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Africa-Indian Ocean Regional Traffic Forecasts 2004–2020

Report of the Fourth Meeting of the Africa-Indian Ocean Traffic Forecasting Group (AFI TFG)

Dakar, 20–24 February 2006

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REPORT OF THE
AFRICA-INDIAN OCEAN
TRAFFIC FORECASTING GROUP (AFI TFG)
FOURTH MEETING

(Dakar, Senegal, 20-24 February 2006)

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1. INTRODUCTION

1.1 The ICAO Africa-Indian Ocean Traffic Forecasting Group (AFI TFG) was set up in 1998 with the objective of developing traffic forecasts and other planning parameters in support of the planning of air navigation services in the AFI region. It has so far held four meetings in 1998, 2001, 2003 and 2006.

1.2 This report provides forecasts prepared by the fourth meeting of the AFI TFG held in Dakar, from 20 to 24 February 2006. The forecasts were developed on the basis of major route groups (region-pairs) using econometric modelling. They were then converted into aircraft movements and expanded to the city-pair level. The city-pair forecasts were then redistributed to match the areas of routing (ARs) defined by the Africa/Indian Ocean Planning and Implementation Regional Group (APIRG), which may not necessarily correspond to the region-pairs. The section related to the FIR data analysis in this report was completed by the Secretariat subsequent to the meeting.

2. GLOBAL TRENDS

2.1 The historical global economic and traffic trends are provided in **Appendix A**.

2.2 The global scheduled passenger traffic forecasts for 2006, 2007, 2008 and over the period to the year 2015, have been developed by the ICAO Secretariat and are based on economic and passenger yield assumptions. According to those forecasts, the general economic performance provides the main factor affecting traffic demand. Global passenger traffic measured in terms of passenger-kilometres is expected to grow by 6.1 per cent in 2006, 5.8 per cent in 2007 and 5.6 per cent in 2008. The ICAO long-term forecast over the period 2002-2015 provides for an average annual increase of 4.4 per cent.

3. REGIONAL TRENDS

3.1 Economic Trends

3.1.1 Over the 1995-2005 period, the aggregate economy of the African region grew at an average annual rate of 3.9 per cent, while GDP per capita increased at a rate of 1.6 per cent per annum in real terms. Factors such as greater macroeconomic stability, modest progress in liberalizing markets and privatizing state enterprises helped the region's improved economic performance significantly. Favourable external conditions such as the rapid growth in world trade, surging private capital flows and a mini-boom in commodity prices (1994-1995) also helped. After achieving a GDP growth of 5 per cent in 1996, the aggregate economy witnessed a decline in growth rates through to 1999. The years 2000 through 2002 were not very impressive in terms of economic growth either. The contributing factors include increases in oil prices, the resurgence of civil conflict, and the losses from terms of trade resulting from weak commodity prices. The aggregate African economy has, however, been performing better and grew at 4.6, 5.5 and 5.2 per cent during 2003, 2004 and 2005, respectively, due to the impact of earlier economic reforms and an increase in the prices of certain commodities. The economic performance of the African region is expected to improve further over the medium term. The aggregate GDP is projected to grow at 5.7, 5.5 and 5.4 per cent in 2006, 2007 and 2008, respectively. Underlying these projections are reforms for economic diversification and liberalization to strengthen the private sector, increase domestic savings, expand non-oil exports and consolidate successfully domestic and international economic policies.

3.1.2 Trends and prospects of the other regions' economies are discussed in **Appendix B**.

3.2 Passenger Air Traffic Trends

3.2.1 Over the 1995-2005 period, scheduled passenger traffic of the airlines of the African region increased at an average annual rate of 5.4 per cent. After achieving high growth rates in 1996 and 1997, traffic declined in 1998 but rebounded in 1999, and continued to grow in 2000. The slowdown in the world economy and the subsequent global crisis in the airline industry following the events of 11 September 2001 resulted in a 2 per cent growth in that year, a decrease of 3 per cent in 2002 and an increase of 1.0 per cent in 2003. The year 2004 witnessed 13.8 per cent growth. In 2005, the growth was 12.1 per cent compared to the world average growth of 8.0 per cent.

3.2.2 According to a medium-term forecast developed by the ICAO Secretariat in 2005, scheduled passenger traffic for the airlines of the African region is expected to increase by 6.9 per cent in 2006, by 6.3 per cent in 2007 and by 5.7 in 2008, well above the levels of passenger traffic growth worldwide. The long term average annual growth rate during the period 2002-2015 is anticipated to be 4.0 per cent.

4. MAJOR ROUTE GROUPS TO, FROM AND WITHIN THE AFRICAN REGION

4.1 Definition

4.1.1 Traffic forecasts in this report are provided on the basis of route groups to, from and within the African region. The major route groups correspond to the following region-pairs:

- Africa - Europe
- Africa - Middle East
- Africa - Asia/Pacific
- Africa - North America
- Intra Africa

4.2 Historical Traffic

4.2.1 According to the historical data, air traffic on the five major route groups to, from and within the African region increased from some 21.9 million passengers in 1993 to 38.3 million passengers in 2004 at an average annual growth rate of 5.2 per cent. The annual passengers carried and growth rates for each of the route groups concerned are illustrated in **Table 1** which shows that passenger air traffic on intra-Africa routes had the highest growth rate and doubled over the period 1993-2004.

4.2.2 This historical data includes all airlines operating on these routes regardless of their region of registration. Traffic data by route group for 2005 was not available at the time of the meeting.

TABLE 1

PASSENGER TRAFFIC BY MAJOR ROUTE GROUP, 1993-2004

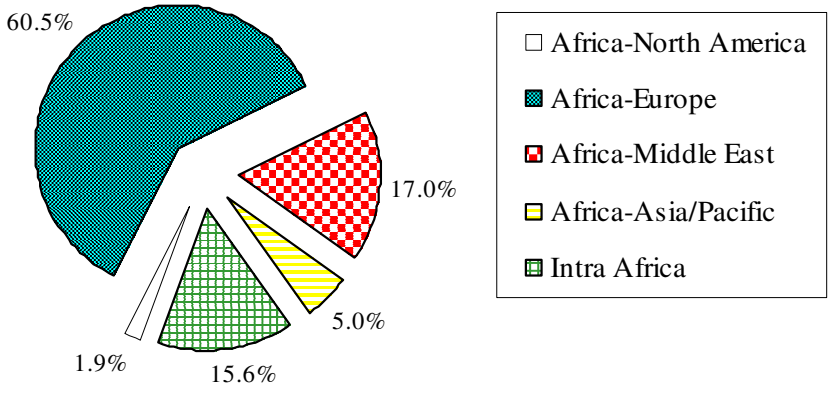
(Thousands of passengers carried)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Average Annual Growth (%) 1993-2004
Africa- North America	366	332	434	456	510	627	714	745	810	655	663	725	
Growth(%)		-9.3	30.6	5.2	11.7	23.0	13.9	4.3	8.8	-19.2	1.3	9.3	6.4%
Africa – Europe	14,735	14,985	15,795	16,821	17,679	18,386	21,291	22,228	20,517	21,399	20,949	23,170	
Growth (%)		1.7	5.4	6.5	5.1	4.0	15.8	4.4	-7.7	4.3	-2.1	10.6	4.2%
Africa – Middle East	3,192	3,413	3,419	3,703	3,955	4,113	4,179	4,162	4,275	4,676	5,205	6,522	
Growth (%)		6.9	0.2	8.3	6.8	4.0	1.6	-0.4	2.7	9.4	11.3	25.3	6.7%
Africa – Asia/Pacific	1,249	1,425	1,821	1,662	1,676	1,533	1,519	1,706	1,744	1,892	1,862	1,933	
Growth (%)		14.1	27.8	-8.7	0.8	-8.5	-0.9	12.3	2.2	8.5	-1.6	3.8	4.1%
Intra-Africa	2,371	2,537	3,120	2,961	3,331	3,787	4,185	4,629	4,666	5,174	5,340	5,970	
Growth (%)		7.0	23.0	-5.1	12.5	13.7	10.5	10.6	0.8	10.9	3.2	11.8	8.8%
Total	21,912	22,691	24,588	25,604	27,150	28,447	31,889	33,470	32,011	33,796	34,019	38,319	
Growth (%)		3.6	8.4	4.1	6.0	4.8	12.1	5.0	-4.4	5.6	0.7	12.6	5.2%

4.2.3 In 2004, the Africa-Europe route group had the highest passenger share in the total international traffic to, from and within Africa, followed by Africa-Middle East, Intra-Africa, Africa-Asia/Pacific and Africa-North America route groups as illustrated in **Figure 1**.

FIGURE 1

Passenger Traffic Shares, 2004



5. METHODOLOGY

5.1 Demand for air travel is primarily determined by income levels, demographics and the price of air travel. In this report, income levels are measured by Gross Domestic Product (GDP) and prices are measured in terms of airline yields (revenue per passenger-kilometre flown). It is also assumed that the general political and economic climate affects air traffic growth; however, no specific assumptions are made about possible political and economic scenarios beyond those implicit in the basic GDP growth rates' forecast.

5.2 The following forecast horizons have been considered:

- Medium-term forecasts (2004-2010)
- Long-term forecasts (2010-2020)

5.3 Econometric models were developed to determine the cause and effect relationship between traffic and other causal factors. It was recognized, however, that even where models were developed, the forecasts should incorporate a significant element of judgement.

5.4 Forecasts of aircraft movements for a particular route-group are determined using the base year movements and the estimated yearly growth rates over the forecast horizon. Yearly aircraft movements growth rates can be derived from the passengers annual growth rates and the changes in load factors and average aircraft size.

5.5 The relationship between the aircraft movements traffic, passenger traffic, load factors and average aircraft size is as follows:

$$\text{Aircraft movements} = \frac{\text{passenger numbers}}{\text{(passenger/seats) . (seats per aircraft)}}$$

$$= \frac{\text{passenger numbers}}{\text{(load factor) . (average aircraft seats)}}$$

5.6 The relationship between changes in the same variables can therefore be deduced:

$$Y = X_1 - X_2 - X_3$$

Where:

Y = change in aircraft movements (%)
X_1 = change in passenger numbers (%)
X_2 = change in load factor (%)
X_3 = change in average aircraft seats (%)

5.7 Assumptions were made about future trends in load factors and average aircraft seats based on expectations about airlines marketing strategies and the types of aircraft that might be introduced to the route over the forecast period.

5.8 The approach adopted for every route-group can be described as follows:

i) Develop econometric models explaining the growth of passenger air traffic using historical data;

ii) Develop aggregate passenger air traffic forecasts for each of the major route groups using appropriate models and judgment;

iii) Analyze the historical trends of other parameters for each route-group: total seats offered, average aircraft capacity (seats per aircraft), average load factor, total passengers carried as well as aircraft movements compiled by ICAO supplemented by data from IATA, the Official Airline Guide (OAG) and other sources; and

iv) Derive aircraft movement forecasts based on assumptions about future trends in average aircraft capacity and load factors.

6. PASSENGER AIR TRAFFIC FORECASTS

6.1 Applying the approach described above, several econometric models were developed for the major route groups listed in paragraph 4.1.1 using explanatory variables such as GDP and airline yields. An analysis of the statistical significance of each model led to the following selection. Each model is provided with its coefficient of determination R^2 and the t-statistics below each regression coefficient.

6.2 The following econometric model was selected for the Africa-Europe route group:

$$\text{Log(Traffic)} = \underset{(8.9)}{1.24 + 1.85\ \text{Log(GDP Europe)}} \qquad R^2 = 0.94$$

The model shows that the traffic between Africa and Europe is highly dependent upon European GDP with an elasticity of 1.85. This dependency can be explained by the growth in the tourism traffic due to an increase in propensity to travel (income) and also by improved business opportunities. Assuming a GDP growth rate of 2.3 per cent for the forecast horizon, a passenger traffic growth rate of 4.8 per cent until the year 2010 and a growth rate of 4.3 per cent for the period 2010- 2020 were projected.

6.3 The following econometric model was selected for the Africa-Middle East route group:

$$\text{Log(Traffic)} = \underset{(10.9)}{1.38 + 1.40\ \text{Log(GDP Middle East)}} \qquad R^2 = 0.96$$

Traffic on this route group is influenced by the GDP of the Middle East region. Assuming a GDP growth rate of 6.4 per cent over the period 2004-2010, the passenger traffic growth rate on this route group would be in the range of 6.8 per cent. Similarly by applying a GDP growth rate of 4.9 per cent for the long- term forecast for the period 2010-2020, the passenger growth would be 6.9 per cent.

6.4 The following econometric model was selected for the Intra-Africa route group:

$$\text{Log(Traffic)} = -7.26 + 2.45\ \text{Log(GDP Africa)} \qquad R^2 = 0.98$$
$$(15.9)$$

Intra-Africa traffic is extremely dependent on Africa GDP as proven by the high elasticity. Assuming a GDP growth rate of 3.6 per cent over the period 2004-2010, the passenger traffic growth rate on this route group would be in the range of 10 per cent. Whereas a GDP growth of 3.1 per cent would result in a passenger traffic growth of 7.6 per cent during the period 2010-2020.

6.5 The following econometric model was selected for the Africa-North America route group:

$$\text{Log(Traffic)} = -15.09 + 2.32\ \text{Log(GDP North America)} \qquad R^2 = 0.92$$
$$(7.3)$$

Traffic between Africa and North America is heavily dependent on the GDP of North America as proven by the high elasticity. Assuming that the GDP of North America would grow at a rate of 2.9 per cent over the period 2004-2010, the passenger traffic growth rate on this route group would be around 7.3 per cent. During the period 2010-2020 a GDP growth of 2.5 per cent would result in a projected passenger traffic growth of 5.9 per cent.

6.6 The following econometric model was developed for the Africa-Asia/Pacific route group:

$$\text{Log(Traffic)} = -1.52 + 0.99\ \text{Log(GDP Asia/Pacific)} \qquad R^2 = 0.8$$
$$(4.2)$$

Assuming a GDP growth rate of 4.5 per cent over the period 2004-2010, the passenger traffic growth rate on this route group would be 4.7 per cent, whereas, a GDP growth of 4 per cent would result in a passenger traffic growth of 4 per cent during the period 2010-2020.

6.7 Based on the results described above, passenger air traffic to, from and within the African region on the five major route groups for the period 2004-2020 is expected to increase at an average annual rate of 5.7 per cent. The Intra-Africa route group is expected to experience the highest average annual growth rate of 8.5 per cent per annum, followed by Africa-Middle East, Africa-North America, Africa-Europe and Africa-Asia/Pacific route groups with growth rates of 6.9 per cent, 6.4 per cent, 4.5 per cent and 4.3 per cent, respectively, for the period concerned as illustrated in **Table 2**.

TABLE 2

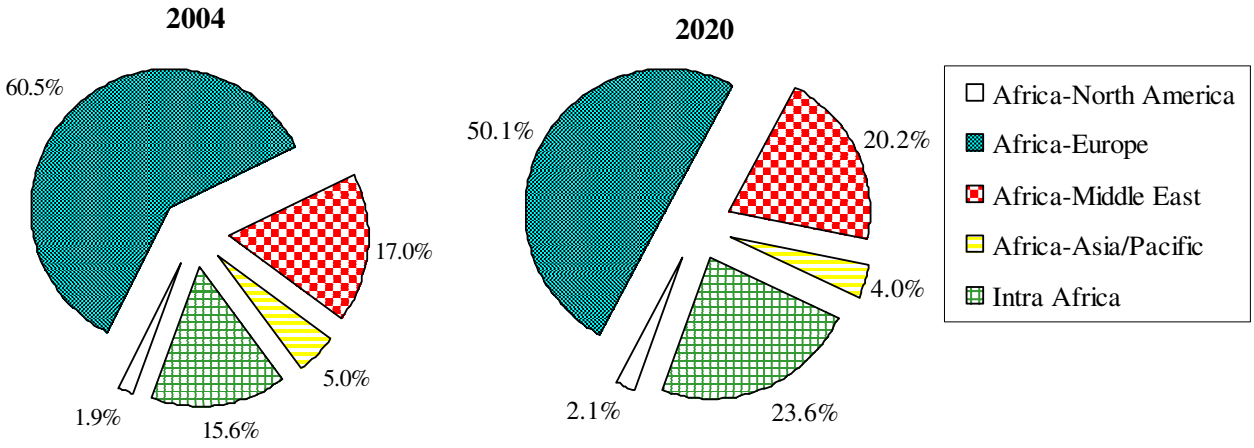
PASSENGER FORECAST TO THE YEAR 2020
(thousands of passengers carried)

	2004	2005	2006	2007	2008	2009	2010	2020	Average annual growth (%)		
									2004-2010	2010-2020	2004-2020
Africa-North America	725	778	835	896	961	1031	1106	1963	7.3	5.9	6.4
Africa-Europe	23170	24282	25448	26669	27949	29291	30697	46767	4.8	4.3	4.5
Africa-Middle East	6522	6965	7439	7945	8485	9062	9678	18861	6.8	6.9	6.9
Africa-Asia/Pacific	1933	2023	2118	2218	2322	2431	2546	3768	4.7	4.0	4.3
Intra-Africa	5970	6567	7224	7946	8740	9615	10576	22001	10.0	7.6	8.5
TOTAL	38319	40616	43063	45673	48458	51430	54603	93360	6.1	5.5	5.7

6.8 These forecasts resulted in a change of the relative passenger traffic shares of the various route groups, from the year 2004 to the year 2020 as depicted in **Figure 2**.

FIGURE 2

PASSENGER TRAFFIC SHARES BY ROUTE GROUP, 2004 AND 2020



7. ROUTE GROUP AIRCRAFT MOVEMENT FORECASTS

7.1 Having established the passenger traffic growth rates for each route group in the manner described above, forecasts of aircraft movement growth rates for the period 2004-2020, were developed using the methodology outlined in section 5 and the assumptions related to the future evolution of load factors and average aircraft seats over the same period. Historical trends from the past decade for these two elements were examined carefully and their growth patterns were kept fairly consistent with their past behaviour.

7.2 The future trends in load factors and average seats for the route groups concerned are described in **Tables 3 and 4**, respectively.

TABLE 3

LOAD FACTORS FORECAST TO THE YEAR 2020

	2004	2005	2006	2007	2008	2009	2010	2020
Africa-North America	64.4	64.4	64.4	64.4	64.4	64.4	64.4	64.4
Africa-Europe	73.0	73.1	73.3	73.4	73.6	73.7	74.1	74.1
Africa-Middle East	68.7	68.8	68.8	68.9	69.0	69.0	69.1	69.1
Africa-Asia/Pacific	65.2	65.2	65.2	65.2	65.2	65.2	65.2	65.2
Intra-Africa	61.9	62.5	63.1	63.8	64.4	65.1	65.7	65.7

TABLE 4

AVERAGE AIRCRAFT SIZE FORECAST TO THE YEAR 2020
(number of seats per aircraft)

	2004	2005	2006	2007	2008	2009	2010	2020
Africa-North America	282	283	283	283	283	284	284	284
Africa-Europe	240	241	242	244	245	246	247	248
Africa-Middle East	217	218	219	220	222	223	224	225
Africa-Asia/Pacific	271	271	271	271	271	271	271	271
Intra-Africa	124	124	124	124	124	124	124	124

7.3 The estimated aircraft movement forecasts for the period 2004-2020 and the respective growth rates are given in **Table 5**. It is important to note that after establishing the passenger forecast growth rates for each of the route-groups, in the manner described in Section 6, per cent growth rates in aircraft movements for the periods 2004-2010, 2010-2020 and 2004-2020 were obtained by plugging the corresponding growth rates of load factors and average aircraft seats in the equation shown in paragraph 5.6. The final aircraft movement forecasts, however, were then prepared for each of the route groups concerned by applying these growth rates to the actual 2004 OAG data as the base year.

TABLE 5

AIRCRAFT MOVEMENTS' FORECAST TO THE YEAR 2020

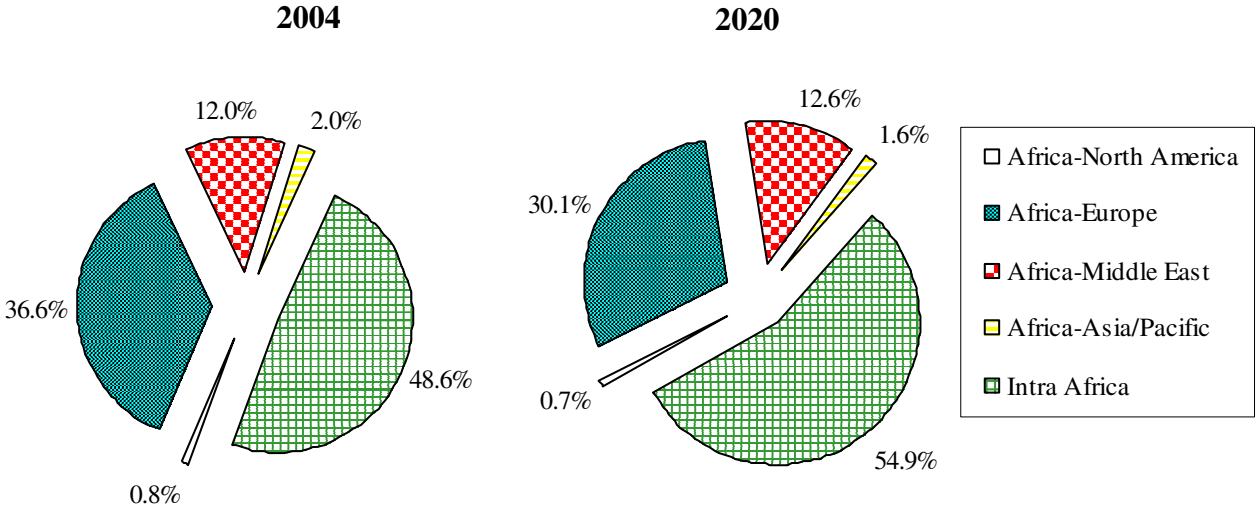
	Actual		Forecast			Average Annual Growths (%)		
	2004*		2010	2020		2004-2010	2010-2020	2004-2020
Africa-North America	3102		4705	8338		7.2	5.9	6.4
Africa-Europe	180551		228700	346692		4.0	4.2	4.2
Africa-Middle East	52412		75034	145502		6.2	6.8	6.6
Africa-Asia/Pacific	9331		12292	18195		4.7	4.0	4.3
Intra-Africa	181984		303711	631806		8.9	7.6	8.1
TOTAL	427380		624442	1150532		6.0	5.9	6.0

*OAG data

7.4 The total aircraft movements to, from and within the African region are forecast to increase from some 427 000 in 2004 to slightly over 1 150 000 in 2020 at an average annual growth rate of 6.0 per cent. The resulting movements' shares for the years 2004 and 2020 are depicted in **Figure 3**.

FIGURE 3

AIRCRAFT MOVEMENTS' SHARES BY ROUTE GROUP, 2004 AND 2020



8. CITY-PAIR AIRCRAFT MOVEMENT FORECASTS

8.1 Using the 2005 OAG data as the base year, aircraft movement forecasts for the top 25 city-pairs of each of the route groups, identified in 4.1, were estimated. Where appropriate, the forecasts for the rest of the city-pairs in each route group are aggregated into one figure, and included as "All Other" in the tables. The city-pairs are ranked by descending order based on 2005 departures. The aircraft movement forecasts for the city-pairs of the route groups concerned are given in **Appendix C**.

9. FORECASTS FOR THE SIX AREAS OF ROUTING DEFINED BY APIRG

9.1 The forecasts of aircraft movements by city-pairs covered by the Areas of Routing AR-1 through AR-6 and their definitions are given in **Appendix D.**

10. PEAK–PERIOD PARAMETERS FOR FIR TRAFFIC

10.1 The analysis of the FIR traffic data provided by ASECNA for the year 2005 covering annual, monthly, daily and hourly traffic parameters as well as traffic densities is provided in **Appendix E**.

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APPENDIX A

GLOBAL ECONOMIC AND TRAFFIC TRENDS

1. Historical Economic Trends

1.1 Between 1995 and 2005, the aggregate world economy measured in terms of Gross Domestic Product (GDP) grew at an average annual rate of 3.6 per cent in real terms. Growth rates varied across regions, from a high of 4.6 per cent for Asia/Pacific to a low of 2.4 per cent for Europe. Between 1995 and 2005, the world population increased at an average annual rate of 1.3 per cent. Hence, the world's GDP per capita increased, during the same period, at an average annual rate of 2.3 per cent.

1.2 The world economy is expected to grow by 4.9, 4.7 and 4.6 per cent in 2006, 2007 and 2008, respectively. Over the long period up to 2020, the world economy is projected to grow at an average annual rate of 3.0 per cent in real terms.

1.3 The reasonably positive economic outlook augurs well for global traffic demand over the forecast period.

2. Historical Traffic Trends

2.1 Total scheduled airline traffic, measured in terms of total tonne-kilometres performed, grew at an average annual rate of 5.2 per cent between 1995 and 2005. Passenger-kilometres grew at an average rate of 5.2 per cent per annum and freight tonne-kilometres at 5.5 per cent per annum.

2.2 In broad terms, the pattern of traffic growth over the 1995-2005 period was a reflection of economic conditions experienced over this period. The economic slowdown in 1991 had a serious effect on air traffic. The recovery in traffic in 1992, which occurred despite continuing poor economic performance, was achieved at a cost of significantly reduced revenue yield. Although real yields declined further in 1993 and 1994, the stimulating effect on traffic demand was less dramatic than had been the case in 1992. On the other hand, economic growth began to provide a more solid foundation for traffic growth. These trends continued until 1997 but reversed in 1998 when GDP grew at only 1.9 per cent, providing for a simultaneous growth of total scheduled passenger traffic of only 2.1 per cent. In 1999 and 2000, traffic increased by 6.5 and 8.6 per cent, respectively, supported by the strong performance of the world economy. The economic downturn and related decline in business and consumer confidence had a negative impact on traffic in late 2000 and in 2001, when the events of 11 September exacerbated an already difficult situation. As a result, traffic declined in 2001 by 2.9 per cent, the first decline since 1991 and only the second since 1945. In 2002, demand for air travel remained depressed and traffic grew at only 0.5 per cent. Following declines in the first part of the year due to the outbreak of the Severe Acute Respiratory Syndrome (SARS) and the war in Iraq, traffic rebounded in the second part of 2003 and increased by 1.8 per cent for the whole year. In 2004, traffic recovery continued, mainly for the airlines in the Asia/Pacific region, the worst affected by the SARS outbreak. It was supported by improved performance of some regional economies (Africa, Asia/Pacific, Europe, North America, Latin America/Caribbean) and sustained performance of the Middle East economy, and to some extent by marginal decline of cost of travel expressed in real terms. Traffic recovered strongly in 2004 and 2005 with growth rates of 14.1 and 8.0 per cent, respectively, due mainly to strong GDP growth rates of 5.1 and 4.8 per cent, respectively. However, the average annual growth during the period 2000-2005 is 4.1 per cent.

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APPENDIX B

REGIONAL ECONOMIC TRENDS

1. Asia/Pacific

1.1 Over the 1995-2005 period, the aggregate economy of the Asia/Pacific region grew at an average annual rate of 4.6 per cent in real terms, and GDP per capita increased at 3.2 per cent per annum. Asia/Pacific has achieved the largest share in the world economy and has also been the fastest growing region despite a slowdown and recession when GDP growth dropped from 3.9 per cent in 1997 to -0.3 per cent in 1998. Following a financial crisis, the region regained its economic strength and GDP continued to grow well above the world average even in 2001 (3.9 %) despite a global slowdown that year. In 2002, the region's economy grew by about 4.6 per cent. Despite the adverse effects of the SARS outbreak in the first half of 2003, the economy bounced back in the second half of the year with a surge in domestic demand coupled with export growth boosted by increased global activity, the upturn in demand for high technology goods, favorable exchange rates, higher consumer confidence and a boost in tourism and registered a growth rate of 5.9 per cent for 2003. The region's GDP grew at 6.8 per cent in 2004. It is estimated that the region's economy has grown at 6.6 per cent in 2005, the highest growth rate among ICAO regions.

2. Europe

2.1 The aggregate economy of the European region went into decline starting in 1990, the primary reason being the serious contractions of the economies of Eastern Europe and the Commonwealth of Independent States (CIS). By 1997, total output was back to where it had been in 1989, but masked a persistent divergence between countries in Western and Eastern Europe. Over the 1995-2005 period, the GDP for the entire region (including the CIS), grew at an average annual rate of 2.4 per cent in real terms while the aggregate GDP per capita grew at a rate of about 2.0 per cent. It is estimated that the European economy grew by 2.4 per cent in 2005. The European Union GDP grew at 1.8 per cent, the economies of Central and Eastern European countries grew in the aggregate at around 5.3 per cent while those of the CIS grew faster, at 6.5 per cent.

3. North America

3.1 Over the 1995-2005 period, the economy of the North American region grew at an average annual rate of 3.2 per cent in real terms and GDP per capita increased at 2.2 per cent. The U.S. economic expansion, which began in 1991, has been the longest since 1945. By the end of 2000, an economic slowdown had affected economic activities, with a worsening impact after the events of 11 September 2001. As a result, the year 2001 saw a GDP growth of only 0.4 per cent. In the years 2002 to 2004, the region's economic growth showed a steady recovery with growths of 2.3, 2.9 and 4.1 per cent, respectively. The year 2005 witnessed a growth of 3.4 per cent.

4. Middle East

4.1 The economy of the Middle East region has been characterized by some pronounced cycles over the past decade. With political and economic stability in the region, GDP growth, which was comparatively low (1.6 %) in 1994, regained its momentum in 1995 and sustained varying degrees of strength for the following nine years. In 2004 and 2005, the economy achieved growth rates of 5.4 per cent and 5.9 per cent, respectively, in real GDP, well above the 5 per cent level for the three consecutive years, benefiting from higher oil prices. Over the period concerned, the aggregate GDP for the Middle East grew at an average annual rate of 4.3 per cent in real terms, while GDP per capita averaged a 2.1 per cent growth rate per annum.

4.2 The following table depicts the regional economic growth rates for the period 1993-2005.

GDP GROWTH RATES BY REGION
(Per cent)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
North America	3.0	3.6	2.0	2.6	3.8	4.2	4.2	4.0	1.0	1.9	2.6	3.9	3.4
Europe	-3.2	0.1	2.0	2.5	2.8	2.5	2.3	3.8	1.7	0.9	0.7	2.0	2.4
Asia/Pacific	3.7	4.3	5.0	5.6	3.9	-0.3	3.5	5.7	3.9	4.6	5.9	6.5	6.6
Africa	1.1	2.4	2.9	5.0	3.4	3.2	2.8	3.3	4.1	3.6	4.6	5.3	5.2
Middle East	3.8	1.6	3.8	5.2	3.8	2.7	1.6	5.4	3.9	4.2	5.8	5.5	5.9

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APPENDIX C

AIRCRAFT MOVEMENT FORECASTS BY CITY-PAIRS

TABLE C-1

BETWEEN AFRICA AND NORTH AMERICA
CITY PAIRS RANKED BY 2005 MOVEMENTS

	City-Pair	Aircraft Movements[1/] 2005[2/]	Aircraft Movements[1/] 2020	Average Annual growth (%)[3/] 2005-2020
1	Atlanta - Sal	730	1800	6.2
2	Dakar - New York (Kennedy)	713	1685	5.9
3	Casablanca - New York (Kennedy)	538	1308	6.1
4	Casablanca - Montreal (P.E. Trudeau)	518	1314	6.4
5	Cairo - New York (Kennedy)	468	1170	6.3
6	Accra - Washington (Dulles Intl.)	203	473	5.8
7	Boston - Sal	120	319	6.7
8	Cairo - Montreal (P.E. Trudeau)	70	135	4.5
9	Accra - New York (Kennedy)	55	106	4.5
10	New York - Johannesburg	17	28	3.5
	TOTAL	3432	8338	6.1

1/ Both directions.
2/ OAG data.
3/ Please note that these growth rates are for the 2005–2020 period and may differ from the ones presented in Table-5.

TABLE C-2

BETWEEN AFRICA AND EUROPE
TOP 25 CITY PAIRS RANKED BY 2005 MOVEMENTS

	City-Pair	Aircraft Movements[1/] 2005[2/]	Aircraft Movements[1/] 2020	Average Annual Growth (%)[3/] 2005-2020
1	Algiers - Paris (Orly)	4920	9940	4.8
2	Johannesburg - London (Heathrow)	3694	5196	2.3
3	Paris (Orly) - Marrakech	3109	9199	7.5
4	Paris (CDG)- Casablanca	3027	6758	5.5
5	Paris (CDG) - Tunis	2989	5785	4.5
6	Casablanca - Paris (Orly)	2803	7209	6.5
7	Cairo - Frankfurt	2168	4979	5.7
8	Paris (Orly) - Tunis	2130	2784	1.8
9	Casablanca - Lisbon	2075	3902	4.3
10	London (Heathrow) - Nairobi	2018	2923	2.5
11	Casablanca - Milan (Malpensa)	1842	3940	5.2
12	Cape Town - London (Heathrow)	1832	3299	4.0
13	Cairo - Milan (Malpensa)	1811	4043	5.5
14	Rome (Fiumicino) - Tunis	1811	2547	2.3
15	London (Heathrow) - Lagos	1796	3953	5.4
16	Brussels - Casablanca	1729	3346	4.5
17	Malaga - Tangier	1698	2459	2.5
18	Milan (Malpensa) - Tunis	1656	3697	5.5
19	Cairo - Istanbul (Ataturk)	1610	4141	6.5
20	Cairo - London (Heathrow)	1601	3098	4.5
21	Frankfurt - Johannesburg	1462	2117	2.5
22	Marseille - Tunis	1462	2149	2.6
23	Casablanca - Madrid	1449	2428	3.5
24	Amsterdam - Nairobi	1434	2077	2.5
25	Athens - Cairo	1433	3434	6.0
	All Other	138015	241290	3.8
	TOTAL	191574	346692	4.0

1/ Both directions.
2/ OAG data.
3/ Please note that these growth rates are for the 2005–2020 period and may differ from the ones presented in Table-5.

TABLE C-3

BETWEEN AFRICA AND MIDDLE EAST
TOP 25 CITY PAIRS RANKED BY 2005 MOVEMENTS

	City-Pair	Aircraft Movements[1/] 2005[2/]	Aircraft Movements[1/] 2020	Average Annual Growth (%)[3/] 2005-2020
1	Cairo - Jeddah	4681	11540	6.2
2	Dubai - Nairobi	2545	7022	7.0
3	Cairo - Kuwait	2447	7140	7.4
4	Cairo -Dubai	2114	5751	6.9
5	Amman - Cairo	1998	5669	7.2
6	Cairo - Riyadh	1807	4916	6.9
7	Abu Dhabi - Cairo	1777	5407	7.7
8	Beirut - Cairo	1707	3977	5.8
9	Dubai - Johannesburg	1460	3213	5.4
10	Cairo - Doha	1352	3477	6.5
11	Cairo - Damascus	1178	2630	5.5
12	Alexandria (El Nozha) - Sharjah	1110	2855	6.5
13	Addis Ababa - Dubai	1099	3584	8.2
14	Bahrain - Cairo	1081	2780	6.5
15	Jeddah - Khartoum	1081	2092	4.5
16	Cairo - Sanaa	943	2425	6.5
17	Cairo - Damman	821	1589	4.5
18	Doha - Khartoum	782	1673	5.2
19	Dubai - Djibouti	719	1849	6.5
20	Casablanca - Dubai	706	2271	8.1
21	Alexandria (El Nozha) - Jeddah	681	1478	5.3
22	Dubai - Lagos	604	1553	6.5
23	Jeddah - Tunis	600	1112	4.2
24	Dubai - Khartoum	592	1266	5.2
25	Cairo - Muscat	582	1651	7.2
	All Other	25052	56581	5.6
	TOTAL	59519	145502	6.1

1/ Both directions.
2/ OAG data.
3/ Please note that these growth rates are for the 2005–2020 period and may differ from the ones presented in Table-5.

TABLE C-4

BETWEEN AFRICA AND ASIA/PACIFIC
CITY PAIRS RANKED BY 2005 MOVEMENTS

	City-Pair	Aircraft Movements[1/] 2005[2/]	Aircraft Movements[1/] 2020	Average Annual Growth (%)[3/] 2005-2020
1	Hong Kong - Johannesburg	1436	3206	5.5
2	Mumbai - Nairobi	1017	1885	4.2
3	Johannesburg - Singapore (Changi)	730	1154	3.1
4	Mumbai - Johannesburg	681	1416	5.0
5	Addis Ababa - Bangkok	619	1147	4.2
6	Johannesburg - Perth	545	801	2.6
7	Mumbai - Mauritius	437	798	4.1
8	Johannesburg - Sydney	426	617	2.5
9	Addis Ababa - Mumbai	388	562	2.5
10	Bangkok - Nairobi	360	648	4.0
11	Johannesburg - Kuala Lumpur	316	529	3.5
12	Cairo -Tokyo	313	580	4.2
13	Addis Ababa - Delhi	259	473	4.1
14	Bangkok - Cairo	240	445	4.2
15	Bangkok - Antananarivo	209	387	4.2
16	Cairo - Kuala Lumpur	208	301	2.5
17	Harare - Singapore (Changi)	208	301	2.5
18	Hong Kong - Mauritius	207	367	3.9
19	Delhi - Mauritius	206	376	4.1
20	Cairo - Osaka(Kansai)	204	373	4.1
21	Mauritius - Singapore (Changi)	170	246	2.5
22	Kuala Lumpur - Mauritius	167	310	4.2
23	Chennai - Mauritius	122	177	2.5
24	Mauritius - Perth	121	175	2.5
25	Cape Town - Singapore (Changi)	104	193	4.2
	All Other	499	726	2.5
	TOTAL	10192	18195	3.9

1/ Both directions.
2/ OAG data.
3/ Please note that these growth rates are for the 2005–2020 period and may differ from the ones presented in Table-5.

TABLE C-5

INTRA AFRICA
TOP 25 CITY PAIRS RANKED BY 2005 MOVEMENTS

	City-Pair	Aircraft Movements[1/] 2005[2/]	Aircraft Movements[1/] 2020	Average Annual Growth (%)[3/] 2005-2020
1	Gaborone - Johannesburg	7026	20789	7.5
2	Mauritius - St Denis de la Réunion	5019	12373	6.2
3	Entebbe - Nairobi	4814	12381	6.5
4	Johannesburg - Windhoek	4551	13095	7.3
5	Accra - Lagos	4414	17220	9.5
6	Dar Es Salaam - Nairobi	3639	12718	8.7
7	Kilimanjaro - Nairobi	3344	13046	9.5
8	Bamako - Dakar	3067	9865	8.1
9	Harare - Johannesburg	3024	8580	7.2
10	Abidjan - Bamako	2863	10719	9.2
11	Johannesburg - Manzini	2804	7011	6.3
12	Johannesburg - Maputo	2693	9412	8.7
13	Cape Town - Windhoek	2618	8901	8.5
14	Johannesburg - Nairobi	2392	8360	8.7
15	Cairo - Khartoum	2169	8233	9.3
16	Johannesburg - Maseru	2162	4184	4.5
17	Abidjan - Cotonou	2085	6895	8.3
18	Abidjan - Accra	2058	8029	9.5
19	Douala - Libreville	2014	8075	9.7
20	Abidjan - Lome	2006	7614	9.3
21	Harare - Lusaka	2004	7004	8.7
22	Johannesburg - Livingstone	1988	9384	10.9
23	Mauritius - St Pierre de la Réunion	1963	6861	8.7
24	Johannesburg - Victoria Falls	1880	5043	6.8
25	Banjul - Dakar	1739	6078	8.7
	All Other	131207	389935	7.5
	Total	205543	631806	7.8

1/ Both directions.
2/ OAG data.
3/ Please note that these growth rates are for the 2005–2020 period and may differ from the ones presented in Table-5

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APPENDIX D

FORECASTS FOR THE SIX AREAS OF ROUTING DEFINED BY APIRG

The geographical scope of the six areas of routing (ARs) to, from and within Africa, defined by APIRG is described below:

AR-1: Europe South Atlantic (EUR/SAT)
AR-2: Atlantic Ocean (AFI-NAT/SAM interface)
AR-3: Europe – Eastern Africa (including Oceanic Areas)
AR-4: Europe – Southern Africa, including Continental Southern Africa routes
AR-5: Continental Western Africa including coastal areas
AR-6: Trans – Indian Ocean

A visual representation of FIRs covered by these areas of routing appears in **Figure D-1** at the end of this Appendix.

The methodology adopted for the development of aircraft movement forecasts for AR-1 to AR-6 is summarized as follows:

1. Analyze historical aircraft movements trends for city-pairs pertaining to AR-1 to AR-6 using OAG data for the past 10 years.

2. Extract the forecast growth rates of the city-pairs pertaining to AR-2 through AR-6 from the city-pair forecasts developed for the major route groups shown in Appendix C.

3. For the city-pairs pertaining to the AR-2 to AR-6 route areas for which no match is available in tables presented in Appendix C, apply the growth rates of the "All Other" traffic category from the corresponding route group in Appendix C. For the area of routing AR-1, the forecast is based purely on the past trends.

4. Aggregate city-pair aircraft movements traffic of AR-1 to AR-6 and develop total aircraft movement forecasts up to the year 2020.

It should be noted that city-pairs in these forecasts are extracted from States which would fall within the geographical area of the FIRs covered by each of the areas of routing AR-1 to AR-6. Flights which originate and terminate outside the geographical coverage of these ARs may not be included in this analysis. Moreover, some city-pairs could be repeated in more than one area of routing due mainly to FIRs overlapping in more than one State. City-pair traffic appearing in Tables D-1 through D-6 refers to traffic in both directions.

TABLE D-1

EUROPE SOUTH ATLANTIC (AR-1)
AIRCRAFT MOVEMENTS FORECAST TO THE YEAR 2020

CITY-PAIR	CITY-PAIR NAME	2005	2020	Growth (%) 2005-2020
EZE-MAD	Buenos Aires - Madrid	2828	5713	4.8
CDG-GRU	Paris (CDG) - Sao Paulo (Guarulhos)	2767	5432	4.6
FRA-GRU	Frankfurt - Sao Paulo (Guarulhos)	2088	4466	5.2
MAD-SCL	Madrid - Santiago(Intl)	1592	3504	5.4
GRU-MAD	Sao Paulo (Guarulhos) - Madrid	1472	2890	4.6
GRU-LHR	Sao Paulo (Guarulhos) - London (Heathrow)	1459	2864	4.6
GRU-LIS	Sao Paulo (Guarulhos) - Lisbon	1358	2666	4.6
GRU-MXP	Sao Paulo (Guarulhos) - Milan	1281	2625	4.9
GIG-MAD	Rio de Janeiro - Madrid	902	1875	5.0
GIG-LIS	Rio de Janeiro - Lisbon	848	1788	5.1
CDG-GIG	Paris(CDG) - Rio de Janeiro	747	1531	4.9
CDG-EZE	Paris (CDG) - Buenos Aires	730	1433	4.6
GRU-JNB	Sao Paulo (Guarulhos) - Johannesburg (Intl.)	730	1393	4.4
LIS-SSA	Lisbon – Salvador	714	1549	5.3
FOR-LIS	Fortaleza – Lisbon	712	1438	4.8
LIS-REC	Lisbon – Recife	695	1552	5.5
AMS-GRU	Amsterdam - Sao Paulo (Guarulhos)	676	1426	5.1
FRA-GIG	Frankfurt - Rio de Janeiro	674	1323	4.6
EZE-FCO	Buenos Aires - Rome (Fiumicino)	642	1354	5.1
GRU-ZRH	Sao Paulo (Guarulhos) - Zurich	521	1099	5.1
EZE-MXP	Buenos Aires - Milan	503	1123	5.5
LIS-NAT	Lisbon - Natal	408	836	4.9
MAD-SSA	Madrid - Salvador	350	781	5.5
MAD-MVD	Madrid - Montevideo	255	523	4.9
CPT-EZE	Cape Town - Buenos Aires	208	464	5.5
FCO-GRU	Rome (Fiumicino) - Sao Paulo (Guarulhos)	174	388	5.5
GIG-LAD	Rio de Janeiro - Luanda	103	211	4.9
FOR-SID	Fortaleza - Sal	96	197	4.9
EZE-FRA	Buenos Aires - Frankfurt	95	195	4.9
BCN-EZE	Barcelona - Buenos Aires	71	146	4.9
EZE-TFN	Buenos Aires - Tenerife (Norte)	66	135	4.9
MXP-NAT	Milan - Natal	58	119	4.9
FOR-MXP	Fortaleza - Milan	56	115	4.9
CDG-SCL	Paris (CDG) - Santiago (Intl.)	53	109	4.9
FRA-SSA	Frankfurt - Salvador	47	96	4.9
MXP-REC	Milan - Recife	47	96	4.9
MCZ-MXP	Maceio - Milan	44	90	4.9
CRD-FRA	Comodoro Rivadavia - Frankfurt	29	59	4.9

TABLE D-1 (Continued)

CITY-PAIR	CITY-PAIR NAME	2005	2020	Growth (%) 2005-2020
MXP- SSA	Milan - Salvador	24	49	4.9
SCL- TFN	Santiago (Intl.) - Tenerife (Norte)	20	41	4.9
FOR- RAI	Fortaleza - Praia (F. Mendes)	16	33	4.9
CDG- REC	Paris (CDG) - Recife	13	27	4.9
FOR- LPA	Fortaleza - Las Palmas	12	25	4.9
EZE- LPA	Buenos Aires - Las Palmas	4	8	4.9
GIG- MXP	Rio de Janeiro - Milan	3	6	4.9
MVD- TFS	Montevideo - Tenerife (Sofia)	2	4	4.9
NAT- TSF	Natal - Venice (Treviso)	2	4	4.9
CDG- SSA	Paris (CDG) - Salvador	2	4	4.9
BPS- MXP	Porto Seguro - Milan	2	4	4.9
FCO- NAT	Rome (Fiumicino) - Natal	2	4	4.9
EZE- SCQ	Buenos - Santiago	1	2	4.9
GIG- LHR	Rio de Janeiro - London (Heathrow)	1	2	4.9
	TOTAL	26203	53820	4.9

TABLE D-2

ATLANTIC OCEAN (AFI-NAT/SAM) (AR-2)
AIRCRAFT MOVEMENTS FORECAST TO THE YEAR 2020

CITY-PAIR	CITY-PAIR NAMES	2005	2020	Growth (%) 2005-2020
JNB- GRU	Sao Paulo (Intl.) - Johannesburg	730	2160	7.5
JFK- DKR	New York (Kennedy) - Dakar	713	1685	5.9
EZE- CPT	Cape Town - Buenos Aires (Pistarini)	208	375	4
IAD- ACC	Washington (Dulles Intl) - Accra	203	473	5.8
LAD- GIG	Rio De Janeiro (Intl) - Luanda	103	173	3.5
JFK- ACC	New York (Kennedy) - Accra	55	106	4.5
JNB- JFK	New York (Kennedy) - Johannesburg	17	28	3.5
	TOTAL	2029	5000	6.2

TABLE D-3

EUROPE-EASTERN AFRICA, INCLUDING OCEANIC AREAS (AR-3)
AIRCRAFT MOVEMENTS FORECAST TO THE YEAR 2020

CITY-PAIR	CITY-PAIR NAME	2005	2020	Growth (%) 2005-2020
FRA- CAI	Frankfurt - Cairo	2168	4979	5.7
NBO- LHR	Nairobi (Intl.) - London (Heathrow)	2018	2923	2.5
MXP- CAI	Milan - Cairo	1811	4043	5.5
IST- CAI	Istanbul - Cairo	1610	4141	6.5
LHR- CAI	London (Heathrow) - Cairo	1601	3098	4.5
NBO- AMS	Nairobi (Intl.) - Amsterdam	1434	2077	2.5
CAI- ATH	Cairo - Athens	1433	3434	6.0
MRU- CDG	Paris (CDG) - Mauritius	1384	2422	3.8
FCO- CAI	Rome (Fiumicino) - Cairo	1211	2119	3.8
VIE- CAI	Vienna - Cairo	1199	2098	3.8
FCO- ADD	Rome (Fiumicino) - Addis Ababa	1045	1828	3.8
CDG- CAI	Paris (CDG) - Cairo	1042	1823	3.8
TIP- LHR	Tripoli - London (Heathrow)	1010	1767	3.8
TIP- MLA	Tripoli - Malta	1005	1758	3.8
CAI- AMS	Cairo - Amsterdam	935	1636	3.8
TIP- FCO	Tripoli - Rome (Fiumicino)	935	1636	3.8
MRU- LHR	Mauritius- London (Heathrow)	877	1534	3.8
TNR- CDG	Paris (CDG) - Antananarivo	875	1531	3.8
ORY- CAI	Paris (Orly) - Cairo	730	1277	3.8
TIP- MXP	Tripoli - Milan	673	1178	3.8
TIP- CDG	Tripoli - Paris (CDG)	634	1109	3.8
ZRH- CAI	Zurich - Cairo	562	983	3.8
HRG- FRA	Hurghada - Frankfurt	541	947	3.8
MAD- CAI	Madrid - Cairo	527	922	3.8
CAI- BUD	Cairo - Budapest	520	910	3.8
TIP- FRA	Tripoli - Frankfurt	518	906	3.8
TIP- IST	Tripoli - Istanbul	505	884	3.8
FRA- ADD	Frankfurt - Addis Ababa	500	875	3.8
SEZ- CDG	Paris (CDG) - Mahe	496	868	3.8
ZRH- TIP	Zurich - Tripoli	482	843	3.8
VIE- TIP	Vienna - Tripoli	476	833	3.8
CAI- BCN	Cairo - Barcelona	470	822	3.8
MUC- HRG	Munich (Intl.) - Hurghada	441	772	3.8
CPH- CAI	Copenhagen (Intl.) - Cairo	438	766	3.8
TIP- LGW	Tripoli - London (Gatwick)	436	763	3.8
SVO- CAI	Moscow (Sheremetyevo) - Cairo	361	632	3.8
DAR- AMS	Dar Es Salam - Amsterdam	358	626	3.8
JRO- AMS	Kilimanjaro - Amsterdam	356	623	3.8
TIP- BRU	Tripoli - Brussels	344	602	3.8
MUC- CAI	Munich (Intl.) - Cairo	339	593	3.8
ATH- ALY	Athens - Alexandria	331	579	3.8

TABLE D-3 (Continued)

CITY-PAIR	CITY-PAIR NAME	2005	2020	Growth(%) 2005-2020
TIP- AMS	Tripoli - Amsterdam	326	570	3.8
MRU- FRA	Mauritius - Frankfurt	318	556	3.8
ZRH- NBO	Zurich - Nairobi (Intl.)	317	555	3.8
FRA- ALY	Frankfurt - Alexandria	314	549	3.8
LHR- DAR	London (Heathrow) - Dar- Es- Salaam	313	548	3.8
LHR- EBB	London (Heathrow) - Entebbe/Kampala	312	546	3.8
SSH- LGW	Sharm El Sheikh - London (Gatwick)	306	535	3.8
PRG- CAI	Prague - Cairo	297	520	3.8
HRG- DUS	Hurghada - Dusseldorf (Intl.)	274	479	3.8
TIP- GVA	Tripoli - Geneva	264	462	3.8
NBO- BRU	Nairobi (Intl.) - Brussels	248	434	3.8
MBA- FRA	Mombasa - Frankfurt	232	406	3.8
GVA- CAI	Geneva - Cairo	213	373	3.8
IST- BEN	Istanbul - Benghazi	209	366	3.8
ZRH- BEN	Zurich - Benghazi	208	364	3.8
SEZ- LHR	Mahe - London (Heathrow)	198	346	3.8
TNR- MXP	Milan - Antananarivo	186	325	3.8
LHR- HBE	London (Heathrow) - Alexandria	183	320	3.8
DME- CAI	Moscow (Domodedovo) - Cairo	178	311	3.8
MRU- FCO	Rome (Fiumicino) - Mauritius	173	303	3.8
MUC- MRU	Munich (Intl.) - Mauritius	172	301	3.8
SEZ- FCO	Rome (Fiumicino) - Mahe	171	299	3.8
KBP- CAI	Kiev (Borispol) - Cairo	168	294	3.8
FCO- ASM	Rome (Fiumicino) - Asmara	158	276	3.8
HRG- AMS	Hurghada - Amsterdam	148	259	3.8
EBB- BRU	Entebbe/Kampala - Brussels	147	257	3.8
MLA- CAI	Malta - Cairo	147	257	3.8
CAI- BRU	Cairo - Brussels	142	248	3.8
TIP- KBP	Tripoli - Kiev (Borispol)	136	238	3.8
VIE- ALY	Vienna - Alexandria	134	234	3.8
OTP- CAI	Cairo - Bucharest (Otopeni)	131	229	3.8
MXP- MRU	Milan - Mauritius	123	215	3.8
CAI- BEG	Cairo - Belgrade	116	203	3.8
VIE- MRU	Vienna - Mauritius	113	198	3.8
SSH- MUC	Sharm El Sheikh - Munich (Intl.)	110	192	3.8
SXF- CAI	Cairo - Berlin (Schoenfeld)	106	185	3.8
DUS- CAI	Dusseldorf (Intl.) - Cairo	104	182	3.8
FCO- BEN	Rome (Fiumicino) - Benghazi	104	182	3.8
LXR- LHR	Luxor - London (Heathrow)	104	182	3.8
MJI- IST	Mitiga - Istanbul	104	182	3.8
ORY- LXR	Paris (Orly) - Luxor	104	182	3.8
TIP- SOF	Tripoli - Sofia	104	182	3.8
MBA- FCO	Rome (Fiumicino) - Mombasa	99	173	3.8
MUC- LXR	Munich (Intl.) - Luxor	99	173	3.8

TABLE D-3 (Continued)

CITY-PAIR	CITY-PAIR NAME	2005	2020	Growth (%) 2005-2020
MUC- MBA	Munich (Intl.) - Mombasa	98	171	3.8
STR- HRG	Stuttgart (Echterdingen) - Hurghada	98	171	3.8
VIE- HRG	Vienna - Hurghada	96	168	3.8
LXR- BRU	Luxor - Brussels	91	159	3.8
KRT- CDG	Paris (CDG) - Khartoum	89	156	3.8
SSH- AMS	Sharm El Sheikh - Amsterdam	88	154	3.8
SSH- DUS	Sharm El Sheikh - Dusseldorf (Intl.)	88	154	3.8
HRG- FCO	Rome (Fiumicino) - Hurghada	86	150	3.8
HRG- GVA	Hurghada - Geneva	85	149	3.8
SEZ- FRA	Mahe - Frankfurt	82	143	3.8
AMS- ADD	Amsterdam - Addis Ababa	79	138	3.8
KRT- AMS	Khartoum - Amsterdam	79	138	3.8
SSH- FCO	Sharm El Sheikh - Rome (Fiumicino)	79	138	3.8
SEZ- MUC	Munich (Intl.) - Mahe	78	136	3.8
SXF- HRG	Hurghada - Berlin (Schoenfeld)	78	136	3.8
TNR- ORY	Paris (Orly) - Antananarivo	76	133	3.8
MXP- HRG	Milan - Hurghada	74	129	3.8
SOF- CAI	Sofia - Cairo	74	129	3.8
SSH- MXP	Sharm El Sheikh - Milan	74	129	3.8
LEJ- HRG	Leipzig/Halle - Hurghada	73	128	3.8
TIP- BEG	Tripoli - Belgrade	73	128	3.8
SSH- LHR	Sharm El Sheikh - London (Heathrow)	66	115	3.8
NBO- MAD	Nairobi (Intl.) - Madrid	62	108	3.8
ZRH- MRU	Zurich - Mauritius	62	108	3.8
MRU- GVA	Mauritius- Geneva - Geneva	60	105	3.8
EBB- AMS	Entebbe/Kampala - Amsterdam	54	94	3.8
KRT- FRA	Khartoum - Frankfurt	54	94	3.8
SSH- MAN	Sharm El Sheikh - Manchester	54	94	3.8
MXP- LXR	Milan - Luxor	53	93	3.8
VIE- LXR	Vienna - Luxor	53	93	3.8
LXR- FCO	Rome (Fiumicino) - Luxor	52	91	3.8
MAD- LXR	Madrid - Luxor	52	91	3.8
ASM- AMS	Asmara - Amsterdam	50	87	3.8
LXR- BCN	Luxor - Barcelona	50	87	3.8
MBA- DUS	Mombasa - Dusseldorf (Intl.)	50	87	3.8
MXP- ASM	Milan - Asmara	50	87	3.8
SSH- FRA	Sharm El Sheikh - Frankfurt	49	86	3.8
SSH- KZN	Sharm El Sheikh - Kazan	49	86	3.8
JRO- FRA	Kilimanjaro - Frankfurt	48	84	3.8
ORY- MBA	Paris (Orly) - Mombasa	48	84	3.8
TIP- BUD	Tripoli - Budapest	48	84	3.8
LGW- ADD	London (Gatwick) - Addis Ababa	47	82	3.8
STR- RMF	Stuttgart (Echterdingen) - Marsa Alam	47	82	3.8
ORY- NBO	Paris (Orly) - Nairobi (Intl.)	44	77	3.8

TABLE D-3 (Continued)

CITY-PAIR	CITY-PAIR NAME	2005	2020	Growth (%) 2005-2020
HRG- HAJ	Hurghada - Hanover	42	73	3.8
LGW- HRG	London (Gatwick) - Hurghada	42	73	3.8
MXP- MBA	Mombasa - Milan	38	66	3.8
RMF- MUC	Munich (Intl.) - Marsa Alam	38	66	3.8
VIE- SSH	Vienna - Sharm El Sheikh	38	66	3.8
TXL- SSH	Sharm El Sheikh - Berlin (Tegel)	30	52	3.8
LHR- ADD	London (Heathrow) - Addis	28	49	3.8
NUE- HRG	Nuremberg - Hurghada	28	49	3.8
SXF- SSH	Sharm El Sheikh - Berlin (Schoenfeld)	27	47	3.8
STR- SSH	Stuttgart (Echterdingen) - Sharm El Sheikh	22	38	3.8
ZNZ- MXP	Zanzibar - Milan	21	37	3.8
MSQ- HRG	Minsk (Intl.) - Hurghada	19	33	3.8
MBA- AMS	Mombasa - Amsterdam	16	28	3.8
STR- CAI	Stuttgart (Echterdingen) - Cairo	14	24	3.8
STR- LXR	Stuttgart (Echterdingen) - Luxor	14	24	3.8
LXR- AMS	Luxor - Amsterdam	13	23	3.8
LXR- FDH	Luxor - Friedrichshafen	13	23	3.8
SZG- HRG	Salzburg - Hurghada	13	23	3.8
SZG- LXR	Salzburg - Luxor	13	23	3.8
MAD- ASW	Madrid - Aswan	11	19	3.8
HBE- CDG	Paris (CDG) - Alexandria	10	17	3.8
LXR- FRA	Luxor - Frankfurt	10	17	3.8
NBO- IST	Nairobi (Intl.) - Istanbul	10	17	3.8
RMF- FRA	Marsa Alam - Frankfurt	10	17	3.8
SSH- GOJ	Sharm El Sheikh - Nizhniy	10	17	3.8
HRG- BEG	Hurghada - Belgrade	9	16	3.8
MBA- LEJ	Mombasa - Leipzig/Halle	8	14	3.8
SXF- MBA	Mombasa - Berlin (Schoenfeld)	8	14	3.8
RMF- AMS	Marsa Alam - Amsterdam	7	12	3.8
NBO- CDG	Paris (CDG) - Nairobi (Intl.)	6	10	3.8
LXR- DUS	Luxor - Dusseldorf (Intl.)	5	9	3.8
MBA- LHR	Mombasa - London (Heathrow)	4	7	3.8
FDH- CAI	Friedrichshafen - Cairo	1	2	3.8
GBM- AEY	Garbaharey - Akureyri	1	2	3.8
IFJ- GBM	Isafjordur - Garbaharey	1	2	3.8
RHO- CAI	Rhodes - Cairo	1	2	3.8
RMF- DUS	Marsa Alam - Dusseldorf (Intl.)	1	2	3.8
SSH- AYT	Sharm El Sheikh - Antalya	1	2	3.8
SSH- GVA	Sharm El Sheikh - Geneva	1	2	3.8
	TOTAL	46268	84522	4.1

TABLE D-4

EUROPE – SOUTH AFRICA INCLUDING CONTINENTAL SOUTHERN AFRICA (AR-4)
AIRCRAFT MOVEMENTS FORECAST TO THE YEAR 2020

CITY-PAIR	CITY-PAIR NAME	2005	2020	Growth(%) 2005-2020
ALG- ORY	Algiers - Paris (Orly)	4920	9940	4.8
JNB- LHR	Johannesburg (Intl.) - London (Heathrow)	3694	5196	2.3
CDG- TUN	Paris (CDG) - Tunis	2989	5785	4.5
ORY- TUN	Paris (Orly) - Tunis	2130	2784	1.8
CPT- LHR	Cape Town - London (Heathrow)	1832	3299	4.0
FCO- TUN	Rome (Fiumicino) - Tunis	1811	2547	2.3
LHR- LOS	Lagos - London (Heathrow)	1796	3953	5.4
MXP- TUN	Milan - Tunis	1656	3697	5.5
FRA- JNB	Frankfurt - Johannesburg (Intl.)	1462	2117	2.5
MRS- TUN	Marseille - Tunis	1462	2149	2.6
CDG- JNB	Johannesburg (Intl.) - Paris (CDG)	1414	3157	5.5
ALG- MRS	Algiers - Marseille	1358	1967	2.5
JNB- ZRH	Johannesburg (Intl.) - Zurich	1357	3345	6.2
LYS- TUN	Lyon - Tunis	1297	1934	2.7
ORN- ORY	Oran - Paris (Orly)	1223	2616	5.2
FRA- TUN	Frankfurt - Tunis	1199	1814	2.8
ALG- LYS	Algiers - Lyon	1117	1618	2.5
CZL- MRS	Constantine - Marseille	1055	2355	5.5
ALG- FCO	Algiers - Rome (Fiumicino)	1021	2345	5.7
BJA- ORY	Bejaia - Paris (Orly)	968	1694	3.8
NCE- TUN	Nice - Tunis	939	1643	3.8
CPT- FRA	Cape Town - Frankfurt	937	1639	3.8
IST- TUN	Istanbul - Tunis	921	1611	3.8
ALG- IST	Algiers - Istanbul	902	1578	3.8
ALG- CDG	Algiers - Paris (CDG)	808	1414	3.8
CZL- LYS	Constantine - Lyon	766	1340	3.8
AMS- JNB	Amsterdam - Johannesburg (Intl.)	734	1284	3.8
CDG- LOS	Lagos - Paris (CDG)	730	1277	3.8
AMS- LOS	Amsterdam - Lagos	728	1274	3.8
MRS- ORN	Marseille - Oran	724	1267	3.8
FRA- LOS	Frankfurt - Lagos	720	1260	3.8
ALG- MXP	Algiers - Milan	707	1237	3.8
ORY- TLM	Paris (Orly) - Tlemcen	679	1188	3.8
LAD- LIS	Lisbon - Luanda	654	1144	3.8
DJE- ORY	Djerba - Paris (Orly)	653	1143	3.8
ALG- LIL	Algiers - Lille	640	1120	3.8
ABV- LHR	Abuja - London (Heathrow)	637	1115	3.8
CZL- ORY	Constantine - Paris (Orly)	589	1031	3.8
AMS- CPT	Amsterdam - Cape Town	588	1029	3.8
LYS- ORN	Lyon - Oran	531	929	3.8

TABLE D-4 (Continued)

CITY-PAIR	CITY-PAIR NAME	2005	2020	Growth (%) 2005-2020
JNB- MAD	Johannesburg (Intl.) - Madrid	527	922	3.8
BCN- TUN	Barcelona - Tunis	520	910	3.8
MAD- TUN	Madrid - Tunis	520	910	3.8
ALG- LGW	Algiers - London (Gatwick)	476	833	3.8
ALG- FRA	Algiers - Frankfurt	444	777	3.8
ALG- LHR	Algiers - London (Heathrow)	444	777	3.8
LGW- TUN	London (Gatwick) - Tunis	434	759	3.8
AAE- ORY	Annaba - Paris (Orly)	429	751	3.8
ALG- BCN	Algiers - Barcelona	425	744	3.8
DUS- MIR	Dusseldorf (Intl.) - Monastir	422	738	3.8
HME- LGW	Hassi - London (Gatwick)	422	738	3.8
LHR- TUN	London (Heathrow) - Tunis	418	731	3.8
FRA- WDH	Frankfurt - Windhoek	415	726	3.8
ORN- TLS	Oran - Toulouse	414	724	3.8
BJA- LYS	Bejaia - Lyon.	413	723	3.8
CDG- PHC	Paris (CDG) - Pt. Harcourt	402	703	3.8
TLS- TUN	Toulouse - Tunis	393	688	3.8
CDG- NIM	Niamey - Paris (CDG)	392	686	3.8
BRU- TUN	Brussels - Tunis	391	684	3.8
CDG- NDJ	N'Djamena - Paris (CDG)	363	635	3.8
CDG- PNR	Paris (CDG) -.Pointe Noire	358	626	3.8
AAE- MRS	Annaba - Marseille	345	604	3.8
MRS- TLM	Marseille - Tlemcen	333	583	3.8
GVA- TUN	Geneva - Tunis	328	574	3.8
LIS- MPM	Lisbon - Maputo	323	565	3.8
BZV- CDG	Brazzaville - Paris (CDG)	319	558	3.8
HRE- LGW	Harare - London (Gatwick)	318	556	3.8
JNB- LGW	Johannesburg (Intl.) - London (Gatwick)	316	553	3.8
LOS- MAD	Lagos - Madrid	314	549	3.8
HRE- LHR	Harare - London (Heathrow)	313	548	3.8
LHR- LUN	London (Heathrow) - Lusaka	313	548	3.8
ATH- JNB	Athens - Johannesburg (Intl.)	312	546	3.8
MIR- ORY	Monastir - Paris (Orly)	312	546	3.8
CDG- FIH	Kinshasa - Paris (CDG)	309	541	3.8
ORY- TOE	Paris (Orly) - Tozeur	309	541	3.8
LOS- MXP	Lagos - Milan	306	535	3.8
MIR- MUC	Monastir - Munich (Intl.)	289	506	3.8
ALG- GVA	Algiers - Geneva	262	458	3.8
LGW- PHC	London (Gatwick) - Pt. Harcourt	258	451	3.8
BRU- MIR	Brussels - Monastir	247	432	3.8
LYS- MIR	Lyon - Monastir	245	429	3.8
CZL- MLH	Constantine - Mulhouse	242	423	3.8
MLA- TUN	Malta - Tunis	239	418	3.8
ALG- TLS	Algiers - Toulouse	236	413	3.8

TABLE D-4 (Continued)

CITY-PAIR	CITY-PAIR NAME	2005	2020	Growth (%) 2005-2020
ALC- ORN	Alicante - Oran	234	409	3.8
BSL- CZL	Basel - Constantine	228	399	3.8
FRA- PHC	Frankfurt - Pt. Harcourt	228	399	3.8
LAD- LHR	London (Heathrow) - Luanda	210	367	3.8
BRU- DJE	Brussels - Djerba	209	366	3.8
SXB- TUN	Strasbourg - Tunis	209	366	3.8
ALG- BRU	Algiers - Brussels	208	364	3.8
BOD- TUN	Bordeaux - Tunis	208	364	3.8
ORY- SFA	Paris (Orly) - Sfax	208	364	3.8
TUN- VIE	Tunis - Vienna	207	362	3.8
CDG- HME	Hassi - Paris (CDG)	206	360	3.8
ALG- MAD	Algiers - Madrid	204	357	3.8
ATH- TUN	Athens - Tunis	203	355	3.8
ALG- ETZ	Algiers - Metz/Nancy	202	353	3.8
BLJ- MRS	Batna - Marseille	202	353	3.8
TUN- ZRH	Tunis - Zurich	201	352	3.8
AMS- TUN	Amsterdam - Tunis	200	350	3.8
CDG- LAD	Luanda - Paris (CDG)	200	350	3.8
ABV- AMS	Abuja - Amsterdam	198	346	3.8
DJE- LYS	Djerba - Lyon	196	343	3.8
MIR- SXF	Berlin (Schoenfeld) - Monastir	185	324	3.8
LIS- TUN	Lisbon - Tunis	182	318	3.8
BRU- FIH	Brussels - Kinshasa	179	313	3.8
BEG- TUN	Belgrade - Tunis	177	310	3.8
MIR- VIE	Monastir - Vienna	170	297	3.8
FRA- MIR	Frankfurt - Monastir	169	296	3.8
TUN- WAW	Tunis - Warsaw	164	287	3.8
BJA- MRS	Bejaia - Marseille	163	285	3.8
DJE- MRS	Djerba - Marseille	163	285	3.8
AAE- LYS	Annaba - Lyon	160	280	3.8
MIR- MRS	Marseille - Monastir	160	280	3.8
BEG- MIR	Belgrade - Monastir	159	278	3.8
HAM- MIR	Hamburg (Fuhlsbuettel) - Monastir	158	276	3.8
LGW- WDH	London (Gatwick) - Windhoek	158	276	3.8
MUC- WDH	Munich (Intl.) - Windhoek	158	276	3.8
MIR- NCE	Monastir - Nice	153	268	3.8
DUS- TUN	Dusseldorf (Intl.) - Tunis	151	264	3.8
CPT- DUS	Cape Town - Dusseldorf (Intl.)	149	261	3.8
ALG- NCE	Algiers - Nice	132	231	3.8
BSK- LYS	Biskra - Lyon	132	231	3.8
BSK- ORY	Biskra - Paris (Orly)	130	227	3.8
DJE- NCE	Djerba - Nice	124	217	3.8
BLJ- ORY	Batna - Paris (Orly)	122	213	3.8
DJE- SXB	Djerba - Strasbourg	121	212	3.8

TABLE D-4 (Continued)

CITY-PAIR	CITY-PAIR NAME	2005	2020	Growth (%) 2005-2020
AMS- KAN	Amsterdam - Kano	113	198	3.8
MUC- TUN	Munich (Intl.) - Tunis	110	192	3.8
KBP- MIR	Kiev (Borispol) - Monastir	107	187	3.8
DJE- ZRH	Djerba - Zurich	106	185	3.8
ALG- BOD	Algiers - Bordeaux	104	182	3.8
BLJ- LYS	Batna - Lyon	104	182	3.8
DJE- GVA	Djerba - Geneva	104	182	3.8
FCO- MIR	Monastir - Rome (Fiumicino)	102	178	3.8
LUX- MIR	Luxembourg- Monastir	102	178	3.8
PMO- TUN	Palermo - Tunis	100	175	3.8
MIR- STR	Monastir - Stuttgart (Echterdingen)	98	171	3.8
PRG- TUN	Prague - Tunis	96	168	3.8
JNB- MXP	Johannesburg (Intl.) - Milan	94	164	3.8
CDG- MIR	Monastir - Paris (CDG)	91	159	3.8
DJE- VIE	Djerba - Vienna	88	154	3.8
LGW- MIR	London (Gatwick) - Monastir	88	154	3.8
BUD- TUN	Budapest - Tunis	87	152	3.8
DJE- FRA	Djerba - Frankfurt	87	152	3.8
JNB- LIS	Johannesburg (Intl.) - Lisbon	85	149	3.8
BRU- ORN	Brussels - Oran	80	140	3.8
MIR- PRG	Monastir - Prague	77	135	3.8
SXF- TUN	Berlin (Schoenfeld) - Tunis	77	135	3.8
DJE- HAJ	Djerba - Hanover	72	126	3.8
DJE- FCO	Djerba - Rome (Fiumicino)	71	124	3.8
LYS- TOE	Lyon - Tozeur	71	124	3.8
DJE- DUS	Djerba - Dusseldorf (Intl.)	69	121	3.8
BUD- MIR	Budapest - Monastir	67	117	3.8
ALG- SVO	Algiers - Moscow (Sheremetyevo)	66	115	3.8
ARN- TUN	Stockholm (Arlanda) - Tunis	66	115	3.8
CPH- TUN	Copenhagen (Intl.) - Tunis	66	115	3.8
HAM- TUN	Hamburg (Fuhlsbuettel) - Tunis	65	114	3.8
GVA- MIR	Geneva - Monastir	63	110	3.8
AMS- MIR	Amsterdam - Monastir	59	103	3.8
BRU- LAD	Brussels - Luanda	52	91	3.8
DUS- WDH	Dusseldorf (Intl.) - Windhoek	50	87	3.8
LAD- SVO	Luanda - Moscow (Sheremetyevo)	50	87	3.8
CDG- DJE	Djerba - Paris (CDG)	48	84	3.8
MRS- TOE	Marseille - Tozeur	47	82	3.8
CPT- MUC	Cape Town - Munich (Intl.)	44	77	3.8
MAD- MIR	Madrid - Monastir	44	77	3.8
SXB- TOE	Strasbourg - Tozeur	43	75	3.8
DJE- MUC	Djerba - Munich (Intl.)	42	73	3.8
LGW- LOS	Lagos - London (Gatwick)	41	72	3.8
DJE- STR	Djerba - Stuttgart (Echterdingen)	32	56	3.8

TABLE D-4 (Continued)

CITY-PAIR	CITY-PAIR NAME	2005	2020	Growth (%) 2005-2020
CDG- TLM	Paris (CDG) - Tlemcen	31	54	3.8
BJA- CDG	Bejaia - Paris (CDG)	28	49	3.8
ALC- ALG	Algiers - Alicante	26	45	3.8
ALG- MPL	Algiers - Montpellier	26	45	3.8
ALG- SXF	Algiers - Berlin (Schoenfeld)	26	45	3.8
BOD- ORN	Bordeaux - Oran	26	45	3.8
CZL- NCE	Constantine - Nice	26	45	3.8
FRA- TBJ	Frankfurt - Tabarka	26	45	3.8
MIR- MLA	Malta- Monastir	26	45	3.8
MPL- ORN	Montpellier - Oran	26	45	3.8
STR- TBJ	Stuttgart (Echterdingen) - Tabarka	26	45	3.8
DJG- ORY	Djanet - Paris (Orly)	23	40	3.8
CDG- ORN	Oran - Paris (CDG)	22	38	3.8
GVA- ORN	Geneva - Oran	22	38	3.8
ORY- TMR	Paris (Orly) - Tamanrasset	22	38	3.8
CZL- GVA	Constantine - Geneva	20	35	3.8
LUX- TUN	Luxembourg- Tunis	20	35	3.8
PMO- TOE	Palermo - Tozeur	20	35	3.8
DJE- HAM	Djerba - Hamburg (Fuhlsbuettel)	18	31	3.8
DJE- SZG	Djerba - Salzburg	16	28	3.8
CDG- CZL	Constantine - Paris (CDG)	12	21	3.8
DJE- KBP	Djerba - Kiev (Borispol)	11	19	3.8
GVA- TBJ	Geneva - Tabarka	10	17	3.8
CDG- TMR	Paris (CDG) - Tamanrasset	9	16	3.8
BSK- CDG	Biskra - Paris (CDG)	8	14	3.8
CDG- SFA	Paris (CDG) - Sfax	8	14	3.8
ETZ- ORN	Metz/Nancy - Oran	7	12	3.8
AAE- BSL	Annaba - Basel	6	10	3.8
CDG- DJG	Djanet - Paris (CDG)	6	10	3.8
CZL- ETZ	Constantine - Metz/Nancy	6	10	3.8
AAE- CDG	Annaba - Paris (CDG)	5	9	3.8
ALG- LUX	Algiers - Luxembourg	5	9	3.8
ATH- MIR	Athens - Monastir	4	7	3.8
BJA- ETZ	Bejaia - Metz/Nancy	4	7	3.8
CZL- LIL	Constantine - Lille	4	7	3.8
CZL- LUX	Constantine - Luxembourg	4	7	3.8
DJE- NUE	Djerba - Nuremberg	4	7	3.8
GAF- IST	Gafsa - Istanbul	4	7	3.8
HAJ- MIR	Hanover - Monastir	4	7	3.8
LUX- ORN	Luxembourg - Oran	4	7	3.8
CDG- TOE	Paris (CDG) - Tozeur	3	5	3.8
LIL- TLM	Lille - Tlemcen	3	5	3.8
BEG- DJE	Belgrade - Djerba	2	3	3.8
BJA- LIL	Bejaia - Lille	2	3	3.8

TABLE D-4 (Continued)

CITY-PAIR	CITY-PAIR NAME	2005	2020	Growth (%) 2005-2020
BRU- TOE	Brussels - Tozeur	2	3	3.8
CGN- MIR	Cologne/Bonn.(Intl.) - Monastir	2	3	3.8
CHQ- TUN	Chania - Tunis	2	3	3.8
FRA- TOE	Frankfurt - Tozeur	2	3	3.8
LAD- OPO	Luanda - Porto	2	3	3.8
LIL- ORN	Lille - Oran	2	3	3.8
BUD- DJE	Budapest - Djerba	1	2	3.8
CFU- TUN	Kerkyra - Tunis	1	2	3.8
DJE- TLS	Djerba - Toulouse	1	2	3.8
FCO- TOE	Rome.(Fiumicino) - Tozeur	1	2	3.8
LEJ- MIR	Leipzig/Halle - Monastir	1	2	3.8
SXB- TBJ	Strasbourg - Tabarka	1	2	3.8
	TOTAL	77995	138208	3.9

TABLE D-5

CONTINENTAL WESTERN AFRICA INCLUDING COASTAL AREAS (AR-5)
AIRCRAFT MOVEMENTS FORECAST TO THE YEAR 2020

CITY-PAIR	CITY-PAIR NAME	2005	2020	Growth (%) 2005- 2020
ABV- LOS	Abuja - Lagos	13437	78630	12.5
LOS- PHC	Lagos - Pt. Harcourt	8750	56196	13.2
ACC- LOS	Accra - Lagos	4414	17220	9.5
CBQ- LOS	Calabar - Lagos	1662	9988	12.7
LOS- QRW	Lagos - Warri	1285	4491	8.7
ABV- IBA	Abuja - Ibadan	1040	2675	6.5
ABV- PHC	Abuja - Pt. Harcourt	798	4670	12.5
CBQ- PHC	Calabar - Pt. Harcourt	713	2492	8.7
ABV- YOL	Abuja - Yola	690	2412	8.7
ABV- MIU	Abuja - Maiduguri	624	2181	8.7
PHC- QRW	Pt. Harcourt - Warri	608	2125	8.7
ACC- ROB	Accra - Monrovia	576	2506	10.3
DKR- ZIG	Dakar - Ziguinchor	576	2247	9.5
KAD- LOS	Kaduna - Lagos	572	1692	7.5
IBA- LOS	Ibadan - Lagos	520	1539	7.5
ABV- KAN	Abuja - Kano	477	1411	7.5
KAN- LOS	Kano - Lagos	443	1311	7.5
ABV- SKO	Abuja - Sokoto	416	1231	7.5
ABV- KAD	Abuja - Kaduna	410	1213	7.5
DKR- ROB	Dakar - Monrovia	279	826	7.5
LOS- YOL	Lagos - Yola	247	731	7.5
CSK- DKR	Cap Skirring - Dakar	195	577	7.5
AEH- NDJ	Abecher - N'Djamena	184	544	7.5
BNI- LOS	Benin - Lagos	178	527	7.5
KAN- SKO	Kano - Sokoto	164	485	7.5
LOS- NIM	Lagos - Niamey	142	420	7.5
KAN- NDJ	Kano - N'Djamena	108	320	7.5
LOS- NDJ	Lagos - N'Djamena	89	263	7.5
KAN- NIM	Kano - Niamey	88	260	7.5
NDJ- NIM	N'Djamena - Niamey	58	172	7.5
ACC- DKR	Accra - Dakar	52	154	7.5
DKR- XLS	Dakar - St. Louis	52	154	7.5
ACC- KAN	Accra - Kano	48	142	7.5
DKR- TUD	Dakar - Tambacounda	40	118	7.5
	TOTAL	39935	201923	11.4

TABLE D-6

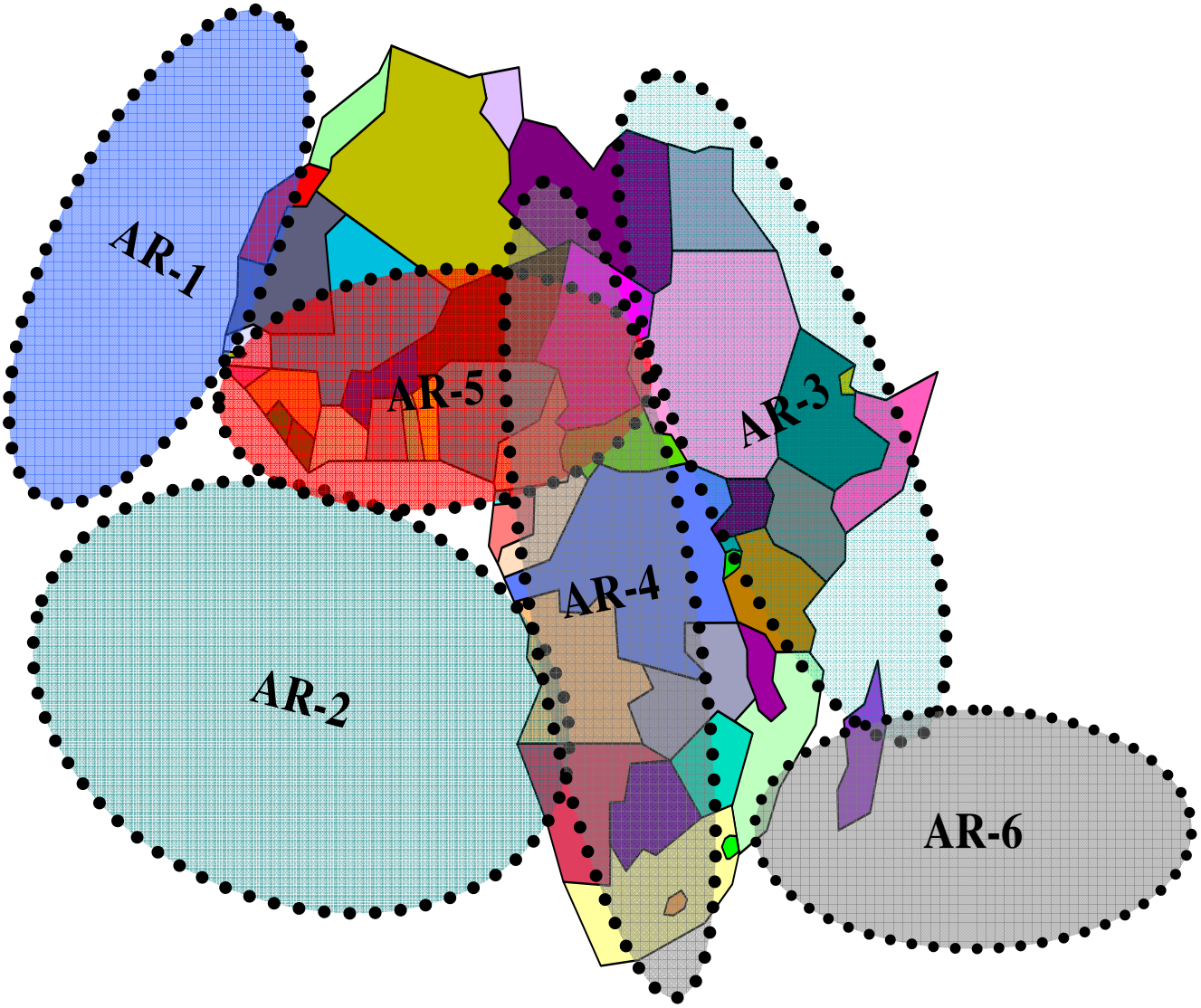
TRANS INDIAN OCEAN (AR-6)
AIRCRAFT MOVEMENTS FORECAST TO THE YEAR 2020

CITY-PAIR	CITY-PAIR NAME	2005	2020	Growth (%) 2005-2020
HKG- JNB	HongKong (Intl.) - Johannesburg (Intl.)	1436	3206	5.5
JNB- SIN	Johannesburg (Intl.) - Singapore (Changi)	730	1154	3.1
BOM- JNB	Johannesburg (Intl.) - Mumbai	681	1416	5.0
JNB- PER	Johannesburg (Intl.) - Perth	545	801	2.6
JNB- SYD	Johannesburg (Intl.) - Sydney (Intl.)	426	617	2.5
JNB- KUL	Johannesburg (Intl.) - Kuala Lumpur	316	529	3.5
BKK- TNR	Antananarivo - Bangkok	209	387	4.2
CPT- SIN	CapeTown (Intl.) - Singapore (Changi)	104	193	4.2
SEZ- SIN	Mahe - Singapore (Changi)	96	139	2.5
MLE- SEZ	Mahe - Male	36	52	2.5
BOM- SEZ	Mahe - Mumbai	28	41	2.5
	TOTAL	4607	8535	4.2

.

FIGURE D-1

AREAS OF ROUTING AR-1 TO AR-6



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APPENDIX E

PEAK- PERIOD ANALYSIS FOR ASECNA FIR

FIR traffic data provided by ASECNA for the year 2005 was analyzed thoroughly in order to determine the main peak- period parameters using a computer application developed by the Secretariat. The analysis covered the following items :

1. Monthly traffic

2. Daily traffic analysis:
   - 2.1 Daily profile of traffic by control centre
   - 2.2 Maximum, minimum and average daily traffic
   - 2.3 Daily traffic ranking
   - 2.4 Daily traffic probability distribution

3. Hourly traffic analysis:
   - 3.1 Hourly traffic (whole year)
   - 3.2 Traffic profile by specified hour
   - 3.3 Maximum, minimum and average hourly traffic
   - 3.4 Traffic peaking by specified hour
   - 3.5 Hourly traffic probability distribution

4. Annual traffic analysis:
   - 4.1 Aircraft movements by aircraft type
   - 4.2 Aircraft movements by flight level
   - 4.3 Aircraft movements by point of entry
   - 4.4 Aircraft movements by point of exit
   - 4.5 Aircraft movements by pair of entry point-exit point.
   - 4.6 Aircraft movements by origin and destination
   - 4.7 Detailed analysis of aircraft movement traffic (through data field combinations)

5. Traffic density analysis:
   - 5.1 Traffic density for a given time interval
   - 5.2 Traffic density for a given point in time

The following sections provide the detailed results for the Dakar Centre.

1. **Monthly traffic**

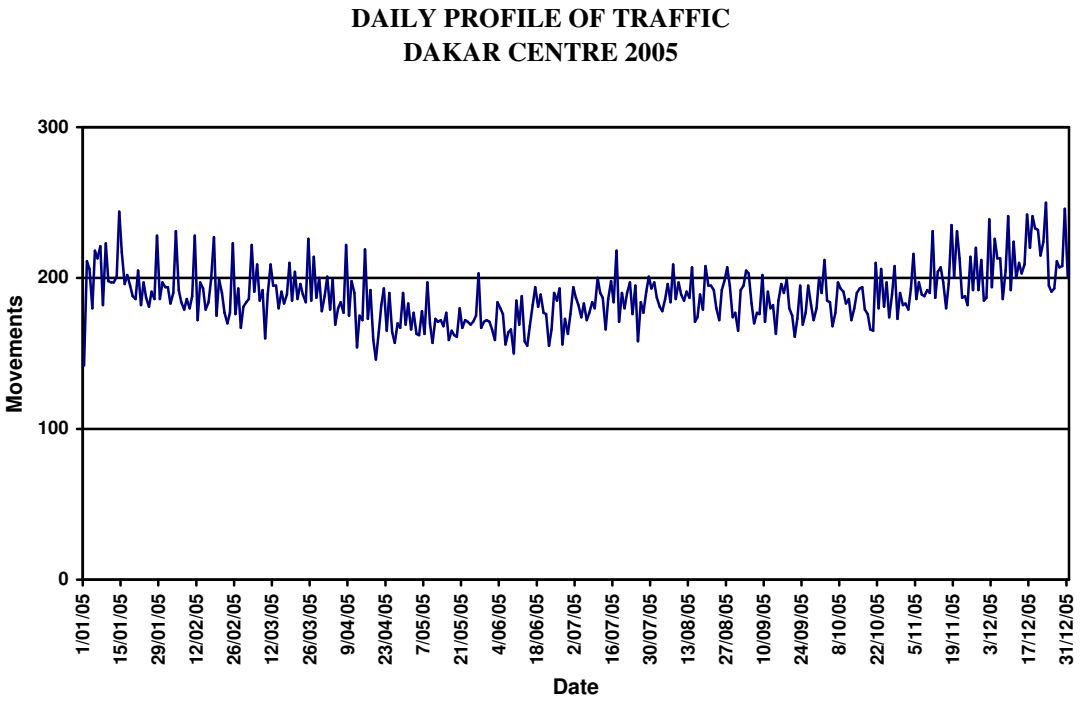
The table below illustrates the monthly traffic for Dakar Centre for the year 2005:

Dakar Centre	
2005	
Month	Movements
January	6151
February	5333
March	5973
April	5375
May	5313
June	5180
July	5762
August	5826
September	5519
October	5771
November	5967
December	6651

2. **Daily traffic analysis**

2.1 **Daily profile of traffic by control centre**

The following figure shows the daily traffic profile for the Dakar- Centre and helps in the identification of any seasonality pattern in the annual traffic.



2.2 **Maximum, minimum and average daily traffic**

Beyond, the graphical display, the maximum, the minimum and the average daily traffic were produced for the centre concerned.

Maximum daily traffic: 250
Minimum daily traffic: 142
Average daily traffic: 188

2.3 **Daily traffic ranking**

The daily traffic was ranked by number of flights. This helps identify the busiest day and the least busy day for the whole year period (365 days). For illustration purposes, the first 20 days of Dakar- centre are displayed in the table below.

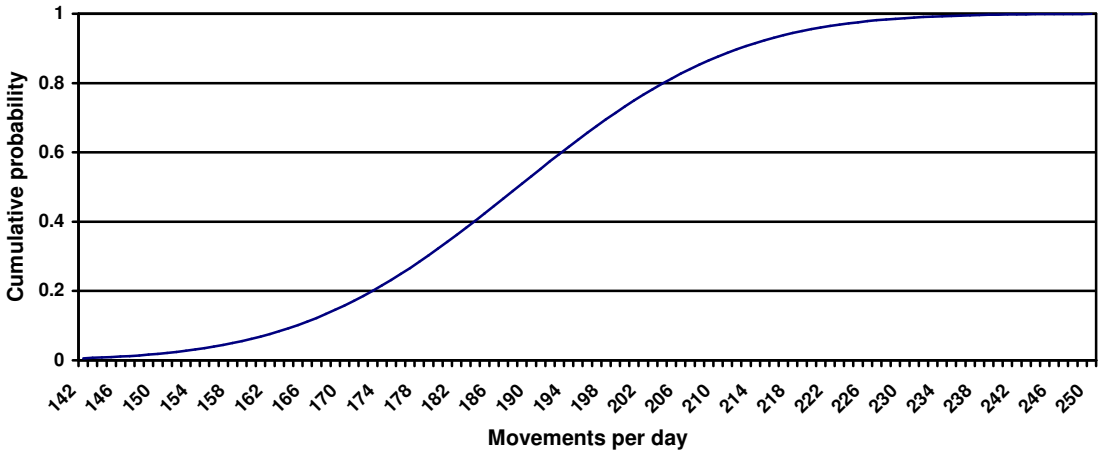
Dakar Centre		
2005		
Rank	Date	Movements
1	23/12/05	250
2	30/12/05	246
3	14/01/05	244
4	16/12/05	242
5	18/12/05	241
6	9/12/05	241
7	2/12/05	239
8	18/11/05	235
9	19/12/05	233
10	20/12/05	232
11	20/11/05	231
12	11/11/05	231
13	4/02/05	231
14	28/01/05	228
15	11/02/05	228
16	18/02/05	227
17	4/12/05	226
18	25/03/05	226
19	11/12/05	224
20	22/12/05	224

***Note*:** The full output result includes all 365 days.

2.4 **Daily traffic probability distribution**

The data was used to build a normal probability distribution for the daily traffic. Such a distribution may be very useful for planning purposes, since it provides for any given daily traffic level, the probability that the actual traffic will exceed it. For example the following chart plotted for traffic through Dakar Centre in 2005 shows that if the capacity is set to 200 flights per day, there would be under- capacity 20 per cent of the time.

DAILY CUMULATIVE DISTRIBUTION
DAKAR CENTRE, 2005



Similarly, if one decides to accept a probability of under- capacity of 10 per cent, then the planning parameter should be around 215 flights per day.

The following table illustrates further the probability distribution and provides further guidance in the capacity setting process.

Dakar Centre	
2005	
Maximum Traffic (per day)	Probability
158	0.05
165	0.1
169	0.15
173	0.2
176	0.25
179	0.3
181	0.35
184	0.4
186	0.45
189	0.5
190	0.55
193	0.6
195	0.65
198	0.7
201	0.75
204	0.8
207	0.85
212	0.9
219	0.95
250	1.0

3. Hourly traffic analysis

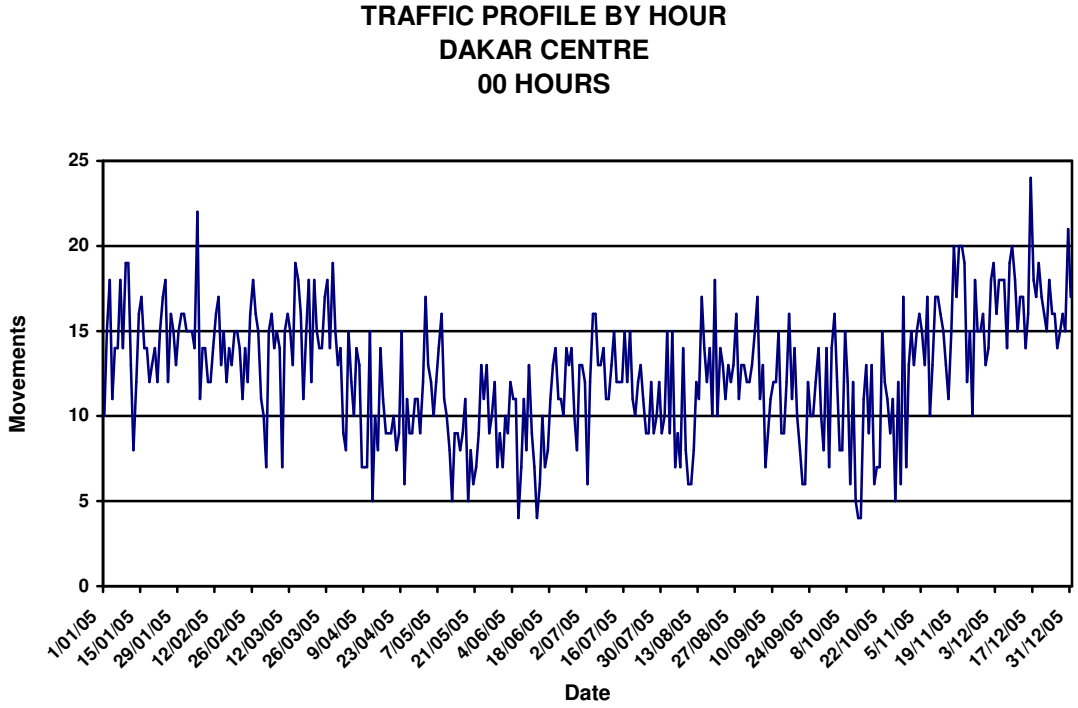
3.1 Hourly Traffic (whole year)

The program calculates the traffic by hour for the whole year and provides a sorted list of traffic by hour (the maximum size of the sorted list is 24*365 = 8760 rows. The following table shows the top 10 hours in terms of traffic for the whole year.

Dakar Centre			
2005			
Rank	Date	Hour	Movements
1	4/08/05	2	25
2	13/09/05	2	25
3	16/12/05	0	24
4	28/10/05	2	23
5	5/11/05	3	23
6	1/08/05	2	23
7	19/12/05	4	23
8	12/06/05	23	23
9	3/10/05	2	23
10	1/09/05	2	23

3.2 Traffic profile by specified hour

Traffic profile charts by generic hour and by control centre were also produced for the 2005 year. The following figure illustrates traffic profile for Dakar- Centre at midnight:



3.3 **Maximum, minimum and average traffic for a specified hour**

Beyond the graphical display, the maximum, the minimum and the average traffic at midnight for the centre concerned, in this case Dakar Centre, were determined:

Maximum daily traffic: 24
Minimum daily traffic: 4
Average daily traffic: 12

3.4 **Traffic peaking by specified hour**

The following table provides more insight into traffic peaking at midnight (by providing the list of the top 20 days for traffic at midnight).

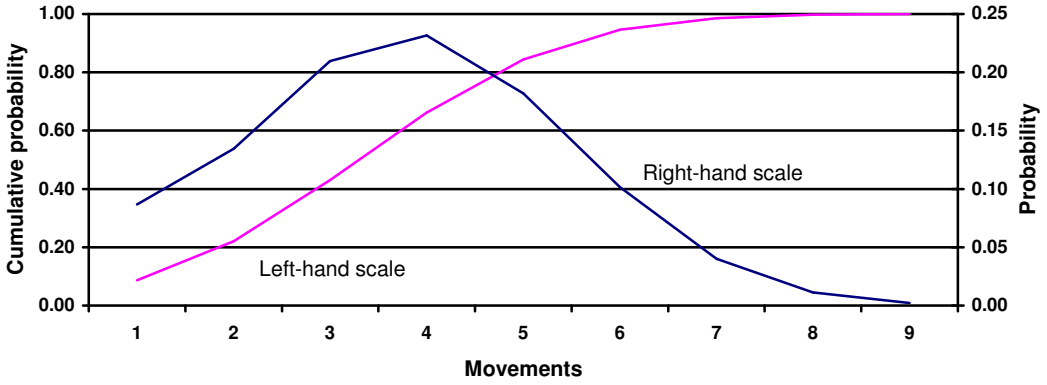
Dakar Centre		
Midnight Traffic 2005		
Rank	Date	Movements
1	16- Dec- 05	24
2	05- Feb- 05	22
3	30- Dec- 05	21
4	09- Dec- 05	20
5	17- Nov- 05	20
6	19- Nov- 05	20
7	20- Nov- 05	20
8	19- Dec- 05	19
9	08- Dec- 05	19
10	28- Mar- 05	19
11	21- Nov- 05	19
12	02- Dec- 05	19
13	10- Jan- 05	19
14	09- Jan- 05	19
15	14- Mar- 05	19
16	19- Aug- 05	18
17	21- Mar- 05	18
18	04- Dec- 05	18
19	15- Mar- 05	18
20	26- Mar- 05	18

***Note*:** The full list has all 365 days.

3.5 **Hourly traffic probability distribution**

It is also possible, for planning purposes, to calculate the probability that traffic would not exceed a given level for a particular hour. The following chart illustrates the probability distribution for midnight traffic in the Dakar FIR.

DAKAR CENTRE
MIDNIGHT TRAFFIC



The following table provides the probabilities for maximum traffic per hour.

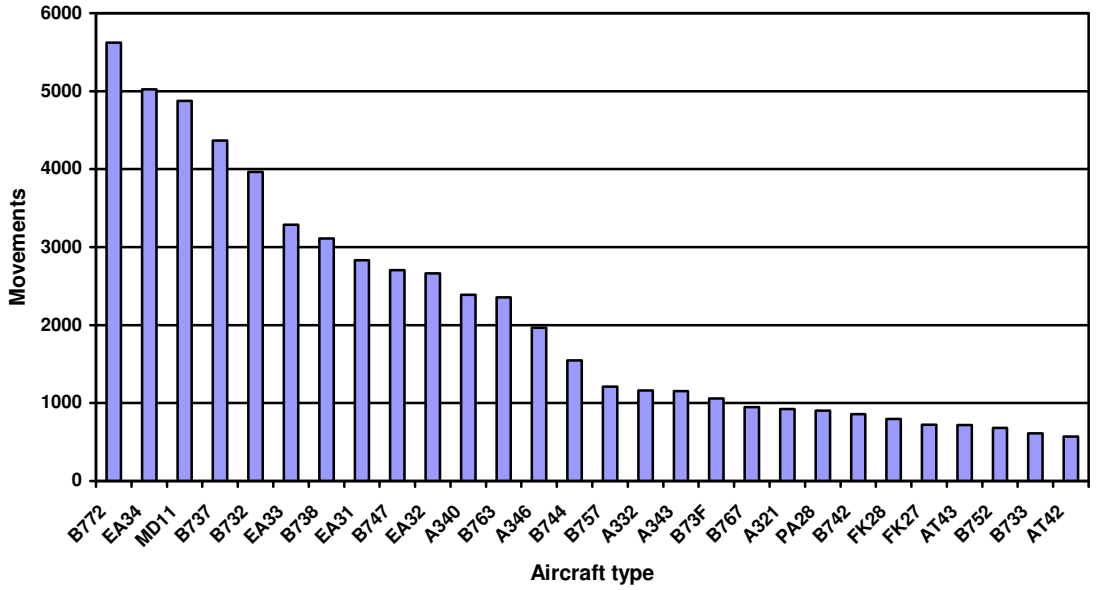
Dakar Centre	
Midnight Traffic	
Maximum Traffic Per Hour	Probability
1	0.087
2	0.221
3	0.431
4	0.662
5	0.844
6	0.946
7	0.986
8	0.997
9	1.0

4. Annual traffic analysis

4.1 Aircraft movements by aircraft type

Using the ASECNA FIR traffic data, it was possible to analyze for each control centre the traffic by aircraft type. For example, the following chart illustrates the aircraft movements traffic by aircraft type.

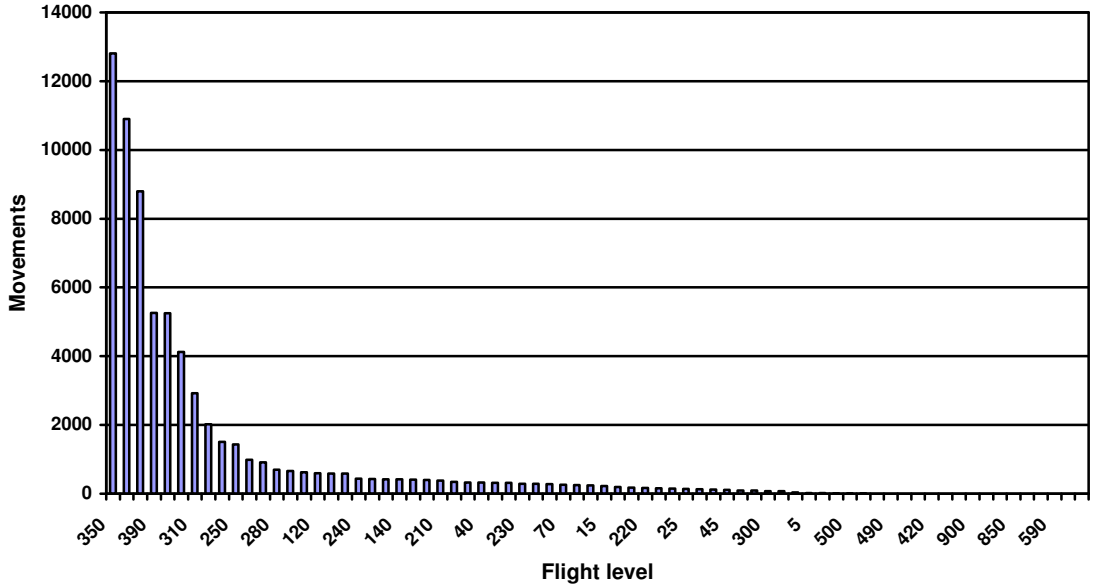
MOVEMENTS BY AIRCRAFT TYPE
DAKAR CENTRE, 2005



4.2 **Aircraft movements by flight level**

Using the same set of data, aircraft movements by flight level are illustrated in the figure below.

MOVEMENTS BY FLIGHT LEVEL
DAKAR CENTRE, 2005



4.3 **Aircraft movements by point of entry**

FIR traffic was aggregated by point of entry (to the FIR) and sorted by traffic volume (aircraft movements). The table below shows the top 10 points of entry for Dakar Centre in 2005.

Dakar Centre		
2005		
Rank	Entry Point	Movements
1	GOOY	13162
2	TASIL	5273
3	ECHED	4920
4	KENOX	4629
5	DEKON	3677
6	POMAT	3473
7	NANIK	2378
8	BOTNO	1973
9	GATIL	1848
10	GBYD	1797

4.4 **Aircraft movements by point of exit**

FIR traffic was aggregated by point of exit (from the FIR) and sorted by traffic volume (aircraft movements). The table below shows the top 10 exit points for Dakar- Centre in 2005.

Dakar Centre		
2005		
Rank	Exit Point	Movements
1	GOOY	13011
2	POMAT	5272
3	NANIK	4634
4	ECHED	4614
5	AMDOL	3673
6	TASIL	3475
7	KENOX	2381
8	ERETU	1978
9	GBYD	1780
10	KODOS	1716

4.5 **Aircraft movements by pair of entry point-exit point.**

In addition, FIR traffic was aggregated by pair of entry and exit points and sorted by traffic volume (aircraft movements). The table below shows the top 10 pair of entry and exit points, for Dakar Centre in 2005.

Dakar Centre		
2005		
Rank	Entry-Exit Point	Movements
1	TASIL- POMAT	5268
2	KENOX- NANIK	4629
3	DEKON- AMDOL	3672
4	POMAT- TASIL	3471
5	ECHED- GOOY	2384
6	NANIK- KENOX	2376
7	GOOY- ECHED	2333
8	BOTNO- ERETU	1973
9	GATIL- GOOY	1768
10	AMDOL- DEKON	1677

4.6 **Aircraft movements by origin and destination**

Moreover, FIR traffic was aggregated by pair of origin and destination and sorted by traffic volume (aircraft movements). The table below shows the top origin- destinations, for Dakar Centre in 2005.

Dakar Centre		
2005		
Rank	Origin-Destination	Movements
1	SAEZ- LEMD	1606
2	LEMD- SAEZ	1601
3	LFPG- SBGR	1376
4	GABS- GOOY	1368
5	SBGR- LFPG	1365
6	GOOY- GABS	1152
7	SBGR- EDDF	1088
8	EDDF- SBGR	964
9	GOOY- DIAP	887
10	GOOY- LFPG	872

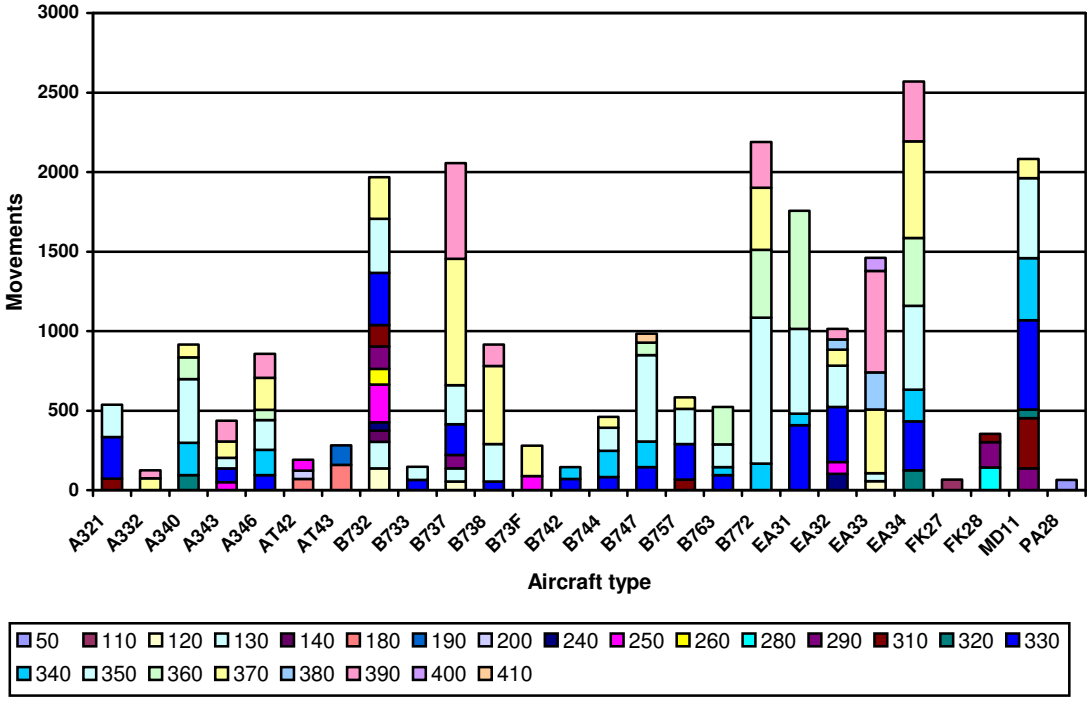
4.7 **Detailed analysis of aircraft movement traffic (through data field combinations)**

The analysis of FIR data was extended further through the production of tables and charts combining relevant data fields such as aircraft type, flight level, pair of entry and exit points, pair of origin and destination and type of traffic (inbound, outbound, overflight, within FIR).

For example, the knowledge of the number of aircraft movements by aircraft type and by flight level would give an indication about the proportion of aircraft not flying at their optimum flight level.

The figure below illustrates the traffic by aircraft type and by flight level for Dakar Centre:

MOVEMENTS BY AIRCRAFT TYPE AND BY FLIGHT LEVEL
DAKAR CENTRE, 2005



5. Traffic density analysis

The traffic density analysis was carried out by time interval and for specific points in time.

5.1 Traffic density for a given time interval

The following table lists all the flights for the annual peak hour occurring on the 4th of August 2005 between 2:00 AM and 3:00 AM. It includes all flights that have either entered or exited the Dakar FIR during that hour or remained in the FIR for the whole period. For this reason, the number of flights (39) is higher than the peak- hour traffic (25), which includes only the flights that have entered the FIR during the same hour.

Date	Aircraft Type	Entry-Exit	Time of Entry	Time of Exit	Origin-Destination	Type of Traffic
4/08/05	B73F	ECHED-UNADO	12:40:00 AM	02:34:00 AM	GMMN-GABS	Inbound
4/08/05	EA34	DEKON-AMDOL	12:49:00 AM	02:11:00 AM	SBGR-LPPT	Overflight
4/08/05	EA34	TASIL-POMAT	01:15:00 AM	02:35:00 AM	SBGL-LPPT	Overflight
4/08/05	MD11	BOTNO-ERETU	01:18:00 AM	02:40:00 AM	LIMC-SBGR	Overflight
4/08/05	EA34	DEKON-AMDOL	01:28:00 AM	02:46:00 AM	SBGR-EDDF	Overflight
4/08/05	PA28	GOOY -ECHED	01:30:00 AM	03:25:00 AM	GOOY-LFPO	Outbound
4/08/05	B772	POMAT-TASIL	01:37:00 AM	02:55:00 AM	LIMC-SAEZ	Overflight
4/08/05	EA34	BADIA-GOOY	01:37:00 AM	02:31:00 AM	FAJS-GOOY	Inbound
4/08/05	EA32	GOOY -BRENA	01:38:00 AM	03:34:00 AM	GOOY-LIMC	Outbound
4/08/05	A321	GUPEL-GOOY	01:46:00 AM	03:10:00 AM	GMMN-GOOY	Inbound
4/08/05	B744	BOTNO-ERETU	01:52:00 AM	03:13:00 AM	LEMD-SAEZ	Overflight
4/08/05	B737	GOOY -ECHED	01:55:00 AM	03:51:00 AM	GOOY-LFML	Outbound
4/08/05	MD11	POMAT-TASIL	02:03:00 AM	03:22:00 AM	LFPG-SBGR	Overflight
4/08/05	MD11	MOGSA-AKDAK	02:07:00 AM	02:55:00 AM	KIAH-FNLU	Overflight
4/08/05	EA33	DEKON-AMDOL	02:08:00 AM	03:29:00 AM	SBGR-LFPG	Overflight
4/08/05	A343	KODOS-ECHED	02:10:00 AM	06:00:00 AM	SBGR-LSZH	Overflight
4/08/05	B747	BOTNO-ERETU	02:10:00 AM	03:46:00 AM	EDDF-SBGR	Overflight
4/08/05	EA31	NANIK-KENOX	02:11:00 AM	03:24:00 AM	SBFZ-LPPT	Overflight
4/08/05	EA34	OPULU-BULIS	02:12:00 AM	03:47:00 AM	FNLU-LPPT	Overflight
4/08/05	A346	BOTNO-ERETU	02:15:00 AM	03:38:00 AM	LEMD-SAEZ	Overflight
4/08/05	EA31	TASIL-POMAT	02:16:00 AM	03:46:00 AM	SBRF-LPPT	Overflight
4/08/05	EA33	AMDOL-DEKON	02:16:00 AM	03:35:00 AM	LFPG-SBGR	Overflight
4/08/05	EA34	BOTNO-ERETU	02:23:00 AM	03:45:00 AM	LSZH-SBGR	Overflight
4/08/05	A332	HR068-HR067	02:25:00 AM	03:18:00 AM	LEMD-SCEL	Overflight
4/08/05	B772	BOTNO-ERETU	02:26:00 AM	03:50:00 AM	EDDF-SBGR	Overflight
4/08/05	B737	BADIA-GOOY	02:28:00 AM	03:35:00 AM	DIAP-GOOY	Within
4/08/05	B747	BADIA-LUMPO	02:32:00 AM	03:24:00 AM	DGAA-KIAD	Overflight
4/08/05	A321	GOOY-PE	02:33:00 AM	03:23:00 AM	GOOY-LPPT	Outbound
4/08/05	B747	AMDOL-DEKON	02:35:00 AM	03:49:00 AM	EGLL-SBGR	Overflight
4/08/05	B763	BOTNO-ERETU	02:38:00 AM	04:01:00 AM	LEMD-SBGL	Overflight
4/08/05	B772	NANIK-KENOX	02:40:00 AM	03:51:00 AM	SAEZ-LFPG	Overflight
4/08/05	B73F	ECHED-IRALO	02:42:00 AM	04:45:00 AM	GMMN-GUCY	Overflight
4/08/05	A340	HR068-HR067	02:48:00 AM	03:44:00 AM	LEMD-SCEL	Overflight
4/08/05	B772	POMAT-TASIL	02:48:00 AM	04:05:00 AM	LFPG-SAEZ	Overflight
4/08/05	G4	TASIL-POMAT	02:52:00 AM	04:30:00 AM	SABE-GVAC	Overflight
4/08/05	A346	BOTNO-ERETU	02:57:00 AM	04:21:00 AM	EDDF-SBGR	Overflight
4/08/05	B772	BOTNO-ERETU	02:59:00 AM	04:18:00 AM	LFPG-SBGR	Overflight
4/08/05	A340	SBITA-KODOS	10:01:00 PM	02:05:00 AM	LIRF-SAEZ	Overflight
4/08/05	B772	KODOS-ECHED	10:29:00 PM	02:13:00 AM	SAEZ-LIMC	Overflight

5.2 **Traffic density for a given point in time**

It is also possible to determine the FIR traffic density at any point in time. For example, the following table lists the flights present in the Dakar FIR on 4th August 2005 at 2:30 AM.

Date	Aircraft Type	Entry-Exit	Time of Entry	Time of Exit	Origin-Destination	Type of traffic
4/08/05	B73F	ECHED-UNADO	12:40:00 AM	02:34:00 AM	GMMN-GABS	Inbound
4/08/05	EA34	TASIL-POMAT	01:15:00 AM	02:35:00 AM	SBGL-LPPT	Overflight
4/08/05	MD11	BOTNO-ERETU	01:18:00 AM	02:40:00 AM	LIMC-SBGR	Overflight
4/08/05	EA34	DEKON-AMDOL	01:28:00 AM	02:46:00 AM	SBGR-EDDF	Overflight
4/08/05	PA28	GOOY-ECHED	01:30:00 AM	03:25:00 AM	GOOY-LFPO	Outbound
4/08/05	B772	POMAT-TASIL	01:37:00 AM	02:55:00 AM	LIMC-SAEZ	Overflight
4/08/05	EA34	BADIA-GOOY	01:37:00 AM	02:31:00 AM	FAJS-GOOY	Inbound
4/08/05	EA32	GOOY-BRENA	01:38:00 AM	03:34:00 AM	GOOY-LIMC	Outbound
4/08/05	A321	GUPEL-GOOY	01:46:00 AM	03:10:00 AM	GMMN-GOOY	Inbound
4/08/05	B744	BOTNO-ERETU	01:52:00 AM	03:13:00 AM	LEMD-SAEZ	Overflight
4/08/05	B737	GOOY-ECHED	01:55:00 AM	03:51:00 AM	GOOY-LFML	Outbound
4/08/05	MD11	POMAT-TASIL	02:03:00 AM	03:22:00 AM	LFPG-SBGR	Overflight
4/08/05	MD11	MOGSA-AKDAK	02:07:00 AM	02:55:00 AM	KIAH-FNLU	Overflight
4/08/05	EA33	DEKON-AMDOL	02:08:00 AM	03:29:00 AM	SBGR-LFPG	Overflight
4/08/05	A343	KODOS-ECHED	02:10:00 AM	06:00:00 AM	SBGR-LSZH	Overflight
4/08/05	B747	BOTNO-ERETU	02:10:00 AM	03:46:00 AM	EDDF-SBGR	Overflight
4/08/05	EA31	NANIK-KENOX	02:11:00 AM	03:24:00 AM	SBFZ-LPPT	Overflight
4/08/05	EA34	OPULU-BULIS	02:12:00 AM	03:47:00 AM	FNLU-LPPT	Overflight
4/08/05	A346	BOTNO-ERETU	02:15:00 AM	03:38:00 AM	LEMD-SAEZ	Overflight
4/08/05	EA31	TASIL-POMAT	02:16:00 AM	03:46:00 AM	SBRF-LPPT	Overflight
4/08/05	EA33	AMDOL-DEKON	02:16:00 AM	03:35:00 AM	LFPG-SBGR	Overflight
4/08/05	EA34	BOTNO-ERETU	02:23:00 AM	03:45:00 AM	LSZH-SBGR	Overflight
4/08/05	A332	HR068-HR067	02:25:00 AM	03:18:00 AM	LEMD-SCEL	Overflight
4/08/05	B772	BOTNO-ERETU	02:26:00 AM	03:50:00 AM	EDDF-SBGR	Overflight
4/08/05	B737	BADIA-GOOY	02:28:00 AM	03:35:00 AM	DIAP-GOOY	Within

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APPENDIX F

LIST OF PARTICIPANTS

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— END —

ICAO PUBLICATIONS AND RELATED PRODUCTS IN THE AIR TRANSPORT FIELD

The following summarizes the various publications and related products in the air transport field issued by the International Civil Aviation Organization:

- *International Standards and Recommended Practices (SARPs)* adopted by the Council in accordance with Articles 37, 54 and 90 of the Convention on International Civil Aviation and designated, for convenience, as Annexes to the Convention. Annex 9 — *Facilitation* — contains SARPs dealing with customs, quarantine, immigration and health matters concerned with international air navigation. Annex 17 — *Security* — is composed of SARPs on all matters related to safeguarding civil aviation against acts of unlawful interference. Any differences between the national regulations and practices of a State and what is prescribed by an International Standard must be notified to the Council in accordance with Article 38 of the Convention. The Council has also invited Contracting States to notify differences from the provisions of the Recommended Practices.

- *ICAO's policies* on the regulation of international air transport, charges for airports and air navigation services, and taxation in the field of international air transport.

- *Technical specifications* on machine readable travel documents (MRTDs).

- *Tariffs* for airports and air navigation services, including charges applied towards users in more than 180 States.

- *Manuals* providing information or guidance to Contracting States on such issues as regulation of international air transport, financial management of airports and air navigation services, air traffic forecasting methods, and compliance with Annex 17 provisions.

- *Circulars* providing specialized information of interest to Contracting States. They include studies on medium- and long-term trends in the air transport industry at a global and regional level and specialized studies of a worldwide nature covering issues such as the economic and financial aspects of CNS/ATM systems implementation, regional differences in airline operating economics, economic contribution of civil aviation, privatization of airports and air navigation services, and regulatory implications of slot allocation.

- *Aviation Security Training Packages (ASTPs) and courses* on a range of subjects designed to assist security professionals, managers and staff in developing a more comprehensive understanding of SARPs, as well as to offer specialized practical expertise in the implementation and monitoring of measures and provisions in accordance with local programmes. For further information, please contact avsec@icao.int or visit the training page on the ICAO AVSEC website at www.icao.int/avsec.

- *Publications in electronic form*, in database and interactive forms, such as the world's air services agreements and the ICAO template air services agreements. *Civil aviation statistics* can be accessed by purchasing an annual subscription to one or more of the data series distributed by ICAO through its commercial website at www.icaodata.com. Questions regarding ICAO statistics or special orders for statistical data should be sent to sta@icao.int.

- *Reports of meetings in the air transport field,* including reports on the Facilitation and Statistics divisional-type meetings and those related to conferences on aviation security, regulation of international air transport, and economics of airports and air navigation services.

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