



Circular 292-AT/124

Economic Contribution of Civil Aviation



INTERNATIONAL CIVIL AVIATION ORGANIZATION

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FOREWORD

1. This Circular consists of *Volume I – Global Perspective* and *Volume II – Assessment Methodologies*. ICAO's evaluation of the economic contribution of civil aviation has been carried out with two objectives, namely to assess the contribution of civil aviation in the global economy and to develop guidance material for States on assessment methodologies. *Volume I* portrays the importance of civil aviation in the global economy with its direct economic contribution and multiplier effects and emphasizes civil aviation's role as a catalyst in the global economy. It presents the results of a detailed study into the economic contribution of civil aviation in terms of global output and employment, followed by a profile of the major contributing civil aviation industries. *Volume II* contains the methodological guidelines on how to assess the economic contribution both of an airport to a regional/national economy and of civil aviation to a national economy. Two principal methodological approaches for an impact assessment are introduced: a core approach and an expanded approach. For both approaches, case studies of impact assessments of airports and a national economy demonstrate the assessment process and results.

2. This study is intended to assist planners and decision-makers to identify the economic contribution of civil aviation, and in turn help to facilitate the funding requirements for the continuous development of the infrastructure and other needs of civil aviation industries at large.

Sources of information

3. In addition to the ICAO Digests of Statistics, research has been undertaken to enhance the Organization's statistics and economic evaluation of civil aviation. Sources of information other than ICAO, referred to in this Circular, include the United Nations (UN), the World Tourism Organization (WTO-OMT), the International Monetary Fund (IMF), the World Bank, the Airports Council International (ACI), the Air Transport Action Group (ATAG), the International Air Transport Association (IATA), the World Travel and Tourism Council (WTTC), aerospace manufacturers, airports and other corporate information as well as various air transport periodicals, Back Aviation Solutions, the WEFA Group (formerly known as Wharton Econometrics Forecasting Associates), Wilbur Smith Associates, the City of Hamburg (Ministry of Economic Affairs), the City of Los Angeles (Department of Airports), the Colorado Department of Transportation, the Mediation Group Frankfurt Airport, Statistics Canada, the United States Department of Transportation (DOT) and Department of Commerce (DOC).

4. Unless indicated otherwise, all references in this circular to “cents” mean U.S. cents, and all references to “dollars” mean U.S. dollars; references to “billion” mean one thousand million.

Status

5. This circular has been approved by the Secretary General and is published under his authority.

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Executive Summary

1. The air transport industry has experienced rapid expansion along with the growth of the world economy, and the demand for air transport services is primarily driven by economic development. In turn, civil aviation acts as an economic catalyst for local/regional and national economies around the globe. The level of economic activity of the air transport industry is closely linked to the level of economic activity in markets and economies that the industry serves. Higher levels of economic activity go hand in hand with a growing demand for air transport, benefiting not only from expanding industries and trade but also from generally higher income and consumer spending. Air transport (airlines, airports and air navigation infrastructure) accommodates the needs of millions of individuals to travel and of business communities to have goods transported by air. In 2002, worldwide scheduled services carried over 1.6 billion passengers and 30 million tonnes of air freight and mail.

Volume I — Global Perspective

2. Volume I of this circular emphasizes the importance of civil aviation in the world economy and provides an assessment of the contribution of civil aviation (in terms of global output and employment), followed by a profile of the major contributing civil aviation industries.

3. Economic activity is the value of goods and services produced in an economy. In this study, economic activity includes the goods and services produced by civil aviation, and other industry groups affected by civil aviation. Economic activities that are directly attributed to civil aviation industries comprise those of airlines, other aircraft operators and affiliates, airports, air navigation services providers and affiliates, aerospace and other manufacturers as well as other industries and their affiliates.

4. Airlines deliver air transport services, the final product of civil aviation industries, to their customers. It has been estimated that civil aviation industries generated a total **direct output** of \$652 billion worldwide in 1998. When these values, which include intermediate inputs, are consolidated in order to eliminate the components of double counting, it is estimated that civil aviation contributed to the world economy some \$370 billion in consolidated direct output in 1998, the production of which required employment of at least 6 million people along the supply chains of intermediate inputs and final demand.

5. The full economic impact of civil aviation industries cannot be assessed without taking into account the indirect and induced impacts involving other related industries. **Indirect impacts** involve the transactions with related suppliers along the production chains. **Induced impacts** cover successive rounds of increased household spending that result from the direct and indirect impacts. In addition, an impact assessment may also include the off-airport expenditure of air transport users (passengers and freight forwarders) and related employment, which are referred to as **catalytic impacts**. These levels of economic activity can

be viewed as having a cascading effect on the global economy. The output of the air transport component of civil aviation yields the direct impacts which in turn stimulate the indirect and ultimately the induced impacts as well as catalytic impacts. These direct economic activities have **multiplier effects** upon industries providing either aviation-specific and other inputs or consumer products (goods and services). The air transport component of civil aviation is estimated to have generated a total output of \$1 360 billion and 27.7 million jobs worldwide in 1998, representing about **4.5 per cent of the world output in terms of real gross domestic product (GDP)**.

6. The multiplier effects of air transport can be calculated as a ratio of the sum of catalytic, indirect plus induced demand effects to the direct demand effects, in terms of output and employment. It is estimated that each dollar of output produced in the air transport industry worldwide creates a demand of \$3.25 output in other industries, and that each job in air transport creates 6.1 jobs in other industries.

Volume II — Assessment Methodologies

Part I. Economic Impact of an Airport

7. Volume II of the circular describes the methodologies to assess the economic impact of civil aviation industries, in terms of output and employment. In order to demonstrate these methodologies, North American and European case studies are used as illustrative examples. Unfortunately, examples from developing countries were not available.

8. The employment generated by an airport could play an important role for the local/regional economy concerned or, in the case of small countries, even for the national economy (particularly islands or land-locked countries). A well researched economic impact study can demonstrate the contribution that an airport makes to the economy concerned. This can be instrumental in obtaining financing or negotiating better loan conditions, particularly from public or foreign sources (such as governmental guarantees or development banks and funds), that may be attracted by the wider economic effects of either planned new aviation infrastructure or expansion of an existing facility.

9. Part I of Volume II describes how to capture the economic contribution of an airport in the adjacent local/regional economy, using two approaches described as a core approach and an expanded approach. A core approach of an impact assessment captures economic activities of an airport in three dimensions: directly in servicing its customers; indirectly through the inter-industry trading and production necessary to provide the final goods and services; and induced impacts generated by increased household spending that result from direct and indirect impacts. The distinction between a core approach and expanded approach lies in their coverage of spin-off demand effects by air transport users. An expanded assessment incorporates the off-airport expenditure of airport users and the related employment as catalytic demand effects.

10. This study uses input-output (I-O) methodology to quantify the output value of transactions that are associated directly or indirectly with civil aviation industries. I-O analysis enables the cascading demand effects generated by an airport to be tracked sequentially along the production process throughout an economy. I-O tables within a system of national accounts capture the supply and demand transactions, in terms of expenditures between industries on an annual basis.
11. I-O tables may be readily available in States from their national accounting systems. While the process appears complex, once the corresponding matrices for external demand stimulus and the relevant sets of impact multipliers are determined, calculations can be executed with spreadsheet software. If impact multipliers can be obtained without applying I-O analysis, they can be used with expenditure and/or employment data to estimate the economic impact of civil aviation.
12. When selecting an I-O framework for an impact assessment, it is important to consider the geographical coverage needed. A significant portion of the economic activities of an airport could occur in the local/regional economy. An airport survey can be used to gather direct output, labour income (wages) and employment data. For example, economic activities of 203 firms/organizations at **Hamburg Airport** were surveyed to obtain data on their annual expenditures and employment in the metropolitan region. Airport expenditures were converted into sales of supplier industries (local, regional or national).
13. Another case study, at **Frankfurt Airport**, illustrates an economic impact assessment covering income and employment effects in both the regional and national economy, using a core approach. The results indicate that in 1998, Frankfurt Airport generated economic activities throughout Germany. For every DM earned at the airport and for every airport-based job, there were DM 2.01 earned and 1.77 jobs created throughout the national economy, including DM 1.26 earned and 1.29 jobs created in the regional economy.
14. The impact multiplier concept provides a simple method of assessing economic impacts; however, this does not provide industry-by-industry distribution of demand effects. A study conducted by **Vancouver International Airport** demonstrates a core assessment, using direct employment data and impact multipliers to estimate the indirect and induced employment as well as output and value added impacts.
15. Employment and income effects for **23 selected European airports** in terms of direct, indirect and induced effects, including multipliers, are reviewed. The income multiplier ranges from a low of 0.36 to a high of 2, whereas the employment multiplier ranges from a low of 0.28 to a high of 3.06. The variation in the multiplier value can be partly attributed to airport location, underlying assumptions and the scale of the benefiting economy. Based on the results for the 23 European airports, an indicative range of multiplier effects of airport employment were identified for international airports, medium/large airports and small regional airports.

16. An example of an expanded assessment approach, which incorporates the off-airport expenditures as catalytic demand, is presented. The 1990 impact assessment of **Los Angeles International Airport** captured off-airport expenditures of airport users.

17. The application of an expanded assessment, using total impact multipliers, is explained and illustrated, using an airport study conducted by the Department of Transportation, State of Colorado. This study follows procedures recommended by the Federal Aviation Administration (FAA) for economic impact analysis of airports, using RIMS II, a regional Input-Output modeling system that maps the flow of products and the interconnection of producers and consumers within the U.S. economy. It identifies the direct and catalytic output of **Colorado's 79 public-use airports**. These outputs together comprise an external demand stimulus which in turn created multiplier effects in the impacted local economies. Total impacts were also measured for the state-wide economy by type of industry.

Part II. Impact of Civil Aviation in a National Economy

18. Whereas Part I of Volume II focussed on the economic impact of an airport, Part II describes how to explore the contribution of civil aviation throughout a national economy.

19. Transportation Satellite Accounts (TSA), such as those jointly developed by the U.S. Departments of Transportation and Commerce, help assess the contribution of air transport to a national economy. These accounts consist of a **make** table and a **use** table (production and consumption accounts), a **direct requirements** table and a **total requirements** table. The direct requirement table shows the amount of commodity that is required by an industry to produce a dollar of the industries output. In the United States, air transport has a total industry output multiplier of 1.89 which implies that in order to deliver a one dollar increase in the final demand of air transport, a total industry output worth of \$1.89 is produced. The TSA framework demonstrates that, in the evaluation of GDP, civil aviation's contribution is underestimated, since GDP considers the final demand for air transport services and excludes expenditures on intermediate inputs. Other multiplier effects are only accounted for in an impact assessment.

20. The impetus of civil aviation in **the United States economy** has been selected as a case study which demonstrates the procedural steps of the expanded assessment phases, using RIMS II and its multipliers. It has been evaluated over a number of years by Wilbur Smith Associates, on behalf of the FAA, and focuses on the provision of airline services, general aviation activities, airport operations and acquisition of aircraft. Expenditures associated with business and leisure trips by air are taken into account. These direct and catalytic expenditures generated additional expenditures and jobs through the indirect demand of supply and induced demand effects. The results for the U.S. economy can be expressed as multiplier effects of the direct demand: every \$1 of output produced and each job created by civil aviation in 2000 triggered another \$4.69 of output and 6.86 jobs in many different industries.

21. At the national level, the stimulating economic impact of civil aviation as job creator and contributor to economic growth is evident when airlines, airports, air navigation services

providers and aerospace industries and their respective affiliates meet a growing direct demand for air transport services by expanding operations and fleets, ordering more inputs from suppliers, hiring more employees and thus increasing outputs at all levels. These direct economic activities have multiplier effects upon other industries throughout an economy. A wider or narrower spread of these multipliers will depend on the circumstances, notably the size of the industries associated with civil aviation and the assessment approach taken. For example, countries with significant aerospace manufacturing will show a wide spread, while those with limited air transport services may have a relatively narrow spread. Non-aviation travel and tourism businesses, such as hotels and restaurants, travel agencies, tour operators and retailers greatly benefit from trip-related expenses of airline passengers.

VOLUME I
GLOBAL PERSPECTIVE

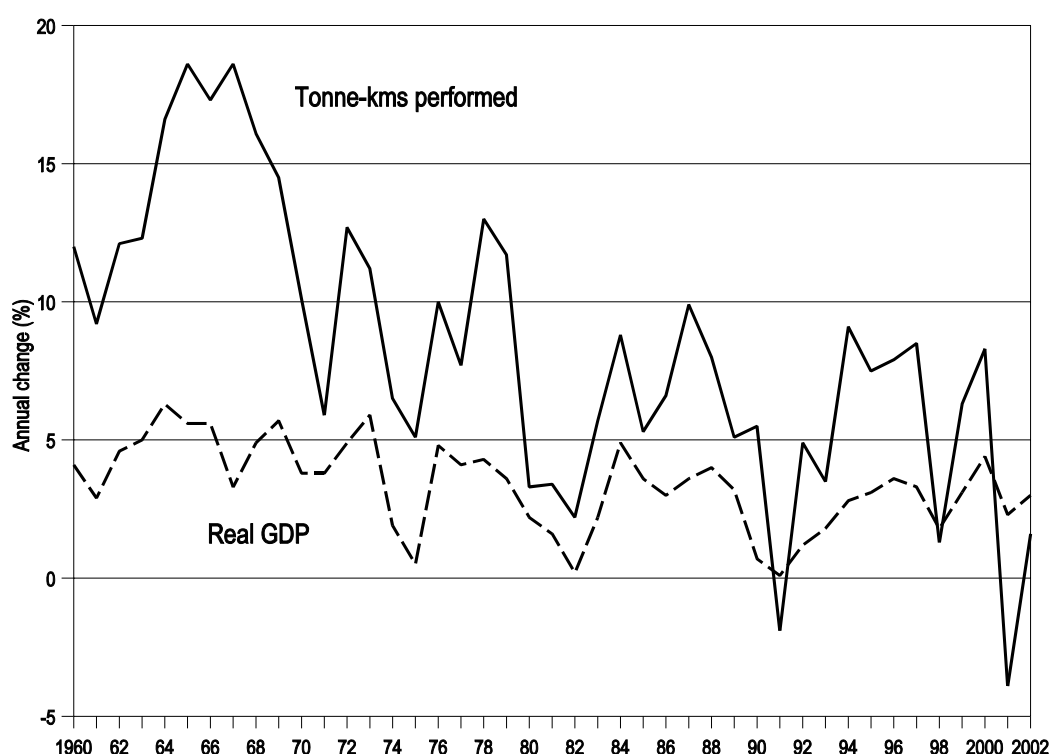
CHAPTER 1. ECONOMIC DEVELOPMENT AND AIR SERVICES

AIR TRANSPORT SERVICES AS AN ECONOMIC CATALYST

1.1 The air transport industry has experienced rapid expansion along with the growth of the world economy, and the demand for air transport services is primarily driven by economic development. In turn, civil aviation acts as an economic catalyst for local/regional and national economies around the globe. The level of economic activity of the air transport industry is closely linked to the level of economic activity in markets and economies that the industry serves. Higher levels of economic activity go hand in hand with a growing demand for air transport, benefiting not only from expanding industries and trade but also from generally higher income and consumer spending. Air transport – airlines, airports and air navigation infrastructure – accommodate the needs of millions of individuals to travel and of business communities to have goods transported by air. In 2002, worldwide scheduled services carried over 1.6 billion passengers and 30 million tonnes of air freight and mail.

1.2 The dynamics of a broadening demand for air travel and freight services, technological progress and associated investments enable air transport services to achieve higher growth rates than most other industries. The global output of the airline industry, in terms of tonne-kilometres performed (TKP), grew by a factor of nearly 30 since 1960. During the same period, the gross domestic product (GDP), which is the broadest available measure of world output, increased by a factor of almost 4.

1.3 Figure 1-1 depicts the relationship between the global economy and traffic demand from 1960 to 2002. It illustrates that the growth in world traffic has been much greater than the world economic growth and has a pronounced pro-cyclical relationship with overall economic activities, meaning that the demand for air transport increases with a rise in the GDP and likewise decreases with a fall in the GDP. Empirical evidence from long-term trends of overall economic development and air traffic indicates that approximately two thirds of traffic growth is explained by GDP whereas the rest is explained by air fares and other factors.



Source: IMF, WEFA Group, ICAO.

Figure 1-1. Economic and air traffic growth — World, 1960–2002
(GDP in real terms and total TKP)

1.4 In broad terms, the pattern of traffic growth over the 1960–2002 period is a reflection of economic conditions experienced over the period concerned. The high growth of traffic during the 1960–1973 period was followed by a decline in the 1974–1975 period largely due to an almost 10 fold increase in crude oil prices experienced by the air transport industry. The industry still managed to keep costs under control through productivity improvements. The economic recessions of 1974–1975 and 1979–1982 were largely caused by the increase in oil prices. The years 1983 to 1989 saw the world economy experience its longest period of sustained progress since World War II, achieving an average annual growth rate of 3.7 per cent. This extended period of growth in the world economy came to a halt during 1990. The impact of the Gulf War (1990–1991) is clearly evident. 1991 was the most difficult year for the global economy since 1982. Recovery commenced in North America in 1992, but it was not until 1994 that it took hold in most of Western Europe. Robust global economic growth lasted until 1997, but the world economy slowed down to 1.9 per cent in 1998 as a result of the financial crisis and recession in several Asian countries. It quickly rebounded in 1999, posting 3.1 per cent GDP growth and continued to grow in 2000 by 4.7 per cent. Another slowdown occurred during 2001 across almost all major regions as a result of a marked decline in trade growth, significantly lower commodity prices, and deteriorating financing conditions in emerging markets. The events of 11 September 2001 amplified the impact of an already weakening global economy, particularly on consumer and business confidence in the United States; as a result, world GDP growth dropped to 2.3 per cent. With trade and industrial production improving across all regions, the world economy began to recover and grew at a rate of 3 per cent in 2002.

1.5 Consequently, the events of 11 September, combined with the slowdown in economic growth, led to sharp demand contractions for air travel, particularly in North America and Europe, and to a lesser degree in Latin America/Caribbean where freight traffic also declined. These regional and event-related developments combined caused global traffic to decline by 3.9 per cent in 2001, only the second time since 1945 that the industry experienced a negative growth. In 2002, while demand for passenger air travel remained depressed, air freight rebounded, resulting in a modest 1.6 per cent expansion in TKP.

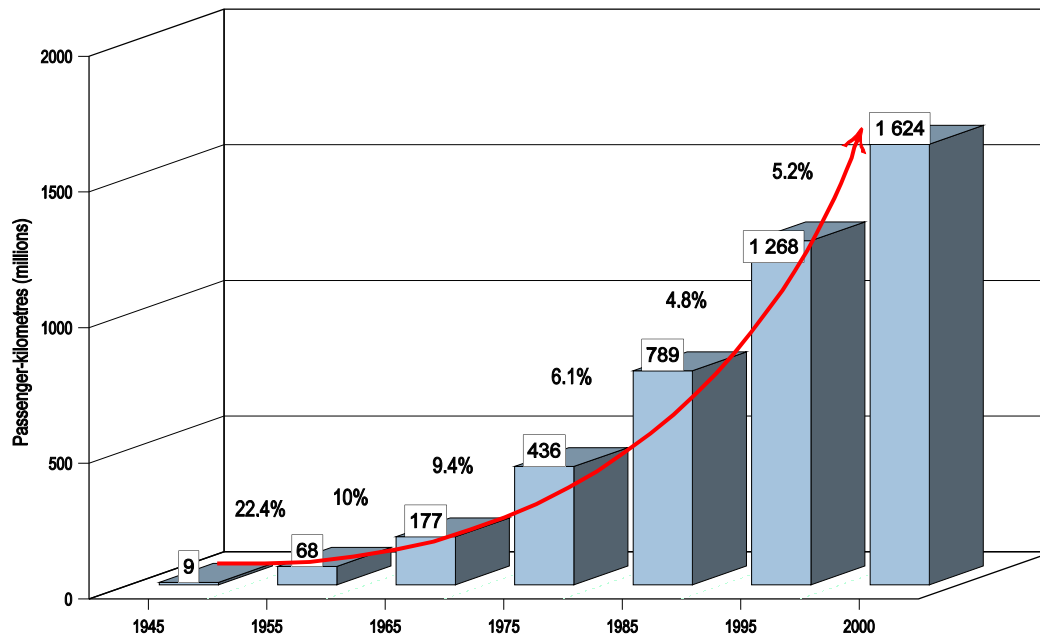
1.6 Between 1991 and 2002, worldwide scheduled traffic, measured in TKP, grew at an average annual rate of 4.9 per cent, compared to a 2.8 per cent GDP growth rate.

1.7 Of the total world traffic in 2002 (in terms of TKP), passenger traffic accounted for 68.6 per cent, while freight and mail traffic accounted for 30.2 per cent and 1.2 per cent, respectively. The rapid expansion of international services was responsible for much of the overall growth performance of airlines and airports. Access to international air transport services gained increasing importance in facilitating international trade in goods and services, foreign direct investment and other driving forces of economic development with global dimensions. With regard to international trade in goods, currently some 40 per cent (by value) of the world's manufactured exports are being transported by air; as for international trade in services, some 45 per cent of over 714 million international tourists are estimated to have arrived by air in 2002. A closer look at the regional distribution of air travel and air freight in the following sections provides the proportion of domestic and international services in different parts of the world.

AIR TRAVEL

1.8 With the evolution of commercial air transport during the second half of the 20th century, air travel became a highly visible economic and social phenomenon. Air travel peaked in 2000, when over 1.63 billion passengers boarded scheduled flights on domestic and international routes, 181 times the 9 million airline passengers carried on scheduled services in 1945. To put this figure in perspective, it is equivalent to just over 26 per cent of the world population in 2000.

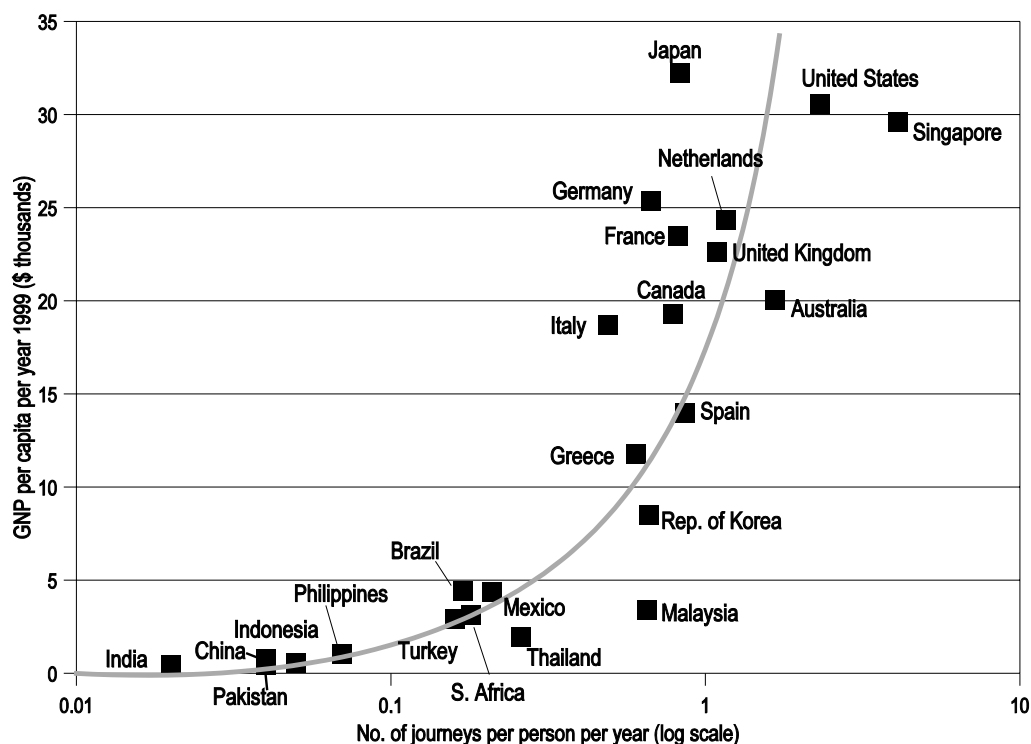
1.9 Figure 1-2 depicts the long-term growth path in air travel in terms of passengers carried on scheduled flights (excluding traffic of the former USSR and Commonwealth of Independent States) with the respective average annual growth rates in ten-year increments from 1945 to 1995 and for the five-year increment from 1995 to 2000.



Source: ICAO.

Figure 1-2. Airline passengers — World, 1945–2000
(scheduled services of air carriers registered in ICAO Contracting States)

1.10 Figure 1-3 illustrates for selected countries, the link between economic prosperity, measured in terms of gross national product (GNP) per capita, and average participation in air travel. It indicates that a low per-capita GNP is directly correlated to low per-capita demand for air travel. The average frequency of air travel increases with higher per-capita GNP levels and a standard of living allowing for more disposable income and time for leisure travel.



Source: World Bank, ICAO.

Figure 1-3. Air travel participation — Selected countries, 1999

1.11 Air travel provides much of the transportation for international tourism. Travel for leisure and business or other international relations are the two major components of the air travel market. Socio-economic factors come into full play in economies that have become an integral part of the international division of labour and trade and have achieved a standard of living allowing for disposable income and time for leisure travel. In practice, air transport services support the tourism business to a larger extent than is evident from scheduled passenger traffic data, since there is also an important contribution from non-scheduled passenger traffic.

1.12 Figure 1-4 depicts the historic trends of international inbound tourism, in terms of arrivals and receipts from 1970 to 2002. The share of arrivals by air is included starting in 1987 when reliable global data became available. In 2002, around 714.4 million international tourists spent about \$472 billion in international tourism receipts, excluding the costs of international passenger transport. In 2001, 39.4 per cent of international tourists used air transport, compared to 35.3 per cent in 1990. Arrivals by air grew at an average annual rate of 5.5 per cent over that period. The expansion of international tourism has benefited from improved access to air transport services. The better match of supply and demand for air transport bridged the complementary needs of outbound and inbound travel markets and was made possible by investments in aviation infrastructure, particularly airport and air navigation facilities, and liberalization of regulatory frameworks, as well as other contributing factors.

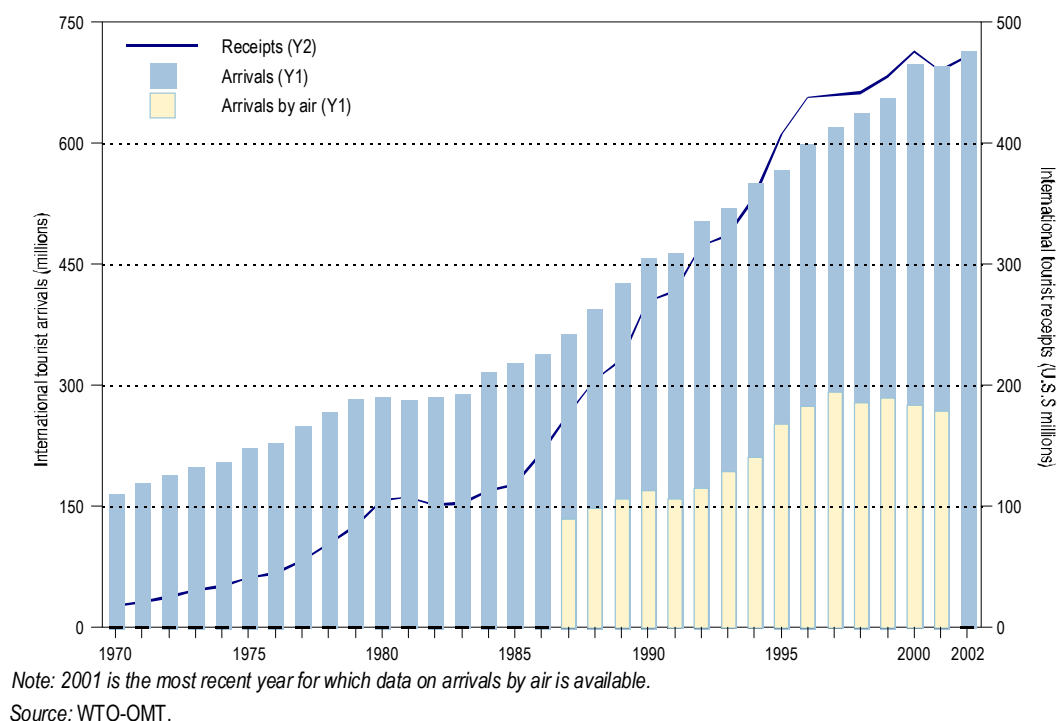


Figure 1-4. International tourist arrivals and receipts — World, 1970–2002

1.13 In terms of international trade, receipts from foreign visitors are accounted for as exports in the framework of the balance of payments within a system of national accounts. For many countries, international tourist receipts rank high among export earnings and are an indispensable source of foreign currency, overtaking traditional exports of bulk commodities or even modern manufactured goods. For instance, among five selected countries analysed in the 1998 *Tourism Economic Report* of the World Tourism Organization (WTO-OMT), tourism ranked in the top five export earnings in four and was the leading source of foreign currency in two out of these selected countries. Receipts from international tourism amounted to \$441 billion and from international fares \$90 billion in 1998. Together, these receipts from tourism and travel activities accounted for about 8 per cent of the world's \$6 738 billion total export earnings on goods and services and topped the list of ten leading export revenue categories.

1.14 Accessibility of tourist destinations by air transport services is an important factor for tourism development. The regional distribution of international tourist arrivals and receipts, together with the share of international tourists arriving by air is shown in Table 1-1 for 2001.

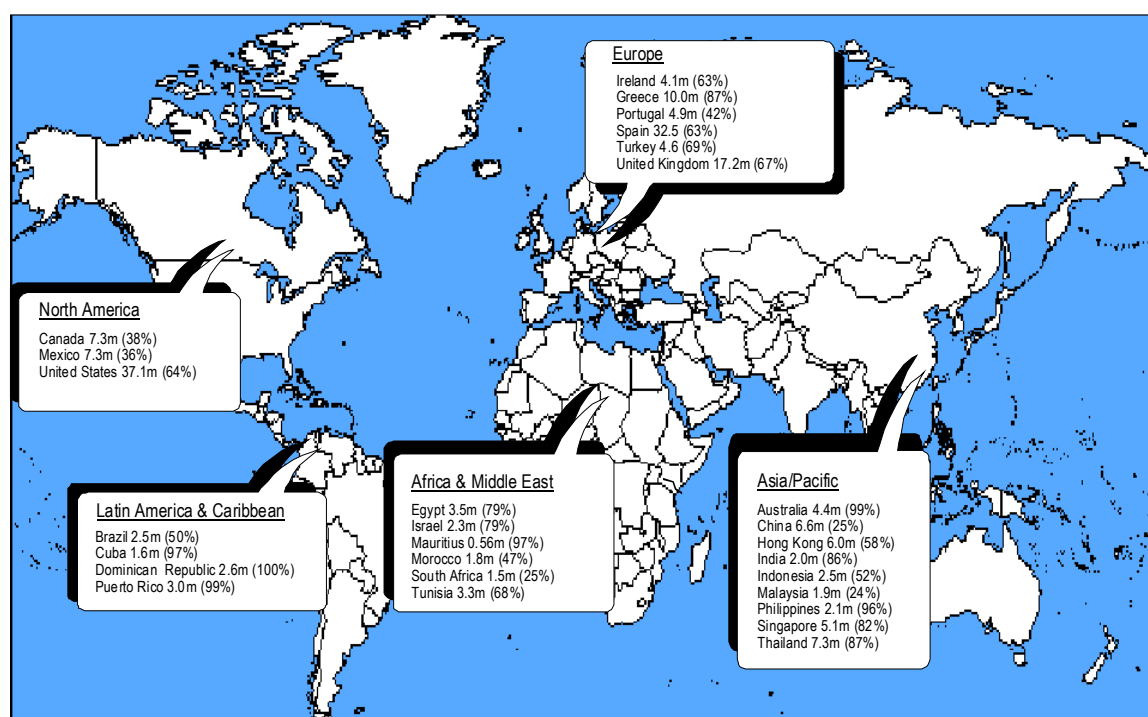
Table 1-1. International tourist arrivals and receipts — World and regions, 2001

	Total arrivals (millions)	Arrivals by air (millions)	Change 2001/2000 (%)	Share of air in total arrivals (%)	Total receipts (\$ billions)	Change 2001/2000 (%)
Africa	28.3	14.0	1.5	49.4	11.8	9.4
Americas	120.2	65.1	-7.6	54.1	113.3	-8.4
Asia and the Pacific	121.1	57.3	-0.9	47.3	94.7	-1.6
Europe	390.8	123.7	-0.4	31.6	240.1	-1.4
Middle East	23.6	9.4	-2.9	39.8	12.1	-4.1
World	684.1	269.4	-2.3	39.4	472.0	-2.8

Note: 2001 is the most recent year for which data on arrivals by air is available.

Source: WTO-OMT.

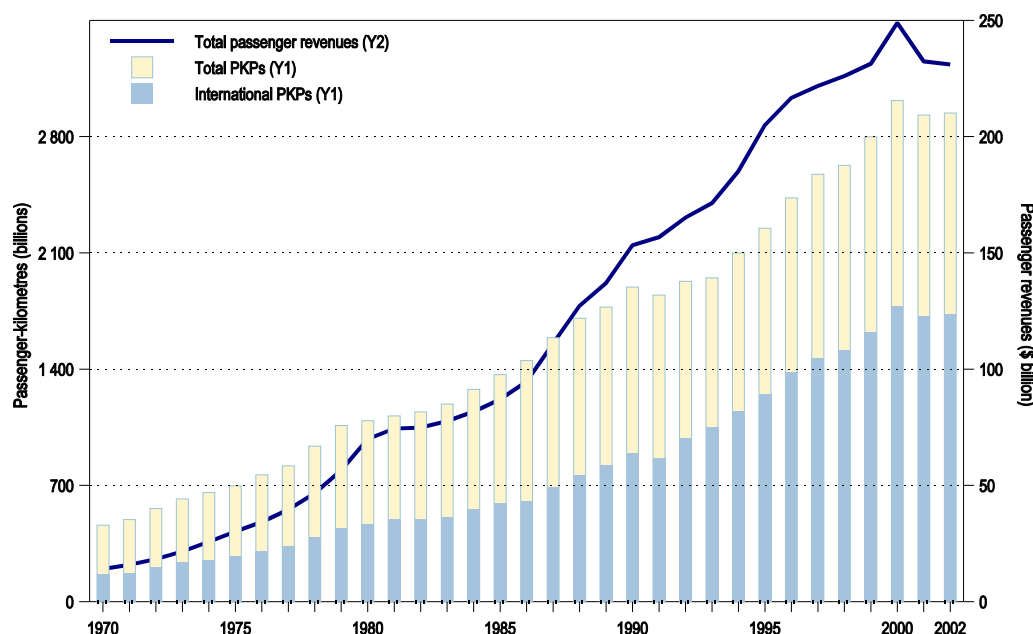
1.15 The selected countries displayed in Figure 1-5 exemplify the high dependency of tourism destinations on the provision of international air travel. Where a tourism industry has been established, the highest shares of airline passengers in total international tourist arrivals were found among island destinations (for example, 100 per cent for the Dominican Republic, 99 per cent for Australia and 97 per cent for Mauritius) and land-locked countries with poor land transport infrastructure. Countries with a large geographical scope which attract tourists using long-haul air routes, such as transatlantic, transpacific and inter-regional route groups, also have a higher proportion of air travel.



Source: WTO-OMT.

Figure 1-5. Tourist destinations, 1999
(international arrivals by air and share of air travelers in total international tourist arrivals)

1.16 Hundreds of millions of people around the globe take advantage of commercial flights every year and their journeys carry them farther and farther on extended route networks of competitive carriers. Figure 1-6 exhibits total (domestic and international) scheduled passenger-kilometers performed (PKP) and passenger revenues earned for the 1970–2002 period. The volume of domestic traffic increased four times, from 298 million PKP performed in 1970 to 1.2 billion PKP in 2002, compared to about eleven times for international traffic, from 162 million PKP to 1.7 billion PKP. As a result, the share of international air services in total passenger traffic increased from 35 per cent to almost 60 per cent over the same period. Total passenger revenues increased from \$14.1 billion in 1970 to \$231.0 billion in 2002.



Source: ICAO.

Figure 1-6. Scheduled passenger traffic and revenues — World, 1970–2002

1.17 Table 1-2 provides passenger traffic developments in the six ICAO statistical regions by airline registration and for the world over the period 1991–2002. It compares traffic levels for 1991 and from 2000 to 2002. In 2002, airlines registered in North America, Europe and Asia/Pacific accounted for approximately 90 per cent of global scheduled passenger traffic, exceeded 2.6 trillion PKPs and earned about \$211 billion in passenger revenues (down from some 2.7 trillion PKPs and \$224 billion passenger revenues in 2000).

1.18 North American airlines, which account for the largest regional share, recently experienced a sharp drop in traffic and revenues, both of which shaped global results. These carriers held a 39 per cent share of the world scheduled passenger traffic in 2000, when they experienced a 4.1 per cent traffic growth, generated almost \$97 billion in passenger revenues and achieved a total operating profit of \$6.8 billion. The slowdown of the global economy and the ramifications of the events of 11 September 2001 led to a sudden and steep decline of world passenger traffic, particularly within, to and from the United States, and greatly worsened the operating climate for air carriers. North American airlines suffered a decline in PKP of 5.6 per cent in 2001 and 2.4 per cent in 2002. They incurred total operating losses of \$10.6 billion in 2001 and \$8.5 billion in 2002 which reflect, to a large

extent, losses from passenger services. Despite these setbacks, North American airlines carried almost 37 per cent of the 2 942 billion PKP flown worldwide in 2002.

1.19 After achieving positive operating results for eight years from 1993 to 2000, the airline industry experienced operating losses of \$11.8 billion in 2001 and \$7.3 billion in 2002, equivalent to 3.8 per cent and 2.3 per cent of total operating revenues for those years. Chapter 2 provides more details about airline finances.

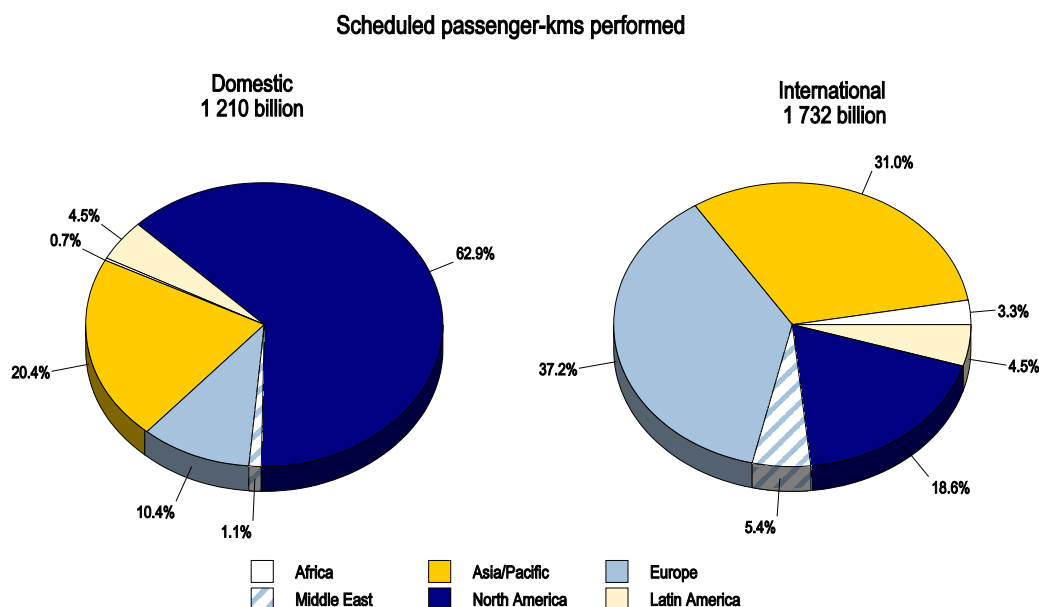
Table 1-2. Scheduled passenger traffic — World and regions, 1991–2002
(air carriers registered in ICAO Contracting States)

Region of airline registration	1991 PKP (billions)	Average annual growth 1991-2001 (%)	2001 PKP (billions)	Change 2001/ 2000 (%)	2002 PKP (billions)	Change 2002/2001 (%)	Share of world traffic 2002 (%)
Africa	39.2	5.5	66.9	0.8	66.2	-1.0	2.3
Asia/Pacific	359.3	7.6	744.1	11.7	785.1	5.5	26.7
Europe	551.9	3.5	778.3	-3.2	769.7	-1.1	26.2
Middle East	45.4	7.9	96.9	3.3	106.7	10.1	3.6
North America	759.8	3.9	1109.3	-5.6	1082.3	-2.4	36.8
Latin America/ Caribbean	87.7	4.4	134.3	-5.3	132.3	-1.5	4.5
World	1843.3	4.7	2929.8	-2.9	2942.3	0.4	100.0

Source: ICAO.

1.20 The regional distribution of domestic and international passenger traffic, measured in PKP, for the year 2002 is provided in Figure 1-7. Almost two thirds of global domestic passenger traffic of 1.2 billion PKP was operated within the North American continent, primarily on the dense route network of the U.S. where demographics, income levels and a very competitive airline industry foster high participation in air travel. Airlines registered in Asia/Pacific had the second largest regional share of domestic air travel with 20 per cent, followed by European carriers with 10 per cent.

1.21 On international routes, airlines registered in Europe held the dominant share as they achieved 37 per cent of the 1.7 billion PKP flown worldwide. Asia/Pacific carriers performed 31 per cent of international PKPs, while North American carriers ranked third with almost 19 per cent.



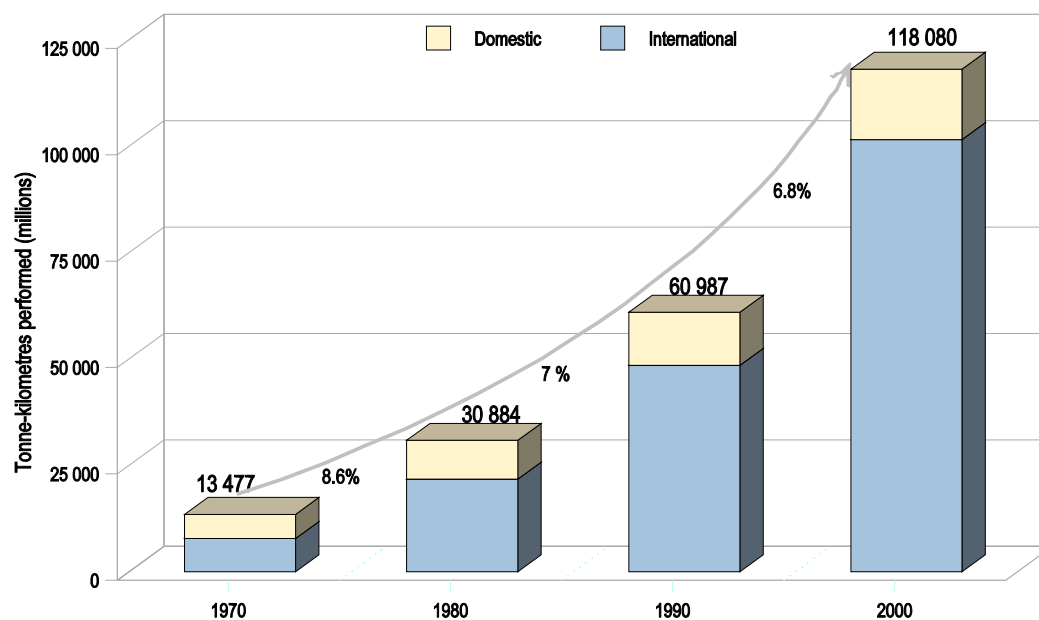
Source: ICAO.

Figure 1-7. Distribution of domestic and international passenger traffic — Regions, 2002

AIR FREIGHT

1.22 Air freight services have adjusted to the requirements of globalizing industries with increased frequency of flights, longer stage lengths and dense route networks. Business strategies of transnational corporations have long involved outsourcing of manufacturing, but recently also of business administration functions and even certain research and development tasks. As new markets opened up and international trade expanded, transporting products to be imported or exported by air was part of the globalization process. About 40 per cent of the value of the world's manufactured exports are being forwarded as air cargo. The just-in-time stock distribution concept relies on the ability of airlines, particularly specialized cargo carriers, to deliver air freight to almost any international destination within a day.

1.23 The air freight volume carried on scheduled flights tripled from almost 10 million tonnes in 1970 to 30.2 million tonnes in 2002, when airlines and specialized cargo carriers handled 18.8 on international and 11.4 million tonnes on domestic routes. Figure 1-8 shows the historic trends of freight traffic (including air mail services), measured in tonne-kilometres performed (TKP), on domestic and international routes for each decade from 1970 to 2000. While total freight traffic grew at an average annual rate of 7 per cent since 1980, international freight traffic grew at a rate of over 8 per cent despite the volatility of international trade during the recessionary phases in 1991 and 1998.



Source: ICAO.

Figure 1-8. Domestic and international freight traffic — World, 1970–2000

1.24 Table 1-3 shows the development of scheduled freight traffic (including air mail) in the regions during the 1991-2002 period. Airlines registered in Asia/Pacific, Europe and North America accounted for 90 per cent of the 121.2 billion TKP performed in 2002. In 2000, global air freight and mail traffic increased by 8.4 per cent in terms of TKP, led by strong demand for international air cargo movements performed by carriers registered in Europe, North America and Asia/Pacific. In 2001, it decreased by 6.2 per cent impacted by the overall economic development and event-related crisis in the air transport industry which also affected the airlines in those three regions.

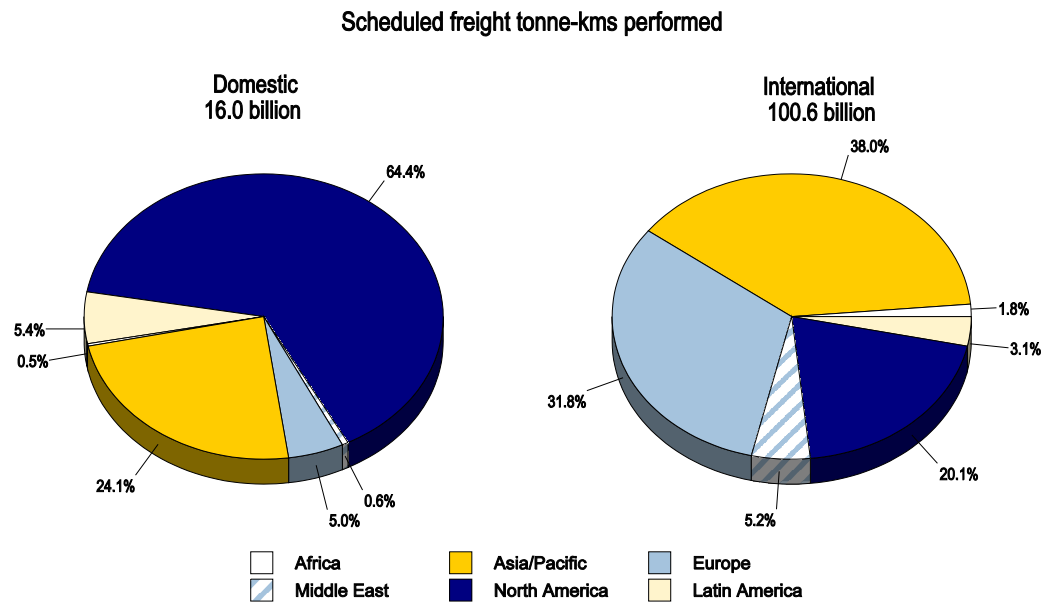
Table 1-3. Scheduled freight and mail traffic — World and regions, 1991–2002
(air carriers registered in ICAO Contracting States)

Region of airline registration	1991 TKP (millions)	Average annual growth 1991-2001 (%)	2001 TKP (millions)	Change 2001/2000 (%)	2002 TKP (millions)	Change 2002/2001 (%)	Share in world traffic 2002 (%)
Africa	1 140	6.3	2 100	-2.8	1 900	-9.7	1.6
Asia/Pacific	18 056	8.0	38 890	-5.5	43 280	10.5	35.7
Europe	20 667	5.0	33 660	-6.3	33 860	1.1	27.9
Middle East	2 288	7.4	4 670	-0.4	5 450	1.8	4.5
North America	18 577	5.7	32 440	-8.8	32 630	1	26.9
Latin America/ Caribbean	2 917	3.7	4 210	-7.4	4 040	-5.8	3.3
World	63 645	6.2	115 970	-6.2	121 160	4.4	100.0

Source: ICAO.

1.25 The regional participation in international freight traffic over the past three decades reflects a division of labour and trade flows between countries and regions that have shifted locations for production and changed patterns of consumption. The share of the airlines registered in North America in global international freight traffic declined from 31 per cent in 1970 to 20 per cent in 2002. In contrast, airlines registered in the Asia/Pacific region with their rapidly growing export-driven economies contributed largely to the overall growth on international routes with both intra-regional and inter-regional (transpacific, Asia-Europe, Asia-Middle East) traffic; their share went up from over 11 per cent to 38 per cent over the same period.

1.26 Figure 1-9 displays the regional distribution of domestic and international freight traffic in 2002.



Source: ICAO.

Figure 1-9. Distribution of domestic and international freight traffic — Regions, 2002

CHAPTER 2.

ECONOMIC CONTRIBUTION OF CIVIL AVIATION

2.1 As portrayed in Chapter 1, in an increasingly globalized economy air transport services meet the demand of business communities and millions of individuals to travel and have goods transported by air. Air transport is the lead constituent of civil aviation, which includes: commercial air transport services provided by scheduled and non-scheduled airlines, commercial aerial work (such as crop dusting, surveying, photography, observation and patrol, search and rescue, advertising, etc.) and general aviation activities (such as flying for instructional, business and pleasure purposes), infrastructure facilities and services of airports and air navigation systems, and aerospace manufacturing (such as airframes, engines and avionics).

2.2 This Chapter presents in its first part the overall results of a detailed study into the economic contribution of civil aviation in terms of global output and employment. Its second part presents a profile of the major contributing industries in terms of size, relevant performance indicators and details about their direct global output and employment.

GLOBAL DIRECT CONTRIBUTION AND MULTIPLIER EFFECTS

2.3 Measuring the economic contribution of civil aviation on an annual basis gives an account of the impact that air transport, aerospace and other affected industries have throughout a given economy. The economic activities directly attributable to civil aviation have been estimated, in terms of output value and related employment, at the global level. On that basis, conclusions are drawn regarding multiplier effects, arriving at an estimation of the total economic contribution of civil aviation.

Direct Economic Contribution

2.4 For the provision of air travel and freight services, airlines and other operators purchase a wide range of products (goods and services) from manufacturing and service industries which in turn depend on inputs from numerous suppliers. In addition, governmental agencies and public corporations render services to expedite flight operations and facilitate passenger, freight and mail movements, typically on a cost-recovery basis. Major inputs purchased from aviation-specific or other industries and services providers cover:

- airframes and engines, avionics and other aviation technology produced by aerospace manufacturers;
- petroleum and chemical products, such as kerosine, oil, de-/anti-icing fluid;

- use of airport facilities and services;
- aircraft servicing, maintenance and repair functions;
- ground-handling services by non-airline and non-airport operators;
- automated booking services through computer reservation systems (CRS);
- in-flight catering and entertainment;
- electronic and communication equipment, business support functions in financing, insurance, advertising, marketing and many other non-aviation products and services;
- training equipment, facilities and services;
- air navigation/air traffic management services rendered by private, public or corporate providers; and
- aviation security, customs and immigration functions rendered by airport operators and/or governmental agencies.

2.5 Economic activities that are directly attributable to civil aviation are grouped by major contributors which — for the purpose of an impact assessment — constitute civil aviation industries as displayed in Figure 2-1. They include: a) **airlines**, other aircraft operators and affiliates, b) **airports, air navigation services providers** and affiliates, and c) **aerospace** and other manufacturers, other services industries, and their affiliates. Airlines deliver air transport services, the final product of civil aviation industries, to their customers.

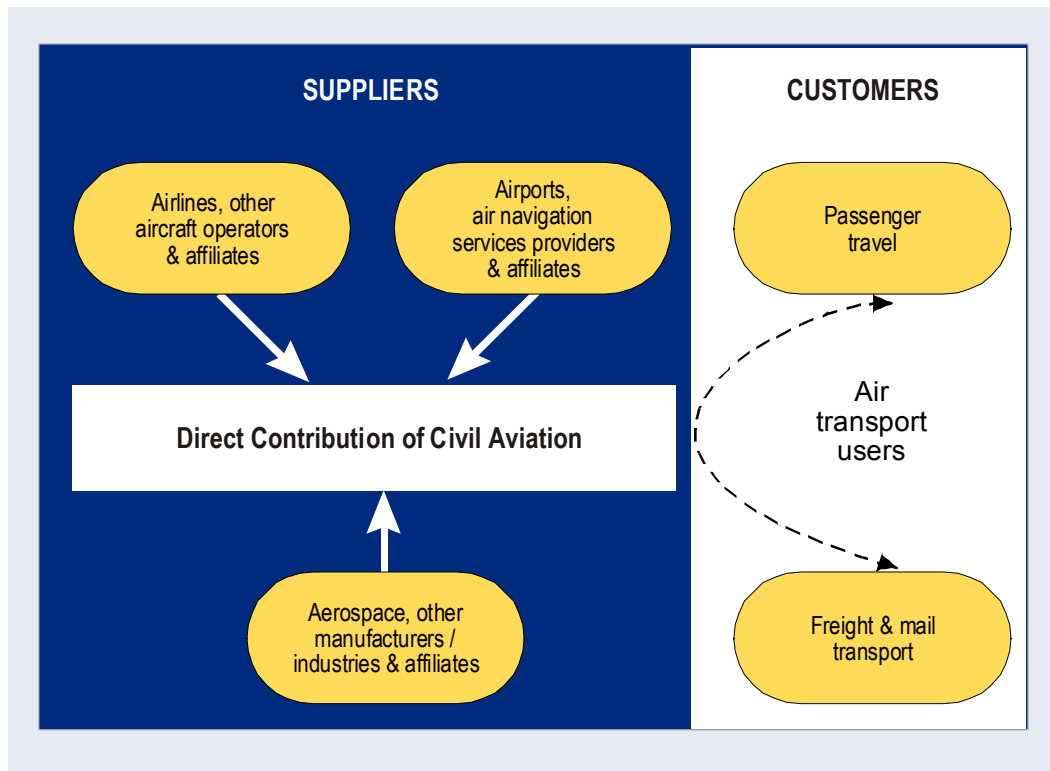


Figure 2-1. Major civil aviation industries

2.6 These three major civil aviation industries and their affiliates have been evaluated at the global level in terms of output value and related employment based on available data for 1998. It has been estimated that they generated a total output of \$652.1 billion that year and some 6 million jobs. Airlines accounted for \$354.7 billion output and 2.3 million jobs; aerospace, other manufacturers and industries as well as their affiliates for \$248.5 billion and 1.8 million jobs; and airports and affiliates for \$48.9 billion and 1.9 million jobs. The percentage distribution for each industry is shown in Figure 2-2, indicating that airlines and their affiliates generated more than half of the output value (54.4 per cent) of civil aviation industries. Airlines deliver the largest share of air transport services as final products to the consumer, backed by aviation technology, other manufacturers, and a host of affiliated suppliers. Aerospace and other industries generated 38.1 per cent of the output, while airports generated some 7.5 per cent.

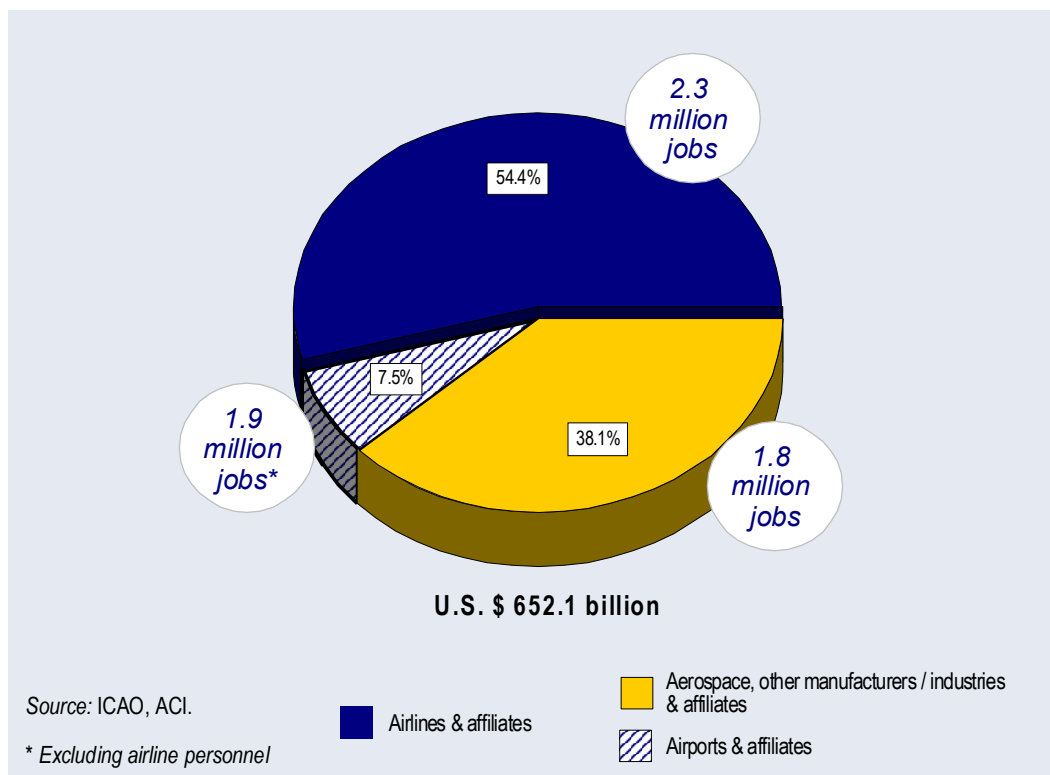


Figure 2-2. Output and employment of major civil aviation industries — World, 1998

2.7 These output values comprise both the final demand delivered by airlines etc. (see Figure 2-1, upper left), non-aeronautical revenues of airport operators (see Figure 2-1, upper right) and others as well as aviation-specific and miscellaneous, intermediate inputs delivered by airports, aerospace manufacturers and other contributors. These values have to be consolidated in order to eliminate the components of double-counting. Accordingly, it is estimated that civil aviation directly contributed to the world economy \$370 billion in consolidated output in 1998, the production of which required cumulatively the employment of at least 6 million people along the supply chains of intermediate inputs and final demand as illustrated in Figure 2-3.

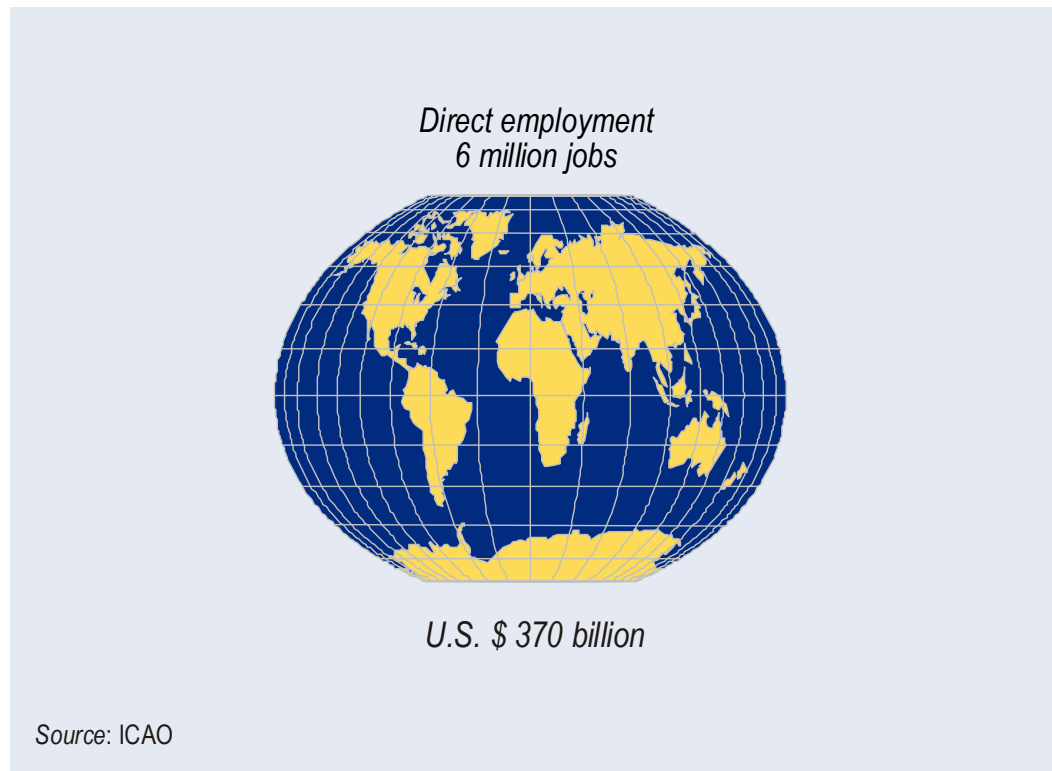


Figure 2-3. Direct economic contribution of civil aviation — World, 1998
(consolidated output and aggregate employment)

Multiplier Effects

2.8 Beyond the direct economic contribution of civil aviation industries, there are multiplier effects with other industries, supplying either intermediate inputs or consumer products. A wider or narrower spread of these effects throughout an economy depends on the circumstances, notably the size of industries associated with civil aviation, and on the approach taken for an impact assessment. For example, economies with significant aerospace manufacturing will show a wide spread, while those without it and/or with limited air transport services will have a relatively narrow spread.

2.9 For an impact assessment, there are two principal methodological approaches: a core approach and an expanded approach. Taking a core approach of an impact assessment, economic activities of civil aviation industries are captured, in terms of output and related employment, on an annual basis in three dimensions: a) **directly** in providing air transport services and related inputs, b) **indirectly** through transactions with numerous aviation-specific and other suppliers along the production chains, and c) **induced** by generating direct and indirect income which is re-channelled mainly into consumer industries.

2.10 An expanded approach of an impact assessment feeds into the analysis the additional **catalytic** demand. The off-airport expenditures of air transport users (passengers and freight forwarders) make up the output element of the catalytic demand, while the related jobs make up the employment element. This catalytic demand of air transport users (air travel, freight and mail) is also illustrated in Figure 2-1 above as spin-off effects from the directly contributing industries. Non-aviation travel and tourism businesses, such as hotels and restaurants, travel agencies, tour operators and retailers, greatly benefit from trip expenditures of airline passengers. In Figure 2-4, a simplified concept of an expanded

assessment approach illustrates the four components (direct, catalytic, indirect and induced) which comprise the total economic contribution.

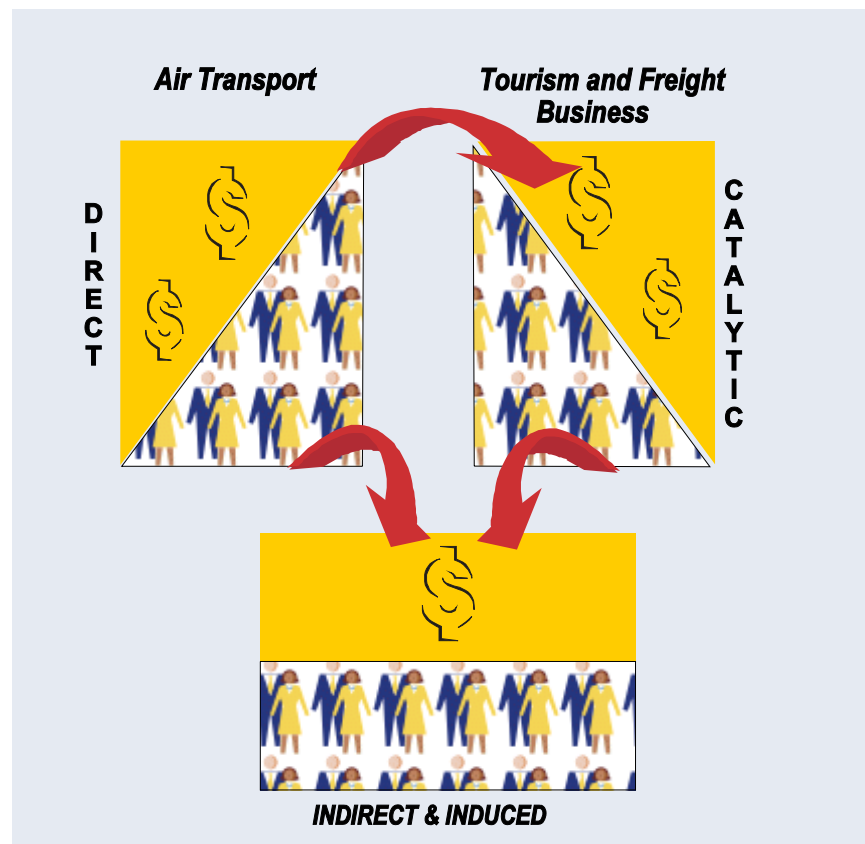


Figure 2-4. Components of total economic contribution
(expanded assessment approach)

2.11 Considering such a composition of the total economic contribution, Figure 2-5 shows the global total output and employment of air transport by type of demand effect. The air transport component of civil aviation generated a total output of \$1 360 billion and 27.7 million jobs worldwide in 1998, according to an estimate by the Air Transport Action Group (ATAG)¹, an industry-based group. This total output result suggests that 4.5 per cent of the world real GDP that year may be attributed to air transport and its multiplier effects.

2.12 ATAG estimates the direct contribution of the air transport industry to be \$320 billion and 3.9 million jobs. This output value is lower than ICAO's estimate of \$370 billion (see Figure 2-2) which also includes contributions from other civil aviation industries (see Figure 2-1). Catalytic demand effects are estimated as \$390 billion and 8.4 million jobs while the combined indirect and induced demand effects are estimated to be \$650 billion output and 15.4 million jobs.

¹ ATAG, 2000.

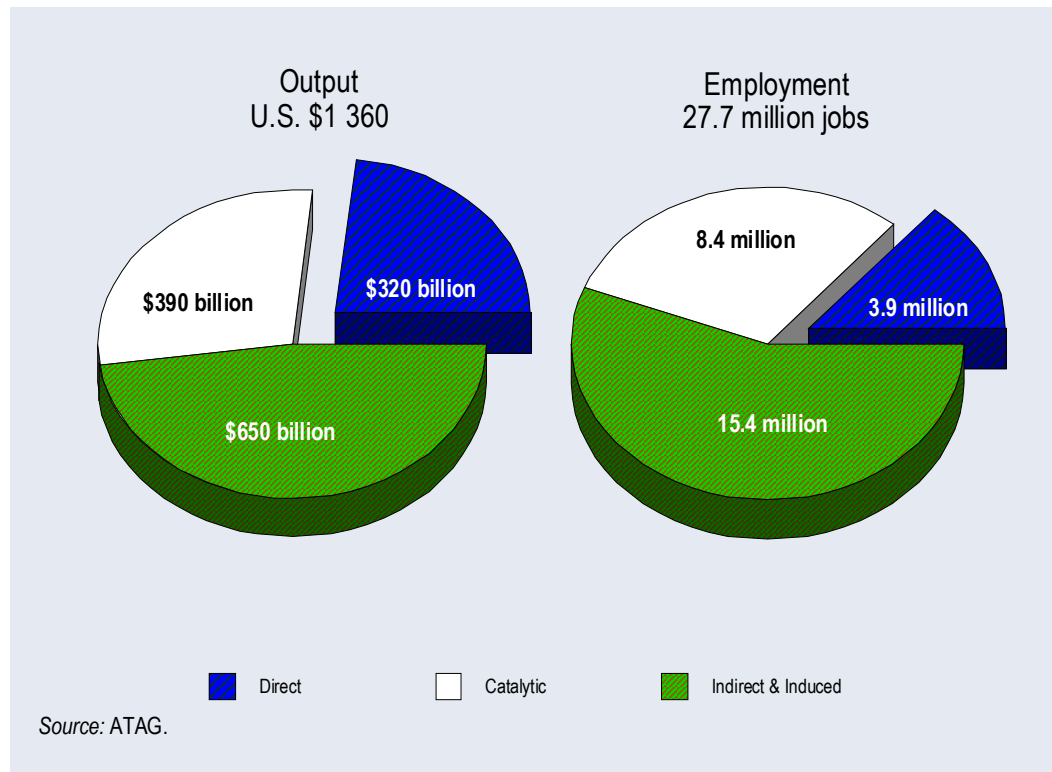


Figure 2-5. Total economic contribution of air transport — World, 1998
(expanded assessment approach)

2.13 The multiplier effects of air transport can be calculated as a ratio of the sum of catalytic, indirect plus induced demand effects to the direct demand effects in terms of output and employment. The economic stimuli of air transport — beyond its direct contribution — can then be expressed with output and employment multipliers. Accordingly, the output multiplier in terms of value is estimated at 3.25 while the employment multiplier is estimated at 6.1. These multiplier effects imply that for every \$100 of output produced and for every 100 jobs generated an additional demand of \$325 and in turn 610 jobs is triggered in other industries as illustrated in Figure 2-6. Over one third of the output and employment multipliers can be attributed to catalytic demand (equivalent to \$122 output and 215 jobs) and almost two thirds to indirect plus induced demand (equivalent to \$203 and 395 jobs).

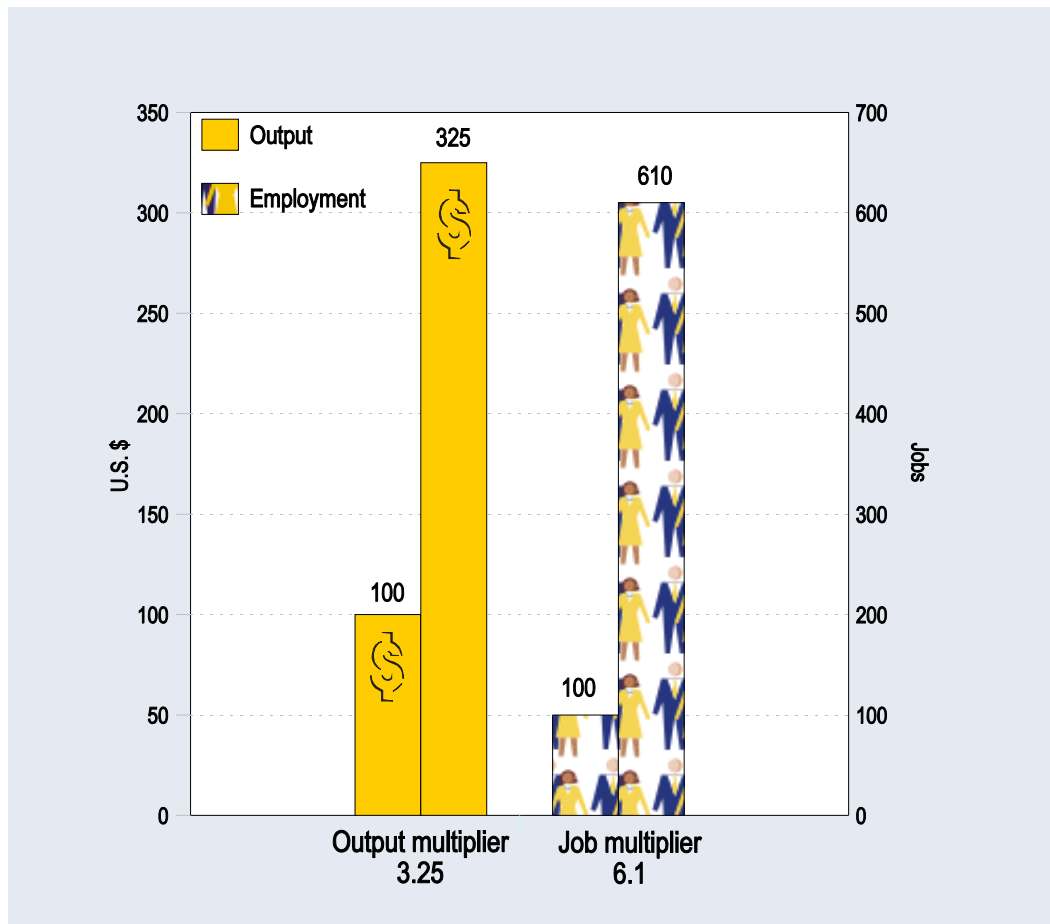


Figure 2-6. Output and employment multipliers of air transport — World, 1998

2.14 The findings on the direct contribution and multiplier effects remain generally relevant beyond the assessment year, particularly in view of the steep demand contractions of air travel in recent years, exacerbated by the events of 11 September 2001, which were followed by two years of stagnation. Despite the recent problems, industry consolidation and traffic recovery are now giving the air transport sector a chance to recuperate and, considering the economic importance of civil aviation, this recovery is expected to have a noticeable effect on other sectors of the world economy.

MAJOR CIVIL AVIATION INDUSTRIES

2.15 The direct contributions of each of the three major civil aviation industries and their affiliates (airlines, airports, aerospace manufacturers and others), shown in Figure 2-1, are profiled in this Section. They demonstrate their economic force as generators of wealth (output value) and as generators of employment while other performance indicators and historical data, covering the 1990s and recent years up to 2002, serve as background information.

Airline Industry and Affiliates

2.16 At the beginning of the 21st century, some 3 000 operators² were involved in commercial air transport services, aerial work or general aviation activities. In 2002, 806 airlines provided scheduled passenger services on international and/or domestic routes (including 76 airlines which provide both scheduled passenger and all-freight services), while 90 carriers operated scheduled all-freight services.

2.17 In summary, the global airline industry and affiliates contributed a total of \$355 billion to the \$652 billion direct aggregate output of civil aviation industries and 2.3 million jobs in 1998 out of the 6 million direct civil aviation employment shown in Figures 2-2 and 2-3, respectively.

Airline output

2.18 Total revenues of commercial airlines mirror the output value of the airline industry which amalgamates the output values of all those industries which provide a wide range of intermediate inputs to airlines. Airline operating expenses include items that reflect the transactions with airport operators, air navigation services providers and other industries to obtain aviation-specific products as well as general business supplies.

2.19 Figure 2-7 illustrates the financial performance of airlines registered in ICAO Contracting States on scheduled services from 1990-2002. From 1994-2000, airline operations recorded a profit, following the recovery from the recessionary years between 1990 and 1993. Airlines incurred financial losses during the 1990-1993 period and then again in 2001 and 2002. Operating revenues, expenses and results from total scheduled traffic are given in Table 2-1 by ICAO statistical regions for the years 2000, 2001 and 2002, along with the average annual performance from 1990-2000. Performance by the world's airlines in terms of traffic volume and financial results peaked in 2000, as discussed in Chapter 1.

² Back Aviation Solutions, 2001.

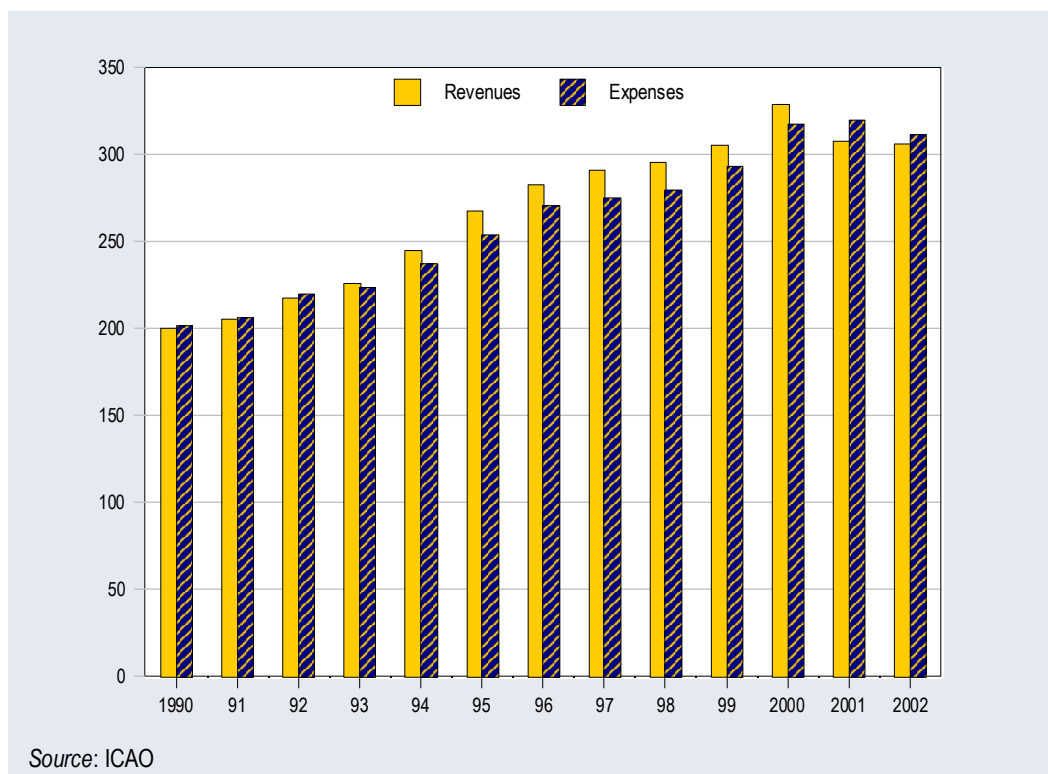


Figure 2-7. Airline expenses and revenues — World, 1990–2002
(scheduled airlines of ICAO Contracting States)

Table 2-1. Finances of scheduled airlines — World and regions, 1990–2002
(scheduled airlines of ICAO Contracting States)

Region of airline registration	Average annual growth 1990-2000 (%)		2000			2001			2002		
	Revenues (REV)	Expenses (EXP)	REV (millions)	EXP (millions)	Operating result as % of REV	REV (millions)	EXP (millions)	Operating result as % of REV	REV (millions)	EXP (millions)	Operating result as % of REV
Africa	0.1	0.1	6 800	6 800	0.0	6 500	6 600	-1.5	6 900	6 700	2.9
Asia/Pacific	6.0	6.0	69 800	66 700	4.4	66 700	65 900	1.2	72 600	69 700	4.0
Europe	4.7	4.5	95 200	93 800	1.5	93 200	94 300	-1.2	94 600	92 800	1.9
Middle East	3.7	4.2	9 500	10 000	-5.3	8 600	8 700	-1.2	9 400	9 500	-1.1
North America	5.3	4.5	132 300	125 500	5.1	118 100	128 700	-9.0	109 700	118 600	-8.1
Latin America/ Caribbean	5.6	5.1	14 900	15 000	-0.7	14 400	15 100	-4.9	12 800	13 500	-5.5
World	5.1	4.7	328 500	317 800	3.3	307 500	319 300	-3.8	306 000	310 800	-1.6

Source: ICAO

2.20 Figure 2-8 presents for the year 2000 airline operating revenues of \$328.5 billion, expenses of \$317.8 billion and \$10.7 billion operating profit. It also shows the breakdown of airline expenditures by major categories as percentage shares in total operating expenses, which cover costs for all operational activities from marketing and sales to delivering passengers and cargo to their destination airports.

2.21 Each of these categories comprises intermediate and primary inputs (value added). For example, the \$98.8 billion expenses for flight operations include \$45.9 billion for aircraft fuel and other consumables (e.g. oil and de-icing fluids) and \$27.1 billion in salaries for flight crews and training which represent part of the value added component. Maintenance and overhaul expenses of \$33.7 billion represent inputs from airlines' in-house technical units, aircraft and engine manufacturers or independent specialized companies (as discussed in relation to airport-based airline support in the following section on airports). Depreciation and amortization of \$20.8 billion include costs of capital investment for replacement, upgrading or expansion of their fleets on an annual basis. Station expenses of \$32.4 billion include ground handling and aircraft servicing. Payments for landing and associated airport charges amounted to \$13.5 billion and for route facility charges to \$8.8 billion. Expenses for passenger services of \$31.8 billion cover inputs from caterers, in-flight entertainment companies and others. Ticketing, sales and promotion costs of \$40.5 billion include the expenses for computer reservation system (CRS) services and travel agent commissions.

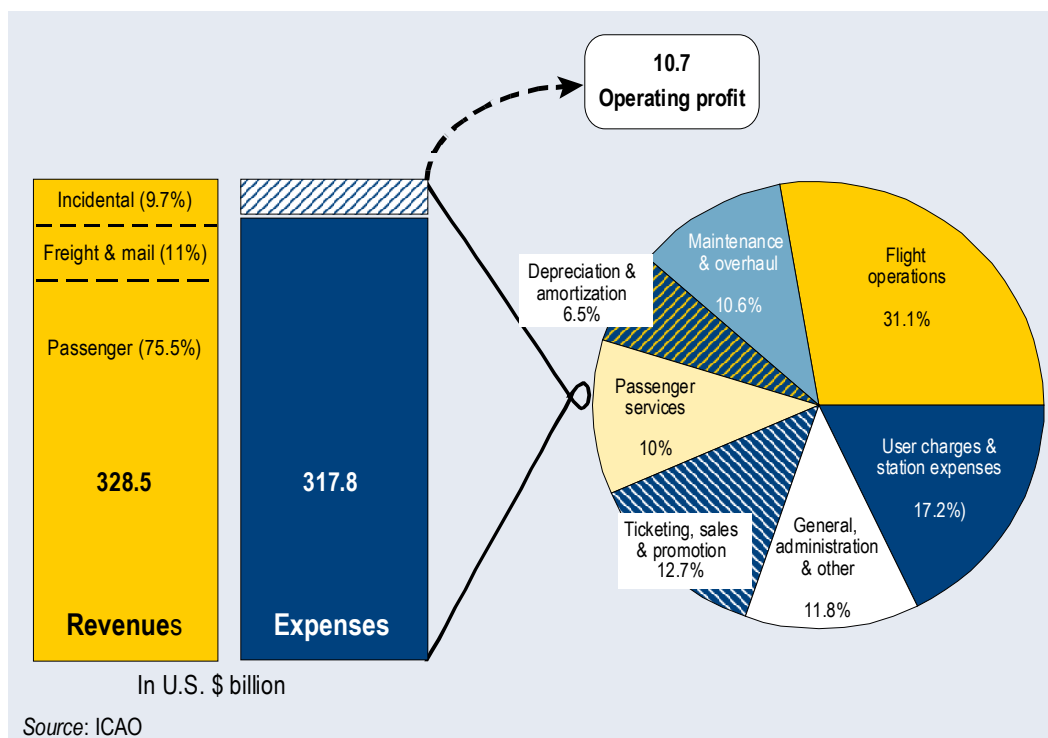


Figure 2-8. Airline finances including composition of operating expenses — World, 2000
(scheduled airlines of ICAO Contracting States)

Airline employment

2.22 Employment created in the airline industry worldwide also peaked in 2000. Airport employment has continued to decline, a trend that began in 2001. IATA member airlines³ employed 1.55 million people in 2002; a reduction of almost 10 per cent (166 000 jobs) over 2000. The Air Transport Association of America (ATA) has indicated that in the U.S. economy for every job the airlines shed, there could be up to six jobs lost in other industries.

2.23 When taking a closer look at airline employment today and the changes by occupational group over the 10-year period 1992 to 2002, expansion of worldwide air transport services, productivity gains and structural adjustments have to be taken into account. Traffic on total scheduled services rose during that period at a rate of 4.9 per cent per annum in terms of total tonne-kilometres performed and at 6.3 per cent for scheduled services on international routes. Overall labour productivity (tonne-kilometres performed per employee) rose at an average 5.2 per cent annually from 1992 to 2002. Structural adjustments materialized in outsourcing functions to independent corporations that were once an integral part of airlines.

2.24 Figure 2-9 provides the composition of airline personnel by occupational group for IATA member airlines for the years 1992 and 2002. In spite of the expansion in worldwide air transport services during the 1990s the number of pilots/co-pilots and cabin attendants increased only marginally because of redundancy effects. Improvements in labour productivity occurred through the introduction of fly-by-wire avionics and other automated equipment as well as procedures on flight decks of modern aircraft. Despite growing fleets, aircraft movements, passenger and air freight traffic, the share of airport handling staff remained unchanged, while the share of maintenance personnel decreased. The number of airline personnel required in these functions has been trimmed through technologically-induced productivity gains and sub-contracting to independent corporations. In particular, repair and maintenance functions were streamlined through computer-based diagnostic procedures, exchange of pre-manufactured components and outsourcing to specialized maintenance bases.

³ As of 1 June 2003, IATA had a membership of 271 member airlines, of which 249 were active members and 22 were associate members.

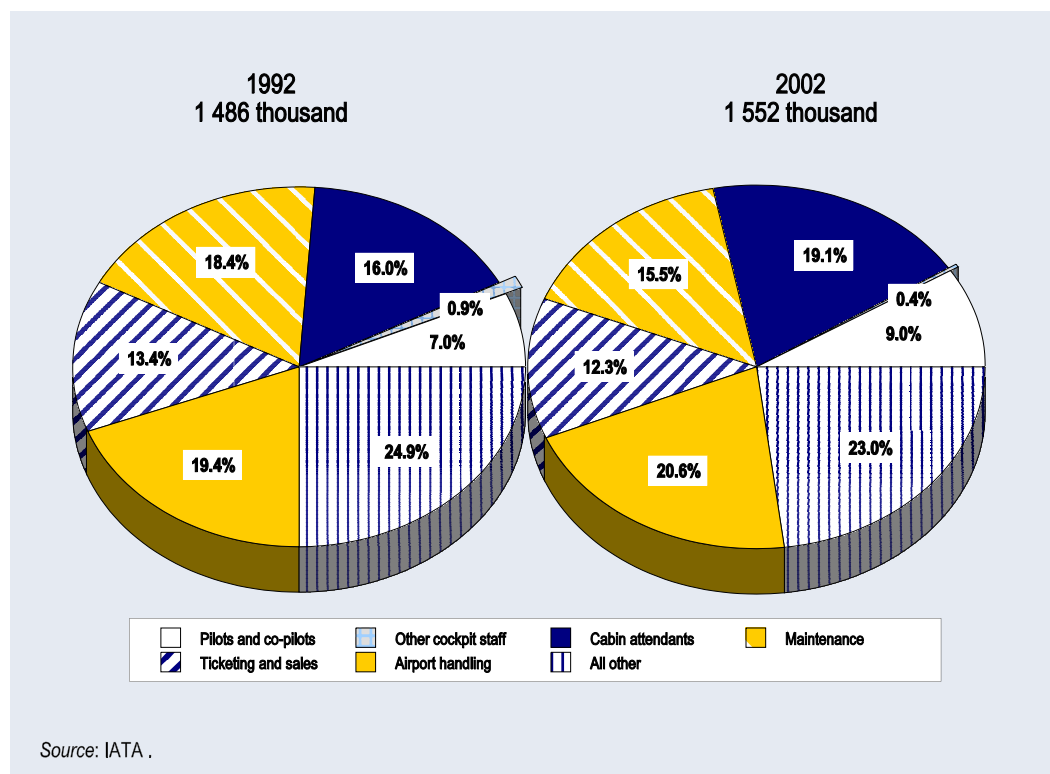


Figure 2-9. Airline personnel by occupational group — World, 1992 and 2002

Contribution of major airlines

2.25 Although the composition of global airline alliances has been changing over time, performance indicators of leading airlines mirror their contribution to the global airline industry. The 30 major scheduled airlines and their alliance partners as of 2002 are presented in Table 2-2, grouped by participation in the four leading alliances and ranked by total revenues. Combined, these four alliances controlled about 55.7 per cent of the global market share in terms of PKP and 54.4 per cent of FTK. They generated \$175.3 billion in revenue and employed about 770 000 people (including air freight revenues and related employment), thus contributing 57.3 per cent to total revenues and nearly half to total employment of the global airline industry.

Table 2-2. Profile of major airline alliances — 2002

Airline by alliance (ranked by revenue)	Revenue (millions U.S.\$)	Personnel	Passengers (000)	PKP (millions)	FTK (millions)	Fleet
Star Alliance						
Lufthansa	18 028	39 822	43 950	93 643	7 167	364
United Airlines	14 286	80 165	68 531	176 047	2 790	567
All Nippon Airways	10 133	13 340	43 680	54 220	1 250	140
Scandinavian Airlines System	6 690	20 911	22 896	24 170	2 402	193
Air Canada	6 221	32 365	23 323	69 019	1 591	244
Singapore Airlines	5 876	15 278	15 337	74 172	6 779	106
Thai Airways International	2 999	25 368	18 112	48 337	1 824	81
Austrian Air Group	2 247	7 178	7 070	13 794	396	87
Asiana Airlines	2 078	6 929	12 295	17 091	2 579	65
Air New Zealand	2 048	10 502	9 231	22 255	680	80
Varig	1 489	11 731	10 030	26 037	1 169	86
Mexicana	1 195	6 514	7 654	11 407	49	60
British Midland	1 073	4 607	7 846	5 523	58	57
Spanair	778	2 853	5 598	4 689	422	51
Sub-total	75 141	277 563	295 553	640 404	29 156	2 181
Oneworld						
American Airlines	17 420	98 960	94 070	195 815	2 577	822
British Airways	11 552	52 818	34 009	99 123	4 124	331
Qantas	5 897	28 107	23 893	72 891	1 467	141
Iberia	4 438	25 692	24 222	40 419	799	147
Cathay Pacific	4 242	14 649	12 299	49 011	4 784	78
Finnair	1 607	8 534	5 838	8 462	217	59
LanChile	1 452	10 770	5 322	11 521	1 441	56
Aer Lingus	1 106	4 288	6 212	8 413	116	34
Sub-total	47 714	243 818	205 865	485 655	15 525	1 668
Skyteam						
Delta Airlines	13 305	66 833	89 868	152 661	1 823	573
Air France Group	11 982	59 882	43 432	98 541	4 862	362
Korean Air	5 206	17 019	22 010	41 439	6 046	119
Alitalia	4 574	21 416	21 862	29 618	1 389	144
Aeromexico	1 354	6 650	8 862	12 728	87	67
Czech Airlines	381	4 411	2 801	3 841	27	31
Sub-total	36 802	176 211	188 835	338 828	14 234	1 296
NW/KLM						
Northwest Airlines (NW)	9 489	44 845	53 807	115 913	2 967	438
KLM Royal Dutch Airlines	6 125	27 072	19 380	58 893	3 992	128
Sub-total	15 614	71 917	73 187	174 806	6 959	566
Four alliances – Total	175 271	769 509	763 440	1 639 693	65 874	5 711
World total	306 000¹	1 552 000	1 615 000	2 942 300	121 160	20 877
Four alliances – Share (%)	57.3	49.6	47.3	55.7	54.4	27.3

1. Includes operating revenues from non-scheduled traffic of scheduled carriers and incidental revenues.

Source: ICAO, IATA, various air transport periodicals.

2.26 Leading airlines operating all-freight services with incorporated express delivery are dealt with separately. United Parcel Services (UPS), Federal Express and DHL are all-cargo carriers with an integrated line of freight forwarding business. Table 2-3 gives their profile as of 2002 in terms of revenues, employment, freight traffic and fleet strength. These three corporations generated \$52.2 billion in revenues and are major employers in their respective communities with close to half a million jobs, of which the vast majority is engaged in freight forwarding activities. In the case of UPS, out of a total personnel of 370 000, less than 10 per cent (3 590 people, including 2 530 flight crew) are employed directly in airline operations.

Table 2-3. Profile of major airlines operating all-freight services with express delivery — 2002

All-cargo airline / express delivery services	Revenue (U.S.\$ million)	Personnel	FTK (million)	Fleet
United Parcel Services	31 300	370 000	6 619	252
Federal Express	20 607	120 000	13 195	647
DHL Airways	254	941	155	249
Total	52 161	490 941	19 969	1 148

Source: Corporate information and various air transport periodicals.

Airline affiliates

2.27 Airlines rely on a host of specialized companies. Aircraft leasing companies perform financing and asset management functions that were once an integral part of airlines, while travel agencies and service providers of global distribution systems (GDS) share sales and marketing functions. Fleet-related functions of aircraft servicing, maintenance and repair and other airport-based airline support are discussed separately.

2.28 The aircraft leasing market started from a niche market for aircraft financing. It underwent consolidation and restructuring in recent years with two mega-lessors emerging that hold dominant positions in terms of customer base, asset value, fleet size and new aircraft on order. Worldwide, approximately 45 per cent of airlines lease a significant portion of their fleet rather than buy aircraft directly from manufacturers. This gives them greater flexibility in their investment into fixed assets and in responding to changing market conditions. Consequently, operating lessors own at least one quarter of the world's airline fleet. Revenues from leasing companies contributed an estimated \$21.7 billion and over 8 100 related jobs to the direct output and employment of airlines and affiliates in 1998 with major lessors listed in Table 2-4.

2.29 According to Airclaims' CASE database, the world's largest 43 operating lessors surveyed in early 2001 commanded a fleet of 4 281 aircraft valued at an estimated \$80.9 billion; this fleet count recorded 3 812 jet aircraft with an estimated valuation of \$77.7 billion. General Electric Capital Aviation Services (GECAS) owns 1 040 aircraft worth \$22.1 billion, followed by International Lease Finance Corp (ILFC) with 498 aircraft worth \$19.8 billion; together they hold half of the value of the lessors' fleet. There are more than a dozen leasing groups (excluding manufacturers) with around \$1 billion or more in fleet assets, and another two dozen in the double and triple digit million category. Lessors are now among the biggest buyers of new aircraft, holding more than 1 000 orders. GECAS and ILFC alone became the largest customers for Boeing and Airbus, benefitting from low-cost funding and access to capital markets through their respective parent companies. While the larger companies cater

to the major commercial carriers around the globe, there are many small companies providing such services for the business and general aviation markets.

2.30 Travel agents have traditionally been airlines' principal distribution medium for passenger traffic. However, airlines depend less on ticketing through travel agencies and were able to reduce related commission costs, the more they take advantage of liberalized tariff regimes and use services of computer reservation systems (CRS), electronic ticketing and e-commerce. Major suppliers of global distribution systems (GDS) diversified from offering just CRS services into becoming information technology providers to the travel industry, in order to maintain their market shares in a rapidly changing business environment. Four multi-national GDS companies dominate the global market for automated bookings, which is still predominantly used for air travel. The four major GDS providers listed in Table 2-4, generated annual revenues of some \$5.8 billion and some 19 700 jobs in 1998. The bulk of bookings and sales via GDS are still made by travel agencies, where about 200 000 employees handle ticket sales for airlines in the approximately 75 000 outlets accredited to IATA (employment data for non-IATA agents is not available).

Table 2-4. Major suppliers of selected airline support services — 1998

Supplier	Ownership	Country of Headquarters	Revenues (US\$ million)	Personnel
AIRCRAFT LEASING				
General Electric Capital Aviation Services (GECAS) ¹	General Electric	USA	8 651	215
International Lease Finance Corp (ILFC)	American International Group Inc. (AIG)	USA	2 080	95
Flightlease	SAir Group	Switzerland	481	130
GATX Capital Corp.	GATX Corporation	USA	196	50
Debis Airfinance	DaimlerChrysler/ several German banks	Netherlands	192	22
Total			11 600	512
GLOBAL DISTRIBUTION SYSTEMS				
SABRE	The Sabre Group Holdings, Inc., 80% owned by AMR Corporation	USA	2 306	10 800
Galileo International	Various airlines	USA	1 480	3 000
Amadeus	Air France, Iberia, Lufthansa	Spain	1 326	2 860
Worldspan	Delta Airlines, Northwest Airlines, Transworld Airlines	USA	700	3 000
Total			5 812	19 660

1. GECAS is the Commercial Aircraft Management Unit under Equipment Management of General Electric's Capital Services (GECS). GECS revenues were US\$48.7 billion out of which Equipment Management contributed US\$14.9 billion in 1998. GECS employed that year 86 000 employees, 38 000 of which were posted in the United States and 48 000 in other countries.

Source: Corporate information and various air transport periodicals.

Airport Industry and Affiliates

2.31 Besides airlines and aerospace manufacturers, airports and affiliates contribute significantly to the output and employment generation of civil aviation industries. Airports are of strategic importance to the competitiveness of a wide range of industries and commercial enterprises. A corporation's ability to gain from international markets and business opportunities requires rapid movement of people and goods in spite of modern telecommunications. Ready access to efficient air services at conveniently located international airports can strongly influence a corporation's choice of location. Therefore, international airports are vital assets in the national and international competition of communities for multinational corporations and inward foreign direct investment.

2.32 In 2002, scheduled flights were operated from nearly 4 000 commercial airports including some 1 187 airports open to international operations. As shown by the regional distribution in Figure 2-10, most airports are located in Asia/Pacific, North America and Europe. However, due to vast differences in traffic volume handled at individual airports, North America and Europe rank first in terms of total traffic volume. Traffic handled by the top 25 airports of the world for the years 2002 and 2001 is listed in Table 2-5, ranked by total passenger throughput with aircraft movements indicated separately.

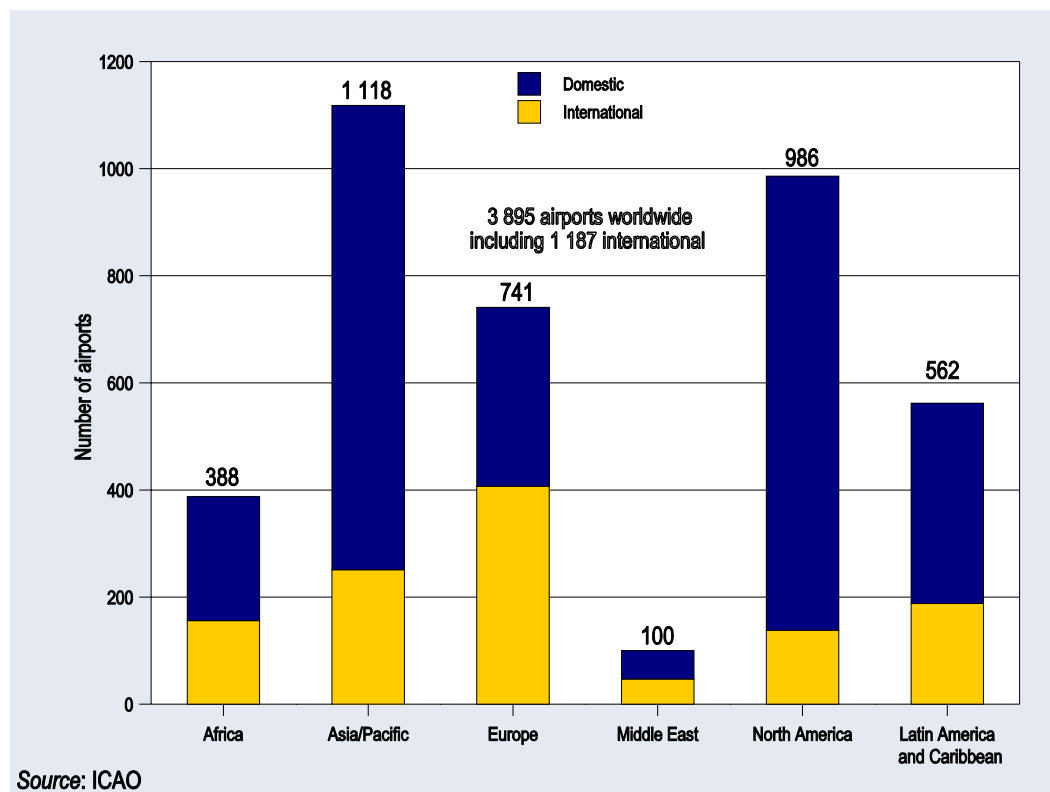


Figure 2-10. Commercial airports — Regions, 2002
(domestic and international operations)

Table 2-5. Total traffic at top 25 airports — World, 2001 and 2002

No	Airport (in brackets ranking by total aircraft movements in 2002)	Passengers embarked and disembarked				Aircraft movements			
		2002 (thousands)	2001 (thousands)	Change 2002/2001 (%)	Average change per annum 2002/1993 (%)	2002 (thousands)	2001 (thousands)	Change 2002/2001 (%)	Average change per annum 2002/1993 (%)
1	Atlanta (2)	76 611	75 503	1.5	5.4	871.6	876.0	-0.5	3.4
2	Chicago (1)	66 566	66 955	-0.6	0.2	892.5	875.1	2.0	1.0
3	London-Heathrow (10)	63 035	60 454	4.3	3.2	460.3	457.6	0.6	1.7
4	Tokyo-Haneda (38)	61 414	58 657	4.7	4.4	276.4	262.0	5.5	4.3
5	Los Angeles (4)	56 224	61 606	-8.7	1.8	626.8	707.3	-11.4	0.1
6	Dallas/Ft. Worth (3)	52 829	55 151	-4.2	0.7	752.8	770.6	-2.3	-0.5
7	Paris-Charles de Gaulle (5)	48 256	47 930	0.7	7.3	501.7	515.1	-2.6	5.7
8	Frankfurt (11)	48 174	47 517	1.4	4.7	450.3	445.6	1.1	3.4
9	Amsterdam (18)	40 588	39 309	3.3	7.7	401.4	416.5	-3.6	5.0
10	Denver (7)	35 651	36 093	-1.2	1.0	495.8	468.3	5.9	-0.6
11	Phoenix (8)	35 547	35 439	0.3	4.7	489.4	488.7	0.1	3.1
12	Las Vegas (17)	35 009	35 181	-0.5	5.0	404.6	402.2	0.6	2.7
13	Houston-G. Bush Intl.(14)	33 905	34 804	-2.6	5.9	436.6	450.2	-3.0	2.5
14	Madrid (24)	33 677	33 778	-0.3	7.7	363.7	371.2	-2.0	7.7
15	Hong Kong (53)	33 451	32 027	4.4	3.6	206.7	196.9	5.0	5.0
16	Minneapolis (9)	32 630	34 308	-4.9	3.8	460.8	452.3	1.9	1.9
17	Detroit (12)	32 478	32 294	0.6	3.3	446.9	478.0	-6.5	1.3
18	New York-Kennedy (35)	30 800	29 349	4.9	1.6	277.3	283.5	-2.2	-1.4
19	San Francisco (30)	30 751	33 944	-9.4	-0.5	331.9	367.5	-9.7	-1.8
20	Bangkok(55)	30 485	28 808	5.8	6.6	198.0	187.3	5.7	4.5
21	New York-Newark (22)	30 442	30 558	-0.4	1.9	390.3	422.7	-7.7	-0.7
22	Miami (21)	30 060	31 668	-5.1	0.5	391.0	417.0	-6.2	-1.7
23	London-Gatwick (47)	29 518	31 097	-5.1	4.4	233.6	244.1	-4.3	3.2
24	Singapore (68)	27 374	25 552	7.1	4.3	174.8	179.0	-2.3	2.8
25	Beijing CN (46)	26 845	24 176	11.0	n.a.	234.7	220.6	6.4	n.a.
TOTAL		1 022 320	1 022 158	0.0	3.7	10 769.9	10 955.3	-1.7	2.0

Source: ICAO, ACI and airport websites.

2.33 The economic importance of airports has been targeted in specific impact assessments, typically in connection with new construction projects, such as runway or terminal expansions, which engage numerous suppliers, e.g. construction materials and civil/aerodrome engineering services. Many international airports have pioneered studies on the economic impact that their infrastructure and operations has brought to the adjacent local, state-wide (regional) and/or national economies.

2.34 In summary, the global airport industry and their affiliates are estimated to have contributed a total of \$48.9 billion to the \$652.1 billion direct aggregate output of civil aviation industries and 1.9 million jobs in 1998 out of the 6 million direct civil aviation employment shown in Figures 2-2 and 2-3, respectively.

2.35 Airports as commercial systems are recognized as highly significant employment generators for their adjacent economies, often exceeding employment by large multinational

manufacturing bases, such as automotive plants or electronics production. A widely accepted concept for measuring direct employment at airports takes into account personnel not only of airport operators, but also personnel with affiliated organizations and companies including concessionaires, air navigation services, ground handling, catering, aircraft servicing, maintenance and repair, custom and immigration offices and, of course, airlines. However, to avoid double counting when assessing the direct employment of civil aviation, airline personnel posted at airports are excluded from direct airport employment.

2.36 At the global level, the direct economic contribution of airports has been evaluated in terms of output value (measured as revenues) and employment. The fourth and sixth *Airport Economics Surveys* of the Airports Council International (ACI) covered airport operations in 1998 and 2001 and assessed four economic indicators: employment, sources of revenue (aeronautical and non-aeronautical), operating results and capital expenditures. The survey samples drew representative and geographically balanced results from all six regions that permitted extrapolation to cover all airports operated by ACI members⁴ worldwide.

2.37 ACI's fourth *Airport Economics Survey*, conducted in 1999, reports some \$39.1 billion revenues of their member airports worldwide in 1998, of which \$18.7 billion were aeronautical and \$20.4 billion were non-aeronautical revenues. Operators of ACI member airports worldwide had 289 000 employees on their payroll in 1998. Additional employment of some 2.7 million jobs existed on airport sites with airlines and airport affiliates that supply aviation-specific and other products needed for airline and airport operations and servicing of their customers. Without airlines, the direct employment at airports (on-site) is estimated at some 1.62 million people. For every employee of an airport operator, there were approximately another 5-6 jobs on the airport site with affiliates excluding airline personnel (or another 9-10 jobs including airline personnel).

2.38 Furthermore, it has been conservatively estimated that yet another 691 000 jobs exist with aviation-related industries located at airports (off-site). On that basis, ACI estimates that airport activities directly create approximately 3.7 million jobs at airports (on- and off-site) in 1998.

2.39 In 2001, down-scaled airline operations immediately affected airports, air navigation services providers, concessionaires, and airport-based as well as other suppliers of airline-support products. On the cost side, fixed costs for aeronautical services remained about the same while other expenses increased dramatically for operational security measures as well as insurance coverage and premiums. Deferred airport construction projects affected supplying industries.

2.40 The world's airports handled 3.12 billion passengers in 2001, a decline of 2.6 per cent over 2000. The global results were largely influenced by the declines at airports in North America (-6.6 per cent) and Europe (-0.6 per cent), which were offset by the continued growth in Asia/Pacific (2 per cent). Airports and air navigation services providers in regions affected by traffic declines lost income from aeronautical user charges (mainly landing, parking and air navigation charges) with less aircraft movements, and passenger service charges as well as non-aeronautical revenues from fewer passengers.

2.41 ACI's sixth *Airport Economics Survey* reports some \$42.2 billion revenues of their member airports worldwide in 2001, of which \$19.6 billion were aeronautical and \$22.6 billion were non-aeronautical revenues. Table 2-6 reviews revenues, earnings and personnel of airport operators by

⁴In 2003, ACI had a membership of 558 airports and airport authorities operating over 1 500 airports in 170 countries and territories.

region, as well as the survey totals for 1998 and 2001. Non-aeronautical revenues constituted about one third of total airport income in 1990 and reached about 52 per cent in 1998. This trend in revenue generation demonstrates that more and more airport operators, in addition to their core air transport business, offer a full-service environment to travelers and airport visitors, such as airport-based retailing including duty-free merchandise, business centres, catering and entertainment. Airports in Asia/Pacific, North America, and Europe have a higher share of non-aeronautical revenues compared to those of Africa, Latin America and the Caribbean.

Table 2-6. Finances and employment of airport operators — Regions, 1998 and 2001

Region	Total (U.S. \$ billion)		Revenues		Share of non-aero- nautical (%)		Operating Result ¹ (U.S. \$ billion)		Net Result (US \$ billion)		Jobs	
	1998	2001	1998	2001	1998	2001	1998	2001	1998	2001	1998	2001
Africa/ Middle East	1.51	2.07	63.6	46.9	36.4	53.1	0.52	0.58	0.01	0.01	36 000	44 000
Asia/Pacific	8.88	9.84	43.4	44.1	56.6	55.9	2.72	4.30	0.12	1.01	73 000	107 000
Europe	16.38	16.31	49.8	48.5	50.2	51.5	5.40	4.92	0.64	0.27	121 000	120 000
Latin America/ Caribbean	1.82	1.64	69.8	63.4	30.2	36.6	0.40	0.62	-0.09	0.27	16 000	18 000
North America	10.49	12.38	42.9	43.5	57.1	56.5	4.29	2.22	0.16	-0.93	43 000	44 000
Survey total	39.08	42.24	47.9	46.5	52.1	53.5	13.32	0.54	0.84	0.63	289 000	333 000

1. Earnings before interest, taxes, depreciation and amortization.

Source: ACI.

2.42 Airport operators employed 333 000 persons worldwide in 2001 according to ACI. The airport association estimates that commercial activities on- and off-site at airports created direct employment of approximately 4.5 million jobs the same year. This includes airline personnel, air navigation services providers and all other on-site jobs with affiliates that supply products for air transport operations and other activities. A recent regional survey conducted by ACI found that about 2 million jobs existed in 2001 on airport sites in North America alone. Additional jobs exist in the airport vicinity typically with freight forwarders and other firms engaged in aviation-related activities located at airports (off-site).

2.43 An indication regarding revenues of air navigation services providers can be derived from operational costs of scheduled airlines of ICAO Contracting States which incurred \$8.02 billion in route facility charges in 2001, representing 2.5 per cent of their total operating expenses. While the direct employment at airports (on-site) covered personnel with air navigation services providers, separate employment data were not available.

Airport-based airline support businesses

2.44 In addition to aircraft servicing/maintenance/repairs (see Section on Aerospace manufacturers and affiliates), airport-based airline support includes fueling, ground handling and catering. Like for fleet-related functions, major providers of specialized products have emerged and created supplier networks that can match the global operations of so-called mega-carriers. Following the strategies of core aviation industries, these groups approach maturing market concentration through contracting from airlines, mergers and acquisitions. Small local industries serving national airlines make up the rest of the airline supply markets.

2.45 Fuel is an intermediate input from the petroleum industry which over the past decade has ranged from 10 per cent to 15 per cent of operational expenditures of scheduled airlines worldwide. Global fuel demand of civil aviation, including general aviation, had an estimated value of \$46 billion in 1998. Fuel consumption of civil aircraft operations grew from 4 million barrels per day in 1998 to 4.4 million in 2000, more than one third of which (1.5 million) were acquired for U.S. operations. Specialized companies for fueling of aircraft exist at U.S. airports, while major transnational oil companies still control this function in Europe. As a consequence, it is difficult to isolate employment that is solely attributable to aviation fuel. In any event, related employment is accounted for as part of direct airport employment since fueling is an airport-based operation.

2.46 Ground handling is another important airport-based aviation support service, with a global market estimated to be worth \$31 billion in 2000, according to industry sources. Worldwide, airlines still perform 55 per cent of this function themselves and airport authorities account for another 10 per cent. A growing number of airport operators and airlines have out-sourced ground handling services; either they have contracted to specialist companies or established independent subsidiaries.

2.47 According to a survey undertaken for *Airline Business* at European airports with an annual throughput of more than one million passengers, the current ground handling market in Europe is estimated at \$11.5 billion, of which airline companies hold a share of 45 per cent, airport authorities 40 per cent and independent operators 15 per cent. Several large airport operators in Europe still manage labour-intensive, ground-handling operations themselves; for instance one major international airport employs some 10 000 workers just for this function.

2.48 Major ground handling companies include Europe-based suppliers such as Swissport, Globeground, AviaPartner, Serviair, and in the U.S. Ogden Aviation, Worldwide Flight Services and Airport Services International Group (ASIG). Combined, these ground service providers generated total revenues of some \$2.9 billion and employed around 62 700 people in 1998, as detailed in Table 2-7.

2.49 As with ground handling, new industry dynamics are affecting in-flight catering since airlines began selling off their flight kitchens and outsourcing food production in the mid 1980s. While some airlines still produce their own meals, this area of support has become a specialized niche market. Multinational corporations gained dominating regional market shares at the expense of local firms serving national airlines. Although they exist as independent firms and also provide catering to other corporate customers (railways, hospitals, schools), most catering suppliers are affiliated to airlines by ownership. LSG Skycheffs and Gate Gourmet, owned by Lufthansa and SAir respectively, consolidated their dominant positions in the in-flight catering business, particularly in North America and Europe where they reached a joint market share of about 80 and 75 per cent respectively, compared to only 15 per cent in Asia. As a result, together they control 55 per cent of the global market. According to the International Flight Catering Association, airlines are incurring costs of approximately \$10 billion a year on in-flight catering: \$3 billion in the Americas, \$2.9 billion in Europe, \$3.2 billion in Asia-Pacific, and \$0.9 billion in the rest of the world. Major providers in the global airline catering business sold products

worth about \$7.35 billion and employed some 100 000 people in 1998 as detailed in Table 2-7, excluding those airlines which still do their own catering.

Table 2-7. Major suppliers of airport-based airline support products — 1998

Supplier	Ownership	Country of Headquarters	Revenues (US\$ million)	Personnel
GROUND HANDLING				
Swissport	SAir Group	Switzerland	625	10 000
Frankfurt Aviation Ground Services	Frankfurt Flughafen A.G.	Germany	486	7 000
Singapore Airport Terminal Services (SATS)	Singapore Airlines	Singapore	348	5 319
Menzies Aviation Group/Ogden Aviation	Menzies Aviation Group	USA	310	1 800
Servisair	Penauille	UK/France	305	8 600
GlobeGround (LH)	Lufthansa Group	Germany	260	16 465
Worldwide Flight Services	Castle Harlen Partners III	USA	220	7 500
AviaPartner	Verougstaete family (75%)	Belgium	185	3 500
Signature (ASIG)	BBA Aviation/Ranger Aerospace	USA	170	2 500
Total			2 909	62 684
CATERING				
LSG Sky Chefs	Lufthansa Group	Germany/USA	3 500	40 000
Gate Gourmet	SAir Group	Switzerland	1 729	26 000
Servair	Air France	France	401	5 200
Alpha Catering Service	Alpha plc	UK	354	5 750
Singapore Airport Terminal Services (SATS)	Singapore Airlines	Singapore	346	2 823
Total			6 330	79 773
MAINTENANCE				
GE Engine Service	General Electric	USA	5 000	12 500
Lufthansa Technik AG	Lufthansa Group	Germany	1 900	10 000
American Airlines Maintenance & Engineering Center	American Airlines	USA	1 300	7 200
Aircraft Maintenance & Engineering Co (AMECO)	Air China/ Lufthansa Group	China	1 100	3 500
Rolls Royce Aero Repair and Overhaul	Rolls Royce plc.	UK	1 100	2 300
MTU Maintenance	MTU Aero Engines	Germany	1 063	3 500
SR Technics	SAir Group	Switzerland	760	3 100
SIA Engineering Co. Pte.	Singapore Airlines	Singapore	495	4 300
Total			12 718	46 400

Source: Corporate information and air transport periodicals.

Aerospace Industry and Affiliates

2.50 Aerospace industries manufacture airframes and engines, avionics and other aviation technology including training equipment; aircraft servicing, maintenance and repair functions also fall in this category. These industries provide the technological base for improved resource efficiency,

performance and safety standards in air transport operations; airlines and their customers benefit and so do airports and their vicinities.

2.51 In summary, civil aviation production of major aerospace and other manufacturers alone contributed about \$216 billion in output and some 1.8 million jobs in 1998 towards the \$652.1 billion direct aggregate output of civil aviation industries and 6 million direct civil aviation employment shown in Figures 2-2 and 2-3, respectively.

Aerospace manufacturers

2.52 The size of the world commercial fleet expanded by 2 024 aircraft or 12 per cent over the 10-year period 1990-2000. Taking stock of the world's commercial aircraft fleet in 2002 shows 20 877 aircraft in service with a minimum take-off weight of 9 tonnes; four in five were powered by jet engines. The world's carriers ordered 497 jet aircraft in 2002 representing a financial commitment of about \$40 billion, down from the 990 orders placed and \$69 billion committed in 2001. By year end 2002, aircraft manufacturers had delivered 999 jet aircraft and had a backlog of unfilled orders for 3 407 aircraft, compared with 1 219 delivered aircraft and 3 799 unfilled orders in 2001. Prior to 11 September 2001, some 2 500 new aircraft had been scheduled for delivery during the 2001-2002 period. Grounding aircraft, as one of the measures to minimize the cost of excess capacity, stockpiled 1 280 western-built commercial jets in storage by year-end 2001 and still 1 133 jets, including 790 aircraft for sale or lease, at the end of 2002.

2.53 Airlines and aircraft leasing companies around the world have deferred or postponed the delivery of new aircraft which has an effect on commercial aircraft production. Output cutbacks and substantial job losses at major manufacturers spread along the production chain to the next tier of numerous parts - producing suppliers.

2.54 Table 2-8 lists major aerospace manufacturers by country or region for which both revenue and employment data in 1998 were available. In a highly concentrated market, manufacturers in North America and Europe together produce \$129.1 billion or almost 90 per cent of the estimated turnover and hold 1.15 million or over 70 per cent of aerospace jobs. Leading aerospace companies produce a significant share of their annual output for export. Exports of manufacturers represented by the Aerospace Industries Association of America (including Boeing Commercial Airplane Group, Lockheed Martin Corporation, General Electric Aircraft Engines, Pratt & Whitney of United Technology Corporation and numerous others) accounted for more than two thirds of their aggregate annual sales in 1998. While the estimated global turnover includes the major aerospace industries, it is an underestimate as the output value for civil production of aerospace industries for the rest of the world is not readily available.

Table 2-8. Output and employment of major aerospace industries — 1998

Country / region	Revenue (U.S.\$ billion)	Employees (‘000)
Aerospace Industries Association (AIA) of America	75.8	802.0
Aerospace Industries Association of Canada (AIAC)	11.5	59.7
European Association of Aerospace Industries (AECMA)	41.8	290.0
Japan	7.8	25.1
Korea	3.8	9.2
Brazil	1.1	6.3
Total	141.8	1 192.3

Source: AIA, AIAC, AECMA and others.

Aerospace after-sales market

2.55 Fleet-related functions of aircraft servicing, maintenance and repair are traditionally shared between aircraft and engine manufacturers, airlines and third-party firms. Coming from an extremely fragmented structure of after-sales suppliers, this airline support business is undergoing industrial restructuring with international dimensions. For an airline, the investment required to keep pace with aircraft maintenance technologies makes an in-house facility extremely cost-intensive. As a result, a growing number of airlines are contracting out their aircraft servicing and maintenance work. Airlines either sold their maintenance facilities to existing suppliers or established subsidiaries which operate independently from the airline core business but still belong to the airline. Lufthansa Technik AG, SR Technics or SIA Engineering Co. Pte. are such firms which evolved from airline technical divisions. They are now competing in this highly specialized activity to become maintenance providers to many international airlines operating from the same hub-airports as their parent airlines. Local maintenance firms often enter joint ventures with multinational firms to cope with technological advancement and globally competitive management and marketing practices.

2.56 In response to airline demands for better solutions to support the efficient use of their aircraft fleets, mega- suppliers have emerged and dominate the global market for third-party servicing, maintenance and repairs which has been estimated at around \$25 billion in 1998 with 151 200 jobs. Details on leading suppliers are given in Table 2-7 above, together with other airport-based airline support. Airlines which perform their own aircraft servicing and heavy maintenance cover employment for these functions under their airline personnel.

2.57 In search of total after-sale support packages, airlines increasingly refer heavy maintenance and repair of both airframes and engines back to the respective original equipment manufacturers or their subsidiaries. This outsourcing strategy has the advantage of having access to integrated systems, processes and infrastructure to deliver all the products that airlines require for their fleets without having to invest themselves in costly facilities for new airframe and/or engine models, requiring a less frequent maintenance routine. Thus, manufacturing firms strengthen their market

position in the consolidation process, e.g. General Electric taking over the engine overhaul operation of British Airways.

2.58 Fleet-related products are the largest component among airport-based airline support with a global market estimated at about \$62.9 billion in 1999. As shown in Figure 2-11, they can be grouped into three major categories: \$13.8 billion spent for aircraft servicing, \$18.5 billion for heavy aircraft maintenance and \$30.6 billion for major aircraft modifications and repairs, specified as airframe and/or engine repairs including manufacturing of parts. Output values for these fleet-related functions exceed the global airline expenditures discussed in the section on airline output (\$33.7 billion in 1998; see also Figure 2-8). This is primarily because second-tier suppliers were accounted for in maintenance and repair, for instance production of airframe and engine components.

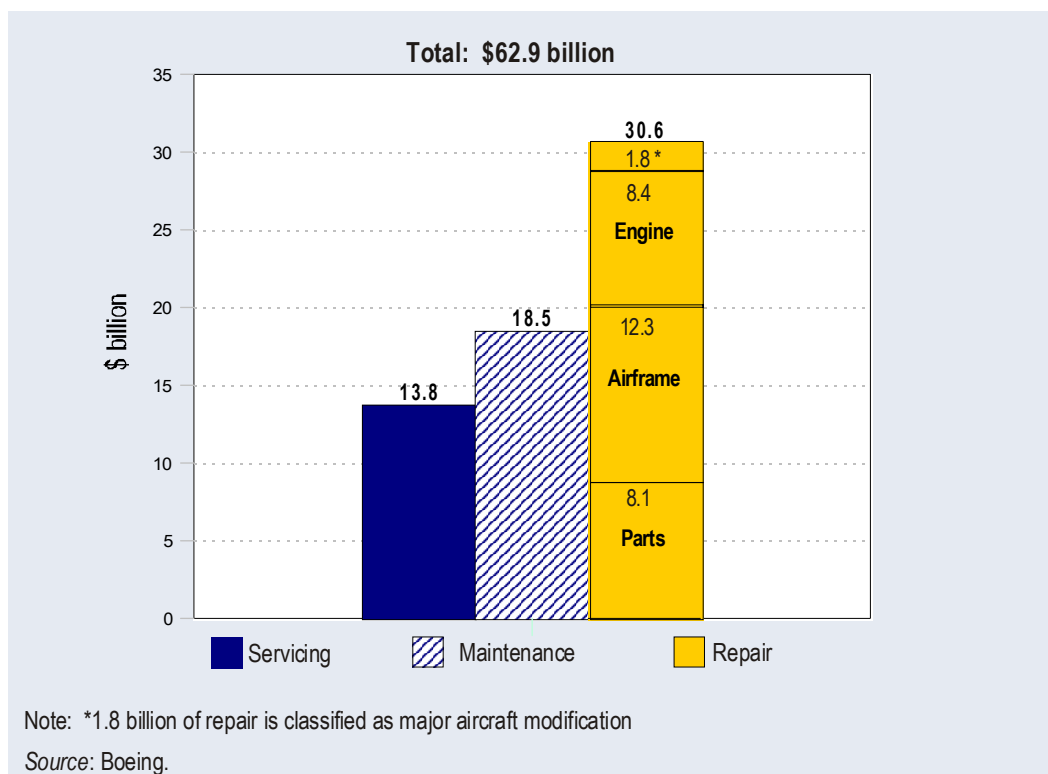


Figure 2-11. Major suppliers of aircraft after-sale products — World, 1999