 1 Additional traffic figures

Table 1. 3 Number of competitors in the top 20 intercontinental routes in Africa

Country 1	Country 2	Estimated seat miles (millions)	Annual growth 2001–7 (%)	No. of airlines
South Africa	United Kingdom	11,693	1.02	5
Germany	South Africa	5,444	9.08	3
France	Morocco	5,378	17.40	8
South Africa	UAE	3,195	28.62	2
South Africa	United States	3,102	-3.34	2
Egypt	Germany	3,099	9.24	8
Hong Kong, PRC	South Africa	3,041	10.85	2
France	South Africa	3,025	9.29	2
Algeria	France	2,954	8.74	3
Kenya	United Kingdom	2,872	8.27	4
France	Mauritius	2,780	-0.12	3
Nigeria	United Kingdom	2,715	9.45	5
Egypt	UAE	2,592	16.94	6
Egypt	Saudi Arabia	2,415	6.04	2
Netherlands	South Africa	2,378	5.84	1
Australia	South Africa	2,139	0.37	2
Kenya	Netherlands	2,077	6.30	3
France	Tunisia	1,982	5.21	5
Mauritius	United Kingdom	1,803	3.85	3

Source: Analysis on data provided by Seabury ADG

Table 1.4 Top 20 airlines with intercontinental travel with Africa

Airline	Seat miles 2001 (millions)	Seat miles 2004 (milllions)	Seat miles 2007 (milllions)	Annual growth 2001–7 (%)	Annual growth 2004–7 (%)	Market share 2007 (%)
South African Airways	14,879	14,088	14,795	-0.09	0.82	9.32
Air France	7,986	11,195	12,654	8.0	2.1	8.0
British Airways P.L.C.	11,387	10,907	10,656	-1.1	-0.4	6.7
EgyptAir	7,800	7,164	10,577	5.2	6.7	6.7
Emirates	1,528	4,398	8,924	34.2	12.5	5.6
KLM Royal Dutch Airlines	4,576	5,854	6,641	6.4	2.1	4.2
Royal Air Maroc	3,872	4,594	6,153	8.0	5.0	3.9
Ethiopian Airlines	1,840	2,398	4,962	18.0	12.9	3.1
Air Mauritius	4,226	4,589	4,838	2.3	0.9	3.1
Deutsche Lufthansa AG	3,228	4,391	4,770	6.7	1.4	3.0
Kenya Airways	1,892	2,686	4,237	14.4	7.9	2.7
Virgin Atlantic Airways	1,889	2,267	3,213	9.3	6.0	2.0
Qatar Airways (W.L.L.)	211	633	2,865	54.5	28.6	1.8
Air Algerie	2,071	2,263	2,636	4.1	2.6	1.7
TunisAir	2,307	2,401	2,569	1.8	1.1	1.6
Saudi Arabian Airlines	1,765	2,047	2,483	5.9	3.3	1.6
Swiss International Airlines.	59	1,919	2,148	82.1	1.9	1.4
Singapore Airlines Limited	1,876	2,121	2,145	2.3	0.2	1.4
Alitalia	1,535	1,674	1,986	4.4	2.9	1.3
TAP	921	1,190	1,948	13.3	8.6	1.2

Source: Analysis on data provided by Seabury ADG

Table 1.5 Overview of the capacities offered for international travel within North Africa

Country 1	Country 2	City pairs 2001	City pairs 2007	Airlines Feb 2001	Airlines Nov 2007	Adj seats 2001 ('000)	Adj seats 2004 ('000)	Adj seats 2007 ('000)	Annual growth 2001–7 (%)	Annual growth 2004 –7 (%)	Herfindahl index Feb 2001	Herfindahl index Nov 2007	Leading airline 2007	Airline market share 2007 (%)	Leading airline 2001	Airline market share 2001 (%)
Egypt	Libya	6	5	2	3	178.3	203.8	527.7	19.8	37.3	6,814	3,965	EgyptAir	45	Jamahirya Libyan Arab Airlines	79
Libya	Tunisia	3	3	3	2	141.2	169.4	298.0	13.3	20.7	4,670	5,037	Jamahirya Libyan Arab Airlines	51	Jamahirya Libyan Arab Airlines	58
Morocco	Tunisia	2	2	4	2	228.4	232.6	270.8	2.9	5.2	3,787	5,006	Royal Air Maroc	52	TunisAir	46
Algeria	Tunisia	1	2	3	2	169.5	184.3	212.0	3.8	4.8	3,576	5,005	TunisAir	54	TunisAir	43
Algeria	Morocco	2	2	5	2	80.9	99.4	165.4	12.7	18.5	2,482	5,017	Royal Air Maroc	58	Air Algerie	32
Egypt	Morocco	1	1	2	2	92.4	66.2	142.0	7.4	29.0	5,005	5,169	Royal Air Maroc	59	Royal Air Maroc	50
Libya	Morocco	1	3	2	4	94.8	109.6	141.9	7.0	9.0	5,214	2,688	Jamahirya Libyan Arab Airlines	37	Jamahirya Libyan Arab Airlines	67
Algeria	Egypt	1	1	2	2	55.2	66.3	99.3	10.3	14.4	5,351	5,152	EgyptAir	58	EgyptAir	65
Egypt	Tunisia	1	1	2	2	69.4	86.7	98.3	6.0	4.3	5,134	5,005	TunisAir	52	TunisAir	59
Algeria	Libya	1	1	2	2	33.9	38.8	35.6	0.8	-2.9	5,001	5,341	Air Algerie	56	Jamahirya Libyan Arab Airlines	52
						1,144.0	**1,257.1**	**1,990.8**	**9.7**	**16.6**						

Source: Analysis on data provided by Seabury ADG

Table 1.8 Airlines operating in monopoly markets in Sub-Saharan international

Leading airline 2007	Seats 2007 ('000)	Seats 2001 ('000)	Percent 2007 (%)	Percent 2001 (%)
Ethiopian Airlines Enterprise	1,173	273	45	43
Kenya Airways	583	35	22	5
Beliview Airlines Ltd.	101	8	4	1
SA Airlink d/b/a South African Airlink	86	45	3	7
Zambian Airways	77	0	3	0
Air Namibia	76	17	3	3
TAAG Angola Airlines	67	12	3	2
Air Seychelles Ltd.	64	0	2	0
Hewa Bora Airways	49	2	2	0
Air Tanzania Co. Ltd.	36	20	1	3
Slok Air International	32	41	1	7
Air Mauritanie	28	11	1	2
Air Mauritius	26	0	1	0
Air Senegal International	25	5	1	1
Rwandair Express	23	8	1	1
Eritrean Airlines	22	0	1	0
South African Airways	18	85	1	13
Air Botswana Corporation	15	0	1	0
Afriqiyah Airways	15	0	1	0
Air Madagascar	14	31	1	5
Air Burkina	14	38	1	6
Sudan Airways Co. Ltd.	13	0	0	0
Inter-Aviation Services (South Africa)	12	0	0	0
Star Equatorial Airlines	12	0	0	0
Nas Air (Eritrea)	10	0	0	0
Steffen Air Charter Services (Swaziland)	9	1	0	0
SN Brussels Airlines	9	0	0	0
Air Zimbabwe (PVT) Ltd.	9	0	0	0
Air Service	9	0	0	0
Transportes Aereos de Cabo Verde (TACV)	2	0	0	0
Benin Golf Air SA	1	2	0	0
Total seats in monopoly markets	2,628	632	100	100

Annual growth rate monopolized routes	27%
Annual growth rate monopolized routes Ethiopian only	28%
Annual growth rate monopolized routes Kenyan only	60%

Source: Analysis on data provided by Seabury ADG.

Table 1.12 Domestic air transport markets in North Africa and their number of airlines in 2007

Country	Estimated seats 2007 (million)	Estimated seat-kilometers 2007 (million)	Annual growth in seat-kilometers 2004–7 (%)	Airlines 2007	City pairs November 2007	Net city pair change 2004–7
Libya	1.23	1,359.67	4.49	4	11	3
Egypt	2.98	1,333.21	12.88	10	18	-2
Algeria	2.17	1,088.71	-2.17	1	44	-5
Morocco	1.74	602.96	5.09	8	18	5
Tunisia	0.33	105.20	-10.62	4	10	2
Totals	8.45	4,489.73		27	101	3

Source: Analysis on data provided by Seabury ADG

Table 1.13 Domestic air transport markets in Sub-Saharan Africa and their number of airlines in 2007

Country	Estimated seats 2007 (million)	Estimated seat kilometers 2007 (million)	Annual growth seat kilometers	Airlines 2007	City pairs November 2007	Net city pair change 2004–7
South Africa	15.9	14,309.96	11.8	12	36	-8
Nigeria	4.7	2,235.54	66.8	7	19	13
Mozambique	0.6	492.62	19.7	3	28	9
Kenya	1	408.13	-3.7	4	15	-3
Tanzania	0.9	386.24	-1.8	5	16	-3
Madagascar	0.6	335.71	3.7	2	24	-61
Angola	0.6	309.64	10	2	21	4
Sudan	0.3	256.69	12.9	3	13	-5
Congo, Dem. Rep. of	0.2	170.91	-5.7	2	9	-7
Mauritius	0.3	150.47	16	2	1	0
Ethiopia	0.4	129.87	-6.5	1	8	-42
Congo	0.2	83.85	-18.1	4	1	-7
Zambia	0.2	65.82	57.7	2	6	0
Botswana	0.1	64.53	6.3	1	3	-3
Cape Verde	0.3	56.01	-7.9	1	10	-1
Zimbabwe	0.1	48.12	-16.4	1	5	3
Gabon	0.2	46.51	-9.4	1	9	-2
Somalia	0.1	45.22	54.5	4	5	2
Namibia	0	22.21	-12.1	1	7	-6
Malawi	0.1	20.28	-1.1	1	3	-3
Ghana	0.1	18.67		1	4	
Senegal	0.1	17.38	4	1	3	0
Cameroon	0.1	16.90	-49	3	3	-7
Seychelles	0.4	15.45	1.5	1	1	0
Uganda	0	12.71	33.6	1	4	3
Comoros	0.1	10.94	11.9	3	7	6
Eritrea	0	9.33		1		
Mauritania	0	3.38	-62	1		
Burkina Faso	0	3.38	-12.9	1	1	0
Equatorial Guinea	0	2.09		1	1	

Source: Analysis on data provided by Seabury ADG

Note: During the year, airlines may have stopped servicing a city pair, that is, though the Republic of Congo may show four airlines for 2007, in November 2007 there were in fact only two. Significant are the very high growth rates in Nigeria, Mozambique, and Zambia. Though Somalia is also growing at a very high rate, the domestic market is roughly only one-tenth of, for example, Kenya's. *Countries with missing growth rates represent new data where previous services in 2001 either did not exist or were not published.*

Table 1.14 Countries with declining international inter-African flights per week affecting their connectivity

Country	Flights per week	Change from 2004	%	Region
Cameroon	66	(18)	-21.4	Central
Central African Republic	1	(6)	-85.7	Central
Chad	8	(6)	-42.9	Central
Congo	41	(22)	-34.9	Central
Gabon	41	(33)	-44.6	Central
Comoros	19	(8)	-29.6	East
Eritrea	9	(3)	-25.0	East
Botswana	75	(22)	-22.7	South
Namibia	98	(3)	-3.0	South
Seychelles	7	(2)	-22.2	South
Benin	47	(7)	-13.0	West
Burkina Faso	37	(3)	-7.5	West
Cape Verde Islands	11	(5)	-31.3	West
Côte d'Ivoire	123	(46)	-27.2	West
Mali	41	(36)	-46.8	West
Mauritania	6	(13)	-68.4	West
Niger	12	(2)	-14.3	West
The Gambia	26	(4)	-13.3	West
Togo	37	(2)	-5.1	West

Source: Analysis on data provided by Seabury ADG

Note: The arrival and departure of an aircraft, or conversely the departure and arrival of an aircraft, in this case constitute one flight, not two, since the arriving or departing passenger is offered only one opportunity, not two.

Table 1.15 Countries with gains in flights

Country	Flights per week	Change from 2004	%	Region
Equatorial Guinea	25	7	38.9	Central
Burundi	42	12	40.0	East
Congo, Dem. Rep. of	57	23	67.7	East
Djibouti	52	24	85.7	East
Ethiopia	177	62	53.9	East
Kenya	359	110	44.2	East
Mozambique	115	33	40.2	East
Rwanda	54	19	54.3	East
Somalia	41	22	115.8	East
Sudan	58	36	163.6	East
Tanzania	205	73	55.3	East
Uganda	110	57	107.6	East
Lesotho	31	9	40.9	South
Madagascar	26	8	44.4	South
Malawi	65	27	71.1	South
Mauritius	33	1	3.1	South
Sao Tome & Principe	5	3	150.0	South
South Africa	681	126	22.7	South
Swaziland	56	16	40.0	South
Zambia	144	47	48.5	South
Zimbabwe	145	49	51.0	South
Angola	31	6	24.0	South/West
Ghana	118	52	78.8	West
Guinea	24	3	14.3	West
Guinea-Bissau	10	4	66.7	West
Liberia	34	17	100.0	West
Nigeria	120	38	46.3	West
Senegal	114	4	3.6	West
Sierra Leone	29	10	52.6	West

Source: Analysis on data provided by Seabury ADG.

Note: Most of the countries with increased connectivity as measured in international inter-African flights are in southern and East Africa. As with the previous table, the arrival and departure of an aircraft, or the departure and arrival of an aircraft, constitute one flight.

Appendix 2 Airport Construction vs Rehabilitation

Estimated basic construction cost of new airport with 3,000 meter runway

Area	Floors	Length	Width	Area	Total	Unit of Measure	Costs	Running Total
Terminal	2	100	100	20,000	20,000	Meters Squared	53,819,552	53,819,552
Dar overall land measurements		2.40	2.10	5.04				
		0.75	1.10	0.83				
		0.77	1.00	0.77	6.63	Km Squared		
Apron (1)		380	140	53,200				
		148	220	32,560	85,760	Meters Squared	18,462,259	72,281,811
Taxiway to Apron (only one for this example)		250	21	5,250	5,250	Meters Squared	1,412,763	73,694,574
Runway		3,000				Meters	17,716,535	91,411,110
Parallel Taxiway		3,000	21	63,000	63,000	Meters Squared	13,562,527	**104,973,637**

Note: Land acquisition costs are not included. Also missing are other significant costs, such as a control tower, ILS (instrument landing system), fuel facilities, vehicles, fire station, parking facilities, land side access, etc

Data source for per unit costs: Florida Department of Transportation, as found at http://www.dot.state.fl.us/planning/policy/costs/Airports.pdf. The per-unit costs have been cross checked with estimates on currently proposed airport projects in Africa.

Estimated costs of rehabilitating airport with 2,000 x 30 meter runway, extending to 3,000 meters, and adding a parallel taxiway

Item	Unit cost per Meter	Cost
Rehab 2000 Meter Asphalt	5,506	11,011,788
Add 1000 Meters Extension	8,000	8,000,000
Add full length taxiway	4,593	13,779,528
Total		**32,791,316**

Appendix 3 Pricing samples

Table 1 Pricing sample for international travel within Africa

FROM		TO		Distance (nautical mile)	Indirect		Duration	Direct	
Country	City	Country	City		Fare $	$ per nautical mile		Fare $	$ per nautical mile
Kenya	Nairobi	Tanzania	Kilimanjaro	126	–	–	0:50	357	2.8320
Kenya	Mombasa	Tanzania	Zanzibar Kisauni	132	–	–	0:50	327	2.4809
Cameroon	Douala	Gabon	Libreville	213	–	–	0:45	369	1.7333
Ghana	Accra	Nigeria	Lagos	216	–	–	1:00	258	1.1943
Côte d'Ivoire	Abidjan	Ghana	Accra	226	–	–	1:00	332	1.4695
Togo	Lome	Côte d'Ivoire	Abidjan	315	–	–	1:00	368	1.1671
Kenya	Nairobi	Tanzania	Dar es Salaam	359	358	$0.9982	1:15	378	1.0542
Cote d'Iviore	Abidjan	Nigeria	Lagos	440	–	–	1:25	453	1.0286
Congo	Pointe Noire	Cameroon	Douala	543	558	1.0270		–	–
Congo	Brazzaville	Cameroon	Douala	595	–	–	3:10	624	1.0488
Namibia	Windhoek	South Africa	Johannesburg	630	–	–	1:45	400	0.6350
Zambia	Lusaka	South Africa	Johannesburg	646	–	–	2:00	360	0.5571
Namibia	Windhoek	South Africa	Cape Town	690	–	–	2:00	403	0.5843
Namibia	Walvis Bay	South Africa	Cape Town	690	–	–	2:00	391	0.5664
Egypt	Cairo	Sudan	Khartoum	871	–	–	2:30	473	0.5427
Sudan	Khartoum	Kenya	Nairobi	1,043	–	–	2:55	497	0.4769
Senegal	Dakar	Ghana	Accra	1,160	–	–	3:10	907	0.7817
Morocco	Casablanca	Senegal	Dakar	1,238	670	0.5415	3:25	732	0.5914
Morocco	Casablanca	Mali	Bamako	1,246	–	–	3:35	956	0.7674
Egypt	Cairo	Kenya	Nairobi	1,905	–	–	4:55	547	0.2870
Kenya	Nairobi	Nigeria	Lagos	2,071	843	0.4072	5:05	862	0.4162
Niger	Niamey	Kenya	Nairobi	2,251	2,088	0.9278		–	–
Senegal	Dakar	SouthAfrica	Johannesburg	3,621	1,429	0.3946	8:35	1,616	0.4462

Table 2 Pricing sample for domestic travel within Africa

Country	FROM	TO	Distance nautical miles	Fare $	Carriers	$ per nautical mile	Duration
	City	City					
South Africa	Johannesburg	Cape Town	790	334	8	0.4229	2:10
South Africa	Hoedspruit	Johannesburg	213	230	1	1.0776	1:10
Nigeria	Lagos	Port Harcourt	264	294	3	1.1121	1:30
Nigeria	Lagos	Abudja	318	311	5	0.9775	1:00
Kenya	Nairobi	Mombasa	263	353	2	1.3413	1:00
Congo, Rep. of	Brazzaville	Pointe Noire	235	199	2	0.8464	0:45
Malawi	Blantyre	Lilongwe	146	193	1	1.3198	0:50
Gabon	Libreville	Oyem	167	351	1	2.1030	0:45
Ethiopia	Bahir Dar	Lalibela	118	125	1	1.0568	0:30
Mauritania	Nouadhiba	Noukchott	209	154	1	0.7361	0:40
Namibia	Ondangwa	Windhoek	334	340	1	1.0189	1:30
Sudan	Juba	Khartoum	745	1,403	1	1.8836	2:00
Tanzania	Dar es Salaam	Mwanza	530	253	2	0.4779	1:30

Table 3 Pricing sample for intercontinental travel within Africa

FROM		TO		Distance nautical miles	Indirect fare $		Nonstop flights		
Country	City	Country	City			$ per nautical mile	Duration	Fare $	$ per nautical mile
Kenya	Nairobi	Tanzania	Kilimanjaro	126	–	–	0:50	357	2.8320
Kenya	Mombasa	Tanzania	Zanzibar	132	–	–	0:50	327	2.4809
Cameroon	Douala	Gabon	Libreville	213	–	–	0:45	369	1.7333
Ghana	Accra	Nigeria	Lagos	216	–	–	1:00	258	1.1943
Côte d'Ivoire	Abidjan	Ghana	Accra	226	–	–	1:00	332	1.4695
Togo	Lome	Côte d'Ivoire	Abidjan	315	–	–	1:00	368	1.1671
Kenya	Nairobi	Tanzania	Dares Salaam	359	358	0.9982	1:15	378	1.0542
Coted 'Iviore	Abidjan	Nigeria	Lagos	440	–	–	1:25	453	1.0286
Congo	Pointe Noire	Cameroon	Douala	543	558	1.0270		–	–
Congo	Brazzaville	Cameroon	Douala	595	–	–	3:10	624	1.0488
Namibia	Windhoek	South Africa	Johannesburg	630	–	–	1:45	400	0.6350
Zambia	Lusaka	South Africa	Johannesburg	646	–	–	2:00	360	0.5571
Namibia	Windhoek	South Africa	Cape Town	690	–	–	2:00	403	0.5843
Namibia	Walvis Bay	South Africa	Cape Town	690	–	–	2:00	391	0.5664
Egypt	Cairo	Sudan	Khartoum	871	–	–	2:30	473	0.5427
Sudan	Khartoum	Kenya	Nairobi	1043	–	–	2:55	497	0.4769
Senegal	Dakar	Ghana	Accra	1160	–	–	3:10	907	0.7817
Morocco	Casablanca	Senegal	Dakar	1238	670	0.5415	3:25	732	0.5914
Morocco	Casablanca	Mali	Bamako	1246	–	–	3:35	956	0.7674
Egypt	Cairo	Kenya	Nairobi	1905	–	–	4:55	547	0.2870
Kenya	Nairobi	Nigeria	Lagos	2071	843	0.4072	5:05	862	0.4162
Niger	Niamey	Kenya	Nairobi	2251	2,088	0.9278		–	–
Senegal	Dakar	South Africa	Johannesburg	3621	1,429	0.3946	8:35	1,616	0.4462

Appendix 4 Connectivity matrices for international travel within Sub-Saharan Africa

Table 4 Number of direct flights per week, November 2007, between different countries in Sub-Saharan Africa. Numbers below 4 have been highlighted, since they suggest that there are weekdays where the two countries cannot access each other directly. Heavily bordered rows and columns represent the three major inter-African hubs (South Africa, Kenya, and Ethiopia), and also Sierra Leone, which acts as a regional hub in West Africa.

Country	Country Code	AO	BF	BI	BJ	BW	CD	CF	CG	CI	CM	CV	DJ	ER	ET	GA	GH	GM	GN	GQ	GW	KE	KM	LR	LS	MG	ML	MR	MU	MW	MZ	NA	NE	NG	RW	SC	SD	SL	SN	SO	ST	SZ	TD	TG	TZ	UG	ZA	ZM	ZW	Grand Total
Angola	AO						**1**		5						4		**1**			4												5								**1**							7	**1**	**2**	31
Burkina Faso	BF				4					10							**3**										9						**1**							6				4						37
Burundi	BI														7							8													20											7				42
Benin	BJ		5						5	10	**2**					**2**	5			**2**		**2**					**1**						**1**	4					**3**					4			**1**			47
Botswana	BW																															**3**															69		**3**	75
Congo DRC	CD								5		**1**				7					**3**		12												**2**												14	7	6	57
Central African Rep.	CF										**1**																																						1
Congo	CG	5			5		11				7				6	**3**											**1**						**1**													**2**			41
Cote D'Ivoire	CI		11		10						7					4	22		9			6		**3**			8					4	8				**1**	14					14			**2**			123
Cameroon	CM						**1**	**1**	6	7					**2**	19				**3**		10												15														**2**			66
Cape Verde Islands	CV																**1**				**1**																	8			**1**								11
Djibouti	DJ													**2**	13							5																		32									52
Eritrea	ER												**2**									**2**																					**1**						9
Ethiopia	ET	4		7			7		6		4		13			4	8					11					**3**			4				10	7		15		**3**	9			5	4	21	14	7	8	**3**	177
Gabon	GA				**2**				**3**	4	18				**2**					4														**3**							**2**						**3**			41
Ghana	GH	**1**	**3**		**1**					23		**1**			7							6		13										41				9			**1**			8			**4**			118
The Gambia	GM																		4					4										**2**				4	12									26
Guinea	GN									8								4						**2**			**1**						**2**					7									24
Equatorial Guinea	GQ	4			**2**		**3**				**3**					4																		6									**2**				**1**	25
Guinea-Bissau	GW											**1**																											9										10
Kenya	KE			7	**2**		12			6	10		5	**2**	11		6						**3**	**3**		**1**	4		**2**	11	7			6	15	**2**	34	**3**	4	4				121	39	26	7	6	359
Comoros	KM																					**3**				10																			6					19
Liberia	LR									**3**							14	5	**2**			**3**												**3**				4										34
Lesotho	LS																																														31			31
Madagascar	MG																					**1**	8						8																	9			26
Mali	ML		7		**1**				**1**	4					**3**							4											**3**					18										41
Mauritania	MR																																					6										6
Mauritius	MU																					**2**				8										**3**									20			33
Malawi	MW														4							9																							5		16	22	9	65
Mozambique	MZ																					7																						5		6		95		**2**	115
Namibia	NA	5				**3**																																								87		**3**	98
Niger	NE		**1**		**1**					4																	4						**3**					**2**										12
Nigeria	NG				**3**		**2**		**2**	8	11				10	**3**	46	**2**	**2**	6		6		**2**																**1**	4	5					7			120
Rwanda	RW			20											7							14																							**1**	11	**1**		54
Seychelles	SC																					**2**							**3**																	**2**		7
Sudan	SD													4	15							28												**1**											8			58
Sierra Leone	SL									**1**							7	5				**3**		6										**3**				4										29
Senegal	SN		6		**3**					14		7			**3**			11	7		9	4		**1**			16	6					**2**	5				4						**2**			14			114
Somalia	SO												28		9							4																											41
Sao Tome and Principe	ST	**1**										**1**				**2**	**1**																																5
Swaziland	SZ																																				5											51			56
Chad	TD													**1**	5																							**2**											8
Togo	TG		4		5					15					4		4			**2**														**1**					**2**										37
Tanzania	TZ														21							127	**3**							5	6				**1**										16	21	**3**	**2**	205
Uganda	UG			7											14							39													11		12									16	11			110
South Africa	ZA	7			**1**	71	14		**2**	**2**	**2**				7	**3**	4					26			31	9			20	13	99	87		7	**1**	**2**			21			51			21	12		89	79	681
Zambia	ZM						**3**								7							7								10																**3**		89		25	144
Zimbabwe	ZW	**2**				**3**	8								**3**					**1**		8								7	**2**	**3**															79	29		145

Table 5 Average speed, in terms of miles per hour, for indirect flights between country pairs. The time for the speed calculation includes layover time, indicating that connections with a particular low speed rating have in fact extensive and long layovers. But in many cases there are direct flights from one of the hubs, as shown in the previous table.

Country	Country Code	Angola	Burkina Faso	Burundi	Benin	Congo DRC	Central African Rep.	Congo	**Cote D'Ivoire**	Cameroon	Cape Verde	Djibouti	Eritrea	**Ethiopia**	Gabon	Ghana	The Gambia	Guinea	Equatorial Guinea	**Kenya**	Comoros	Liberia	Mali	Mauritania	Mauritius	Malawi	Mozambique	Namibia	Niger	Nigeria	Rwanda	Sudan	Sierra Leone	Senegal	Somalia	Chad	Togo	Tanzania	Uganda	**South Africa**	Zambia	Zimbabwe	Avg.
		AO	BF	BI	BJ	CD	CF	CG	CI	CM	CV	DJ	ER	ET	GA	GH	GM	GN	GQ	KE	KM	LR	ML	MR	MU	MW	MZ	NA	NE	NG	RW	SD	SL	SN	SO	TD	TG	TZ	UG	ZA	ZM	ZW	
Angola	AO							139						319	209																												222
Burkina Faso	BF				179				164																				**58**					286			165						170
Burundi	BI													260						61																							161
Benin	BJ		185					273	182						173								232											305						348			243
Congo DRC	CD									216				365																									314	160		264
Central African Rep.	CF									221																						273											247
Congo	CG	144			253					**96**					170																						285						189
Cote D'Ivoire	CI		174					288		246				368	257		326	199		327				286					229	190			250	283			**43**			364			255
Cameroon	CM					**89**		223	246						129					312			312							211						223						218
Cape Verde	CV																																						380			380
Djibouti	DJ																			242															166						204
Eritrea	ER																			248																					248
Ethiopia	ET	327		272		343			384							366							386			348					263				174		344	272	199	375	337		314
Gabon	GA				190	221		177	258	127									108				308							188							194			366			214
Ghana	GH								**30**					352				293				217	256										282	334						252			
The Gambia	GM								295															153						292											247			
Guinea	GN								199							289														283				231						250			
Equatorial Guinea	GQ									**33**					113																											**73**	
Kenya	KE								394	354		242	250			333					280				335	189				60							184		306	248	304	268
Comoros	KM																			245					244		263										213					241
Liberia	LR															250														242												246
Mali	ML				230				**87**	280				399	308	263								195						220							227						245
Mauritania	MR								286								153						195																			211
Mauritius	MU																			326	248																					287
Malawi	MW													291						190																				247	**66**		199
Mozambique	MZ																																					270		209		160	213
Namibia	NA																																							171		207	189
Niger	NE		110						229																									330									223
Nigeria	NG								190	211					188		292	283				264	220										318	310								253
Rwanda	RW			**7**										257																										280			181
Sudan	SD						273																							338												305
Sierra Leone	SL																													311												311
Senegal	SN		286		303				285									231											330	312							331					297
Somalia	SO											280		174																												227
Chad	TD									225																																225
Togo	TG		165					288		225				340	201								227											331			165					254
Tanzania	TZ													266						195	213					161	270										165					221
Uganda	UG													198																												198
South Africa	ZA				348	314			375		366			357	366					302							201	171											314		217		303
Zambia	ZM					165														255						168																221
Zimbabwe	ZW																			295							160	207													231			223

Appendix 5 List of all known carriers with scheduled traffic between 2001 and 2004

The following two tables list all carriers found in the Seabury ADG dataset with known scheduled traffic in Africa. The list is split between African and non-African carriers, ranked by estimated seat miles flown in 2007. By the nature of the sorting failed carriers appear in the bottom of each list, in descending order according to the last known seat mile figures.

Table 6 List of carriers with traffic in Africa, based in Africa. The total count for 2007 is 79 carriers.

Airline	IATA code	ICAO code	Country	Region	Seat miles 2001 (mil.)	Seat miles 2004 (mil.)	Seat miles 2007 (mil.)
South African Airways	SA	SAA	South Africa	SSA	21,517	20,961	21,196
EgyptAir	MS	MSR	Egypt	NA	9,560	8,823	13,444
Ethiopian Airlines Enterprise	ET	ETH	Ethiopia	SSA	4,711	5,633	8,558
Royal Air Maroc	AT	RAM	Morocco	NA	2,815	3,860	7,763
Kenya Airways	KQ	KQA	Kenya	SSA	3,245	4,402	7,209
Air Mauritius	MK	MAU	Mauritius	SSA	4,581	4,987	5,343
Comair Ltd.	MN	CAW	South Africa	SSA	2,942	3,256	3,636
Air Algerie	AH	DAH	Algeria	NA	2,626	2,833	3,129
TunisAir	TU	TAR	Tunisia	NA	–	1,475	2,465
Air Namibia	SW	NMB	Namibia	SSA	830	1,020	1,507
Virgin Nigeria	VK	VGN	Nigeria	SSA	868	1,248	1,490
Nationwide Airlines (Pty) Ltd.	CE	NTW	South Africa	SSA	429	1,006	1,462
Atlas Blue	8A	BMM	Morocco	NA	–	5	1,415
African Star Airways (Pty) Ltd.	4M	ASG	South Africa	SSA	–	–	1,290
Air Seychelles Ltd.	HM	SEY	Seychelles	SSA	1,070	1,043	1,242
1Time Airline	1T	RNX	South Africa	SSA	1,026	1,598	1,203
TAAG Angola Airlines	DT	DTA	Angola	SSA	1,714	844	1,176
Afriqiyah Airways	8U	AAW	Libyan Arab Jamahiriya	NA	42	515	1,128
South African Express Airways	YB	EXY	South Africa	SSA	875	582	1,086
Air Madagascar	MD	MDG	Madagascar	SSA	–	–	979
SA Airlink d/b/a South African Airlink	4Z	LNK	South Africa	SSA	529	–	949
Air Senegal International	V7	SNG	Senegal	SSA	1,106	983	885
Air Zimbabwe (Pvt) Ltd.	UM	AZW	Zimbabwe	SSA	116	855	782
Jamahirya Libyan Arab Airlines	LN	LAA	Libyan Arab Jamahiriya	NA	365	547	757
Zambian Airways	Q3	MBN	Zambia	SSA	–	552	656
Transportes Aereos de Cabo Verde	VR	TCV	Cape Verde Islands	SSA	–	514	575
Ghana International Airlines	G0	GHB	Ghana	SSA	243	356	534
Guinee Airlines, S.A.	J9	GIF	Guinea	SSA	125	352	400
Bellview Airlines Ltd.	B3	BLV	Nigeria	SSA	–	–	384
Mango	JE	MNO	South Africa	SSA	50	19	382
Air Tanzania Company Ltd.	TC	ATC	Tanzania	SSA	–	–	342

Airline	IATA code	ICAO code	Country	Region	Seat miles 2001 (mil.)	Seat miles 2004 (mil.)	Seat miles 2007 (mil.)
Sudan Airways Co. Ltd.	SD	SUD	Sudan	SSA	84	–	312
Aero Contractors Company of Nigeria	AJ	NIG	Nigeria	SSA	1,112	1,010	302
Precision Air Services Ltd.	PW	PRF	Tanzania	SSA	–	250	302
Air Botswana Corporation	BP	BOT	Botswana	SSA	105	180	282
LAM	TM	LAM	Mozambique	SSA	395	389	276
Daallo Airlines	D3	DAO	Djibouti	SSA	–	133	245
Cameroon Airlines	UY	UYC	Cameroon	SSA	290	477	244
Hewa Bora Airways	EO	ALX	Congo, Dem. Rep. of	SSA	82	319	182
Regional Air Lines	FN	RGL	Morocco	NA	–	79	164
Société Nouvelle Air Ivoire	VU	VUN	Côte d'Ivoire	SSA	27	81	163
Tuninter, S.A.	UG	TUI	Tunisia	NA	101	108	127
Air Mali International	XG	KLB	Mali	SSA	136	147	123
Pelican Air Services CC (Pelican Air)	7V	PDF	South Africa	SSA	38	189	121
Eritrean Airlines	B8	ERT	Eritrea	SSA	72	48	120
Trans Air Congo (TAC)	Q8	TSG	Congo	SSA	107	137	101
Rwandair Express	WB	RWD	Rwanda	SSA	–	65	101
Air Burkina	2J	VBW	Burkina Faso	SSA	–	–	101
Catovair	0C	IBL	Mauritius	SSA	–	–	94
Air Malawi Ltd.	QM	AML	Malawi	SSA	–	76	93
Alajnihah For Air Transport	2T		Libyan Arab Jamahiriya	NA	–	–	78
Air Mauritanie	MR	MRT	Mauritania	SSA	119	274	77
Marsland Aviation	M7	MSL	Sudan	SSA	–	–	75
JetLink Express	J0	JLX	Kenya	SSA	24	105	66
Air Service	X7		Gabon	SSA	31	38	62
Slok Air International	S0	OKS	The Gambia	SSA	–	–	60
Djibouti Airlines	D8	DJB	Djibouti	SSA	56	–	58
Inter-Aviation Services	D6	ILN	South Africa	SSA	107	–	54
Air Corridor	QC	CRD	Mozambique	SSA	–	–	50
Interlink Airlines (Pty) Ltd.	ID	ITK	South Africa	SSA	–	13	48
Nas Air (Eritrea)	UE		Eritrea	SSA	–	–	42
Airkenya Aviation Ltd. d/b/a Regional Air	QP		Kenya	SSA	–	42	39
ZanAir Ltd.	B4		Tanzania	SSA	–	–	35
African Express Airways (K) Ltd.	XU	AXK	Kenya	SSA	4	–	32
Air Senegal	DS		Senegal	SSA	–	–	30
Steffen Air Charter Services	Q4	SWX	Swaziland	SSA	–	–	27
Nouvelair Tunisia	BJ	LBT	Tunisia	NA	–	–	25
Eagle Air Ltd.	H7	EGU	Uganda	SSA	–	–	25
Wimbi Dira Airways	9C	WDA	Congo, Dem. Rep. of	SSA	–	–	23
Antrak	O4		Ghana	SSA	–	–	13
Star Equatorial Airlines	2S		Equatorial Guinea	SSA	0	7	13

Airline	IATA code	ICAO code	Country	Region	Seat miles 2001 (mil.)	Seat miles 2004 (mil.)	Seat miles 2007 (mil.)
Benin Golf Air SA	A8	BGL	Benin	SSA	–	–	12
Proflight Commuter Services	P0	PFZ	Zambia	SSA	24	10	11
Overland Airways Ltd.	OJ	OLA	Nigeria	SSA	7	3	8
Karthago Airlines	5R	KAJ	Tunisia	NA	–	–	7
Air Sinai	4D	ASD	Egypt	NA	–	–	5
Gambia International Airlines Ltd.	GC	GNR	The Gambia	SSA	–	–	3
Comores Aviation	KR	KMZ	Comoros	SSA	22	11	3
Air Burundi	8Y	PBU	Burundi	SSA	4	2	2
Ghana Airways Corp.	GH	GHA	Ghana	SSA	1,542	1,374	–
East African Safari Air	S9	HSA	Kenya	SSA	757	710	–
Air Gabon	GN	AGN	Gabon	SSA	–	599	–
Air Luxor STP	C2	ALU	Sao Tome and Principe	SSA	–	183	–
STA	T8		Mali	SSA	–	100	–
Flamingo	F7		Kenya	SSA	–	99	–
Panafrican Airways	PQ	PNF	Côte d'Ivoire	SSA	–	89	–
Air Togo S.A.	YT	TGA	Togo	SSA	79	41	–
Air Luxor GB, Lda	L8	LXG	Guinea-Bissau	SSA	–	37	–
Nationwide Airlines (Zambia) Ltd.	4J	NWZ	Zambia	SSA	2	22	–
East Afrian Airlines Ltd.	QU	UGX	Uganda	SSA	–	21	–
Chari Aviation Services	S8	CAH	South Africa	SSA	113	17	–
Avirex	G2	VXG	Gabon	SSA	–	16	–
Sierra National Airlines	LJ	SLA	Sierra Leone	SSA	–	8	–
Ocean Airlines	4O	KMO	Comoros	SSA	–	7	–
Satgur Air Transport	2S		Liberia	SSA	–	2	–
National Airways	YJ	NTN	South Africa	SSA	5	1	–
Business Aviation	4P		Congo DRC	SSA	2	0	–
Air Afrique	RK	RKA	Côte d'Ivoire	SSA	3,225	–	–
Bravo Air Congo	K6	BRC	Congo DRC	SSA	984	–	–
Majestic Air P/L	6M	MJC	Zimbabwe	SSA	371	–	–
Nigeria Airways Ltd.	WT	NGA	Nigeria	SSA	309	–	–
Ecoair International	9H	DEI	Algeria	NA	138	–	–
Chanchangi Airlines Nigeria Ltd.	3U	NCH	Nigeria	SSA	67	–	–
Salaam Express Air Services	N8	SEK	Kenya	SSA	62	–	–
Scorpio Aviation	8S	SCP	Egypt	NA	45	–	–
Eagle Aviation Ltd.	Y4	EQA	Kenya	SSA	39	–	–
Antinea Airlines	HO	DJA	Algeria	NA	21	–	–
Zircon Airways Benin, S.A.	Z4	BZW	Benin	SSA	19	–	–
Air Zambezi	ZT	TZT	Zimbabwe	SSA	18	–	–
Unknown (probably an Eritrean carrier)	7R		Eritrea	SSA	16	–	–
Eagle Air Ltd.	EY	EFL	Tanzania	SSA	15	–	–

Airline	IATA code	ICAO code	Country	Region	Seat miles 2001 (mil.)	Seat miles 2004 (mil.)	Seat miles 2007 (mil.)
Guine Bissau Airlines	G6	BSR	Guinea-Bissau	SSA	8	–	–
Inter Islands Airlines	H4	IIN	Cape Verde Islands	SSA	7	–	–
Linhas Aereas de Air Sao Tome And Principe	KY	EQL	Sao Tome and Principe	SSA	1	–	–
					72,176	75,787	97,796

Table 7 List of carriers with traffic in Africa not based in Africa. The total count for 2007 is 117 carriers.

Airline	IATA code	ICAO code	Country	Seat miles 2001 (mil.)	Seat miles 2004 (mil.)	Seat miles 2007 (mil.)
Air France	AF	AFR	France	10,564	13,580	14,109
British Airways P.L.C.	BA	BAW	United Kingdom	13,305	10,925	10,656
Emirates	EK	UAE	United Arab Emirates	1,562	4,422	9,012
KLM Royal Dutch Airlines	KL	KLM	Netherlands	4,717	5,854	6,641
Deutsche Lufthansa AG	LH	DLH	Germany	3,488	4,405	4,770
Virgin Atlantic Airways Ltd.	VS	VIR	United Kingdom	1,889	2,267	3,213
Alitalia	AZ	AZA	Italy	211	683	2,873
Air Austral	UU	REU	Reunion Island	274	2,389	2,635
Delta Air Lines, Inc.	DL	DAL	United States of America	1,825	2,069	2,483
Swiss International Airlines	LX	SWR	Switzerland	112	–	2,176
Singapore Airlines Ltd.	SQ	SIA	Singapore	59	1,919	2,148
Cathay Pacific Airways Ltd.	CX	CPA	Hong Kong, PRC	1,946	2,121	2,145
Qatar Airways (W.L.L.)	QR	QTR	Qatar	1,540	1,677	1,994
TAP	TP	TAP	Portugal	956	1,207	1,968
Saudi Arabian Airlines	SV	SVA	Saudi Arabia	1,192	1,719	1,965
Qantas Airways Ltd.	QF	QFA	Australia	902	1,439	1,794
Iberia	IB	IBE	Spain	2,571	472	1,630
Aigle Azur	ZI	AAF	France	1,088	1,216	1,541
Etihad Airways	EY	ETD	United Arab Emirates	883	1,317	1,517
SN Brussels Airlines	SN	SAB	Belgium	1,093	1,153	1,454
Aviation Enterprise TESIS Ltd.	UZ	TIS	Russian Federation	–	577	1,439
Turkish Airlines, Inc.	TK	THY	Turkey	1,273	1,124	1,405
China Southern Airlines	CZ	CSN	China	–	–	1,281
Corse Air International	SS	CRL	France	606	332	891
Air Arabia	G9	ABY	United Arab Emirates	1,140	1,223	825
Gulf Air Company G.S.C.	GF	GFA	Bahrain	–	–	740
GB Airways Ltd.	GT	GBL	United Kingdom	–	–	721
LTU International Airways	LT	LTU	Germany	–	591	693
Flyhy Cargo Airlines Ltd	W3		Thailand	141	415	679
Olympic Airlines	OA	OAL	Greece	–	266	603
Euro-Asia International, JSC	5B	EAK	Kazakhstan	–	–	565
Transaero Airlines	UN	TSO	Russian Federation	407	500	512
Malaysia Airline System Berhad	MH	MAS	Malaysia	–	–	501
Condor Flugdienst GmbH	DE	CFG	Germany	422	409	490
Korean Air Lines Co. Ltd.	KE	KAL	Korea, Republic of	237	329	470
North American Airlines, Inc.	NA	NAO	United States of America	55	196	470
Komiinteravia Joint-Stock Company	8J	KMV	Russian Federation	–	–	466
Ryanair Ltd.	FR	RYR	Ireland	1,225	1,278	464

Airline	IATA code	ICAO code	Country	Seat miles 2001 (mil.)	Seat miles 2004 (mil.)	Seat miles 2007 (mil.)
Thai Airways	TG	THA	Thailand	350	398	461
Easyjet Airline Company Ltd.	U2	EZY	United Kingdom	–	296	443
Eastair	XZ		Sweden	–	–	436
Rossiya-Russian Airlines	FV	PLK	Russian Federation	–	–	416
Kuwait Airways	KU	KAC	Kuwait	–	–	383
Air Berlin GmbH & Co. Luftverkehrs KG	AB	BER	Germany	–	–	376
China Eastern Airlines	MU	CES	China	–	–	370
Oman Aviation Services Co. (SAOG)	WY	OAS	Oman	–	–	323
British Mediterranean Airways Ltd.	KJ	LAJ	United Kingdom	268	266	299
Austrian Airlines	OS	AUA	Austria	–	–	296
British Midland Airways Ltd. d/b/a bmi	BD	BMA	United Kingdom	–	–	285
Superior Aviation, Inc.	SO	HKA	United States of America	261	244	279
Air India Ltd.	AI	AIC	India	227	181	275
Middle East Airlines	ME	MEA	Lebanon		64	274
Yemenia	IY	IYE	Yemen	182	220	261
VIM Airlines	NN	MOV	Russian Federation	–	–	251
Royal Jordanian (Alia	RJ	RJA	Jordan	–	–	248
Aerotrans Airlines Ltd.	6F	PFO	Cyprus	–	124	246
President Airlines	TO	PSD	Cambodia	510	217	238
Eurofly S.P.A.	GJ	EEZ	Italy	–	–	234
Hapag-Lloyd Express GmbH	X3	HLX	Germany	–	–	226
Thomsonfly	BY	TOM	United Kingdom	–	–	223
Siberia Airlines	S7	SBI	Russian Federation	146	149	216
El Al Israel Airlines Ltd.	LY	ELY	Israel	–	–	212
MyAir	8I	MYW	Italy	–	–	192
Air Europa Lineas Aereas, S.A.	UX	AEA	Spain	279	340	191
Dutch Caribbean Airline N.V.	K8	DCE	Netherlands Antilles	–	–	185
Hahn Air Line	HR	HHN	Germany	–	–	183
Hapag Lloyd Fluggessellschaft mbH	HF	HLF	Germany	–	13	167
Aeroflot Russian Airlines	SU	AFL	Russian Federation	264	288	166
Transavia	HV	TRA	Netherlands	–	–	151
Aerosvit Airlines	VV	AEW	Ukraine	48	–	146
First Choice Airways Ltd..	DP	FCA	United Kingdom	–	–	145
Syrian Arab Airlines	RB	SYR	Syrian Arab Republic	97	83	139
Czech Airlines A.S. , CSA	OK	CSA	Czech Republic	–	–	129
Volare	VE		Italy	–	233	127
Tyrolean Airways Tiroler Luftfahrt GmbH	VO	TYR	Austria	–	–	126
Spanair, S.A.	JK	JKK	Spain	–	–	123
TUI Airlines Belgium	TB	TUB	Belgium	–	–	119
FlyGlobeSpan	Y2	GSM	United Kingdom	–	1	118

Airline	IATA code	ICAO code	Country	Seat miles 2001 (mil.)	Seat miles 2004 (mil.)	Seat miles 2007 (mil.)
Luxair	LG	LGL	Luxembourg	–	–	104
Excel Airways	JN	XLA	United Kingdom	273	98	92
Air Malta p.l.c.	KM	AMC	Malta	–	–	91
Britannia Airways AB	6B	BLX	Sweden	102	76	83
MALEV Hungarian Airlines Ltd.	MA	MAH	Hungary	99	–	80
Astraeus Ltd.	5W	AEU	United Kingdom	–	–	77
Air Slovakia BWJ, Ltd.	GM	SVK	Slovakia	–	–	76
Air Bashkortostan		BBT	Russian Federation	–	241	71
Martinair Holland N.V.	MP	MPH	Netherlands	55	72	70
Livingston S.p.A.	LM	LVG	Italy	–	–	66
Iraqi Airways	IA	IAW	Iraq	–	–	60
Aegean Airlines, S.A.	A3	AEE	Greece	72	73	55
Air Italy	I9	AEY	Italy	–	–	47
flyniki / NL Luftfahrt GmbH	HG	NLY	Austria	–	15	44
Hainan Airlines Company Ltd.	HU	CHH	China	59	58	42
TAROM	RO	ROT	Romania	–	–	41
Air Baltic Corporation S/A	BT	BTI	Latvia	–	–	40
Jat Airways	JU	JAT	Serbia and Montenegro	48	27	36
Virgin Express	TV	VEX	Belgium	–	–	34
Skynet Asia Airways	6J	SNJ	Japan	–	–	33
Blue Panorama Airlines S.p.A.	BV	BPA	Italy	–	–	31
Jordan Aviation	R5	JAV	Jordan	–	–	31
Air Finland Ltd.	OF	FIF	Finland	–	–	30
Joint stock Aviation Company Donavia	D9	DNV	Russian Federation	–	–	29
MyTravel Airways	VZ	MYT	United Kingdom	–	–	28
Hamburg International	4R	HHI	Germany	–	–	26
Utility Enterprise DonbassAero Airline	7D	UDC	Ukraine	–	19	24
Futura International Airways	FH	FUA	Spain	–	–	20
Air Nostrum L.A.M.S.A.	YW	ANS	Spain	–	–	16
Uzbekistan Havo Yullary	HY	UZB	Uzbekistan	–	–	13
Helvetic Airways AG	2L	OAW	Switzerland	13	11	11
Binter Canarias	NT	IBB	Spain	–	–	10
Cyprus Airways Ltd.	CY	CYP	Cyprus	–	–	10
Norwegian Air Shuttle A.S.	DY	NAX	Norway	–	–	10
Lauda Air Luftfahrt AG	NG	LDA	Austria	26	53	8
Aer Lingus Ltd.	EI	EIN	Ireland	–	–	7
Kaliningradavia Open Joint Sotck Co.	KD	KNI	Russian Federation	–	–	7
Hemus Air	DU	HMS	Bulgaria	9	6	6
Air Bourbon	ZN	BUB	Reunion Island	–	612	2
Birdy Airlines S.A.	4V	BDY	Belgium	–	1,044	–

Airline	IATA code	ICAO code	Country	Seat miles 2001 (mil.)	Seat miles 2004 (mil.)	Seat miles 2007 (mil.)
TAM Linhas Aeras	JJ	BLC	Brazil	–	293	–
Varig S.A. (Viacao Aerea Rio-Grandense)	RG	VRG	Brazil	–	278	–
Aero-Service	BF	RSR	Colombia	33	79	–
State United Venture Kavminvodyavia	KV	MVD	Russian Federation	66	54	–
Pakistan International Airlines	PK	PIA	Pakistan	–	44	–
Air Littoral	FU	LIT	France	25	30	–
Maersk Air A/S	DM	DAN	Denmark	–	30	–
Scandinavian Airlines System (SAS)	SK	SAS	Sweden	65	26	–
Air Ukraine	6U	UKR	Ukraine	20	21	–
Aero Flight GmbH & Co	GV	ARF	Germany	–	18	–
Belavia	B2	BRU	Belarus	–	18	–
Phoenix Aviation	P3	PHG	Kyrgyzstan	–	17	–
Ukraine International Airlines	PS	AUI	Ukraine	–	14	–
Fischer Air s.r.o.	8F	FFR	Czech Republic	–	11	–
Georgian Airways	A9	TGZ	Georgia	–	8	–
Palestinian Airlines	PF	PNW	Occupied Palestinian Terr.	1	2	–
Swiss Air UA	SR		Switzerland	2,393	–	–
AOM French Airlines	IW	AOM	France	1,037	–	–
TWA (Trans World Airways)	TW	TWA	United States of America	806	–	–
TAT (Touraine Air Transport)	IJ		France	561	–	–
Royal Air Force	RR	RFR	United Kingdom	285	–	–
Axis Airways	6V	AXY	France	268	–	–
Air Europe S.p.A.	PE	AEL	Italy	200	–	–
Anderson Airlink (AC-Coach Ops, Inc.)	4Q		United States of America	78	–	–
Aero Lloyd Flugreisen	YP		Germany	36	–	–
Teamline Air Luftfahrt GmbH	L9	TLW	Austria	33	–	–
PGA—Portugalia	NI	PGA	Portugal	31	–	–
Balkan	LZ	LAZ	Bulgaria	23	–	–
Aviaenergo	7U	ERG	Russian Federation	20	–	–
Heli France	8H	HFR	France	16	–	–
Menajet	IM	MNJ	United Arab Emirates	11	–	–
Romanian Aviation Company	WQ	RMV	Romania	5	–	–
Armenian Airlines	R3	RME	Armenia	4	–	–
Mahfooz Aviation (Gambia) Ltd.	M2	MZS	Saudi Arabia	3	–	–
Phuket Airlines Co. Ltd.	9R	VAP	Thailand	2	–	–
Trans State Airlines, Inc.	AX	LOF	United States of America	1	–	–
				65,093	74,539	101,179

Note: Reunion Island is grouped with these countries, since it is part of the French Overseas Department.

Appendix 6 Additional data on airport charges

The following charges are a regional sample as of January, 2007, as collected for a financial analysis for a new airport in Kigali, Burundi.[25]

Table 8 Passenger fees

Airport	Passenger fee ($)
Kenya–JKIA	40
Congo–Kinshasa	20
Burundi–Bujumbura	25
Nigeria–Lagos	35
Tanzania–Dar es Salaam	30
Uganda–Entebbe	40

Table 9 Landing fees

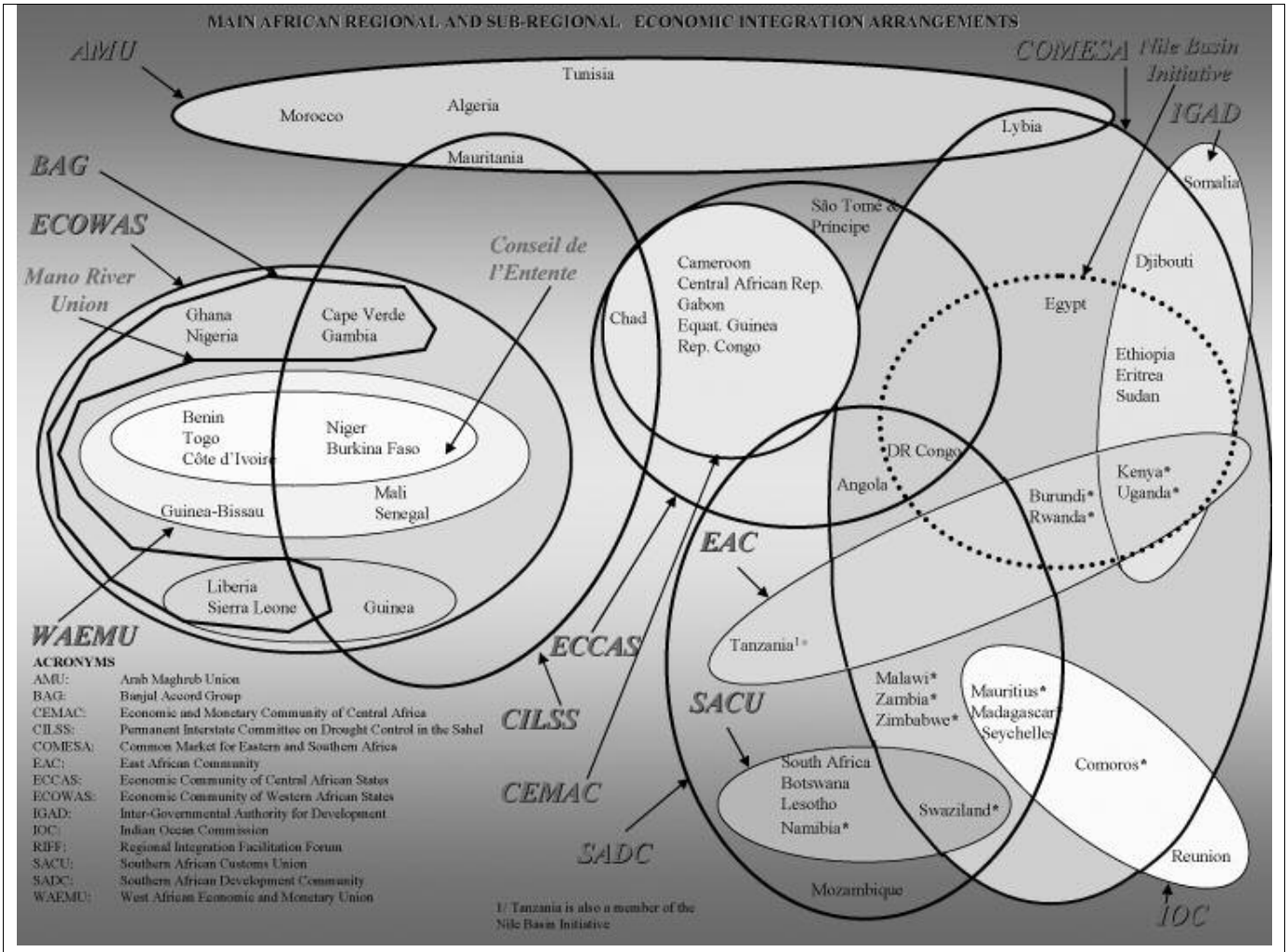
Airport	A 330–300 ($)	B 737–400 ($)
Rwanda	1,240	390
Kenya–JKIA	1,345	223
Congo–Kinshasa	2,530	544
Burundi–Bujumbura	1,288	380
Nigeria–Lagos	2,090	618
Tanzania–Dar es Salaam	1,150	340
Uganda–Entebbe	1,150	408
Average	1,541	415

Table 10 Aircraft parking charges

Airport	Free period (hours)	A 330–300 ($ per day)	B 737–400 ($ per day)
Rwanda	6	40	20
Kenya–JKIA	6	50	25
Congo–Kinshasa	0	1,104	326
Burundi–Bujumbura	2	552	163
Nigeria–Lagos	3	6,293	1.860
Tanzania–Dar es Salaam	2	120	120
Uganda–Entebbe	6	40	12

[25] New Kigali Airport Business and Financial Analysis, Jacobs Consultancy, January 2007, p. 49–50.

Appendix 7 Main African regional and subregional economic integration arrangements



Appendix 8 Evaluation of Schedule Balance of Main Airport in each Country

Group	Country	City	Airport	Ratio of Maximum Flights per Hour to Weekly Average	Maximum Flights Per Hour
Generally Balanced	South Africa	Johannesburg	JNB	2.03	47
	Morocco	Casablanca	CMN	2.76	19
	Egypt	Cairo	CAI	1.84	19
	Kenya	Nairobi	NBO	2.86	15
	Nigeria	Lagos	LOS	2.41	14
	Algeria	Algiers	ALG	2.83	13
	Ethiopia	Addis Ababa	ADD	4.79	12
	Libya	Tripoli	TIP	3.63	11
	Tunisia	Tunis	TUN	2.83	11
	Mauritius	Mauritius	MRU	3.62	7
	Senegal	Dakar	DKR	3.16	7
	Seychelles	Mahe Island	SEZ	3.15	7
	Mozambique	Maputo	MPM	4.62	6
	Gabon	Libreville	LBV	4.57	5
	Madagascar	Antaninvarivo	TNR	3.82	4
Scheduel may be able to be rebalanced if needed	Tanzania	Dar Es Salaam	DAR	3.29	8
	Zambia	Lusaka	LUN	4.06	7
	Sudan	Khartoum	KRT	3.45	7
	Namibia	Windhoek	WDH	6.42	6
	Angola	Luanda	LAD	6.22	6
	Zimbabwe	Harare	HRE	5.07	6
	Uganda	Entebbe	EBB	3.82	6
	Comoros	Dzaoudzi	DZA	13.77	5
	Swaziland	Manzini	MTS	7.71	5
	Cameroon	Douala	DLA	5.19	5
	Cote D'Ivoire	Abidjan	ABJ	4.18	5
	Ghana	Accra	ACC	2.84	5
	The Gambia	Banjul	BJL	13.71	4
	Guinea	Conakry	CKY	11.39	4
	Congo Brazaville	Brazzaville	BZV	8.20	4
	Congo DRC	Kinshasa	FIH	8.10	4
	Benin	Cotonou	COO	8.00	4
	Malawi	Lilongwe	LLW	7.55	4
	Rwanda	Kigali	KGL	6.65	4
	Djibouti	Djibouti	JIB	5.60	4
	Cape Verde Islands	Sal Island	SID	5.29	4
	Mali	Bamako	BKO	5.17	4
	Botswana	Gaborone	GBE	4.05	4
	Sierra Leone	Freetown, Lungi Intl	FNA	13.62	3

	Somalia	Hargeisa	HGA	9.33	3
	Equatorial Guinea	Malabo	SSG	7.64	3
	Burkina Faso	Ouagadougou	OUA	6.90	3

Group	Country	City	Airport	Ratio of Maximum Flights per Hour to Weekly Average	Maximum Flights Per Hour
Not graded - maximum two flights per hour	Liberia	Monrovia	ROB	15.27	2
	Guinea-Bissau	Bissau	OXB	14.00	2
	Chad	Ndjamena	NDJ	12.92	2
	Niger	Niamey	NIM	8.84	2
	Eritrea	Asmara	ASM	8.40	2
	Mauritania	Nouakchott	NKC	7.30	2
	Burundi	Bujumbura	BJM	5.89	2
	Togo	Lome	LFW	5.89	2
	Lesotho	Maseru	MSU	5.42	2
	Central African Republic	Bangui	BGF	42.00	1
	Sao Tome and Principe	Sao Tome Is.	TMS	28.00	1

Appendix 9 Evaluation of Schedule Balance of Main Airport in each Country

Country	Strong State Owned	Weak State Owned	Private	None
Algeria		1		
Angola		1		
Benin			1	
Botswana		1		
Burkina Faso			1	
Burundi			1	
Cameroon		1		
Cape Verde Islands		1		
Central African Republic				1
Chad			1	
Comoros		1		
Congo			1	
Congo, Democratic Republic			1	
Cote D'Ivoire			1	
Djibouti		1		
Egypt	1			
Equatorial Guinea			1	
Eritrea			1	
Ethiopia	1			
Gabon			1	
Ghana			1	
Guinea			1	
Guinea-Bissau			1	
Kenya	1			
Lesotho				1
Liberia			1	
Libyan Arab Jamahiriya		1		
Madagascar		1		
Malawi		1		
Mali		1		
Mauritania		1		
Mauritius		1		
Morocco	1			
Mozambique		1		
Namibia		1		
Niger				1
Nigeria			1	
Rwanda			1	
Sao Tome and Principe			1	
Senegal			1	
Seychelles		1		

Sierra Leone			1	
Somalia			1	
South Africa	1			
Sudan		1		
Swaziland			1	
Tanzania, United Republic of		1		
The Gambia			1	
Togo			1	
Tunisia	1			
Uganda			1	
Zambia			1	
Zimbabwe		1		
Total Count	**6**	**20**	**25**	**3**

Source: Analysis based on data found in The Implementation of the Yamoussoukro Decision, Charles. E. Schlumberger, McGill Institute of Aerospace Law, 2008, pp 287-288. Author altered the rating of Tunisia's flag carrier from Weak State Owned to Strong State Owned, since it is, though small, a successful niche operator..