Foreword

Every year, Boeing publishes its latest assessment of the demand for world air travel. This assessment estimates the jet airplane capacity to meet the projected growth in travel demand, plus the replacement market for older in-service airplanes.

The sources used in the preparation of this outlook included AEA, Airclaims, DOT Form 41, DRI-McGraw Hill, Jet Information Services, OAG, IATA, ICAO, AAPA, WEFA, and Boeing primary research. Historical data are estimates based on Boeing analyses. Data for 1997 are preliminary. This document may be referenced as the Boeing outlook for the future of commercial aviation.

The *1998 Current Market Outlook* can also be found on the Internet at:
http://www.boeing.com/cmo

In this year's edition, we are providing traffic numbers expressed in the more universal measurement of RPKs, rather than in RPMs used in previous forecasts. However, Appendix A does appear in the Internet version in both RPK and RPM formats.

The Internet version contains an added feature to this printed document. All of the data necessary to plot the charts in this publication can be found by opening the file labeled "background data."

Please continue to give us your comments by filling out the reader response card at the back of the document. We rely on this method to maintain an up-to-date list for next year's Outlook.

Tim Meskill
Project Director, Current Market Outlook
Boeing Commercial Airplane Group
P.O. Box 3707, MC 76-15
Seattle, WA 98124-2207
USA

Telephone: 425-237-9167
Facsimile: 425-237-1706

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Executive Overview

Air travel in 1997 continued to grow at a rate above long-term trend. However, a dramatic slowdown in Asia in the second half of the year resulted in traffic growth of 6.1%, compared to 6.8% in 1996.

For the industry as a whole, load factors reached record levels in 1997. This contributed significantly to the fifth consecutive year of profitability recorded by the world airlines, particularly those in Europe and the United States. Results for Asian airlines weakened as load factors softened and yields deteriorated in the second half of 1997.

Air travel growth and airline profitability led to more airplane orders. Orders booked during 1996 and 1997 have been equivalent to 8% and 9% of the world airline fleet, respectively.

While airplane orders have increased for the past four years, airplane deliveries have just begun to rise. In 1998, more than 900 airplanes will be delivered. Strong traffic growth in Europe and large profits in the US will likely sustain production through 1999, and possibly into 2000, as airlines buy airplanes for Stage 2 replacement and growth requirements. Thereafter, airplane requirements should decline to a level that more closely reflects passenger and cargo traffic growth.

Air travel growth is driven primarily by economic growth, and the long-term economic outlook for the world is healthy. Recessions in 1998 in Asia should give way to recovery of growth rates within three years. Worldwide air travel is projected to average 5% per year over the next 10 years. This is down from last year's forecast due to current difficulties in Asia. Measured in aircraft, this reduces needs worldwide by a total of 150 aircraft for the period 1998–2002.

10-Year Outlook

Economic and traffic growth 1998–2007	*Major projections for the period 1998 to 2007 are as follows:* *Worldwide economic growth will average 2.9% per year.* *Passenger traffic growth will average 5.0% per year.* *Cargo traffic growth will average 6% per year.*
Worldwide demand for commercial airplanes 1998–2007	*The world fleet will be 17,700 passenger and cargo jets in 2007. The composition of the world fleet in 2007 will be:* *71% single-aisle airplanes.* *22% intermediate-size airplanes.* *7% 747-size or larger airplanes.* *The total market potential for new commercial airplanes is 7,600 airplanes, or an equivalent $520 billion in 1997 US dollars. Airlines will take delivery of:* *5,310 single-aisle airplanes.* *1,900 intermediate-size airplanes.* *390 747-size or larger airplanes.*

Competition forces airlines to make choices about how to supply capacity to accommodate air travel growth. In tightly regulated markets, airlines have little incentive to look beyond the option of employing larger airplanes. In competitive markets, airlines consistently choose to add flights. Comparison of scheduled services between 1987 and 1997 shows that available seat-kilometers (ASKs) grew by about two-thirds. Only 2% of this ASK growth resulted from larger airplanes. The rest was produced by longer flights, new city pairs, and new flights in existing city pairs.

Congestion has not forced the use of large airplanes. One reason why is that investment and improved coordination have allowed infrastructure capacities to grow. The data show average seat count per departure has decreased by 5% to even 9% in the busiest airports of most regions.

As governments throughout the world take action to liberalize their air transportation systems, competitive pressures will only intensify. This will require the system to make adjustments on an unprecedented scale. Airlines will continue to avoid bottlenecks. Airports will continue to adapt. Communications, Navigation, and Surveillance/Air Traffic Management (CNS/ATM) will be a vital part of the solution to the challenges of increasing air travel, increasing numbers of flights, and relieving airport congestion.

Airlines will increase airplane size only moderately in the next decade. ASKs are projected to grow by more than 60%. As in the previous decade, the majority of ASK growth will be supplied by adding more flights. Airlines will produce just 8% of this growth by moving to larger airplanes. Even this modest increase is proportionately five times as much as in the last 10 years. The total demand for very large airplanes will be small, and will be concentrated late in the forecast period when a small number of markets become very dense.

20-Year Outlook

Economic and traffic growth 1998–2017	*Major projections for the 20-year period 1998 to 2017 are as follows:* *Worldwide economic growth will average 3.0% per year.* *Passenger traffic growth will average 4.9% per year.* *Cargo traffic growth will average 6.4% per year.*
Worldwide demand for commercial airplanes 1998–2017	*The world fleet will be 26,200 passenger and cargo jets in 2017. The composition of the world fleet in 2017 will be:* *69% single-aisle airplanes.* *24% intermediate-size airplanes.* *7% 747-size or larger airplanes.* *The total market potential for new commercial airplanes is 17,650 airplanes, or an equivalent $1.25 trillion in 1997 US dollars. Airlines will take delivery of:* *12,260 single-aisle airplanes.* *4,360 intermediate-size airplanes.* *1,030 747-size or larger airplanes.*

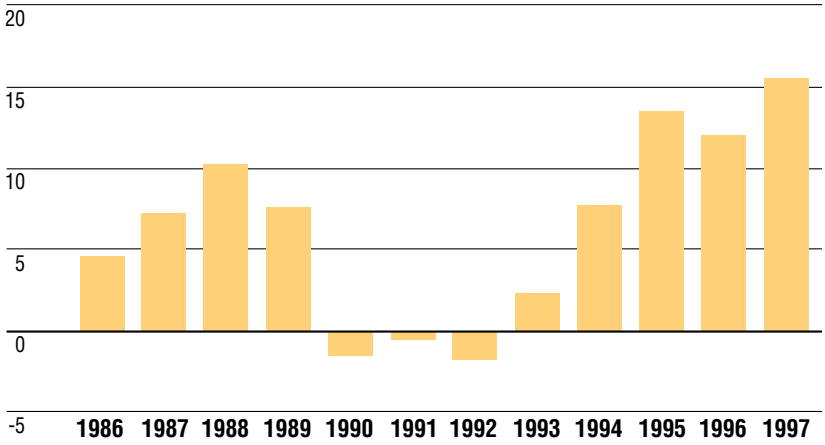
State of the Industry

Airline profits are at record levels. In 1997, the world airline industry recorded a fifth consecutive year of profitability. Air travel continued to grow at rates above long-term trend. Load factors reached record levels on many routes as traffic growth outstripped capacity increases. However, as airplane production rates rise, capacity growth is beginning to more closely match travel growth.

In the United States, airlines again posted record profits in 1997. This performance benefited from moderating fuel prices and a two-month lapse of the 10% passenger ticket tax at the start of the year. International operations provided the bulk of US profits in 1997. The domestic market's contribution to profits improved in the fourth quarter, when airlines successfully raised fares.

World Airline Operating Profits

Current dollars, billions



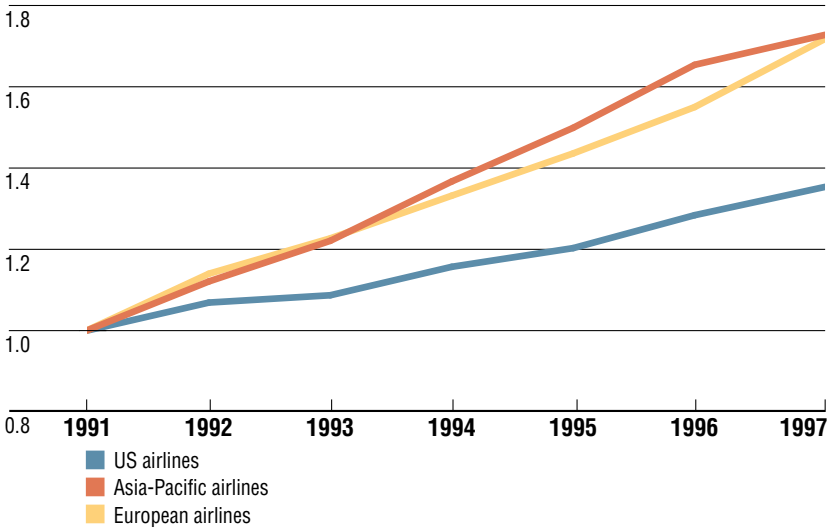
European airlines also had a strong year in 1997. Buoyed by sustained traffic increases and stimulated by liberalization, operators are fine-tuning their service strategies in the face of rising competition. Many European airlines are actively restructuring to reduce costs. As in North America, most are also reducing debt levels and increasing their financial strength.

Traffic and profitability soften in Asia-Pacific. Results were mixed for Asia-Pacific airlines. Most saw profits decline as load factors softened and yields deteriorated in the second half of 1997. A number of carriers reported net losses for the year. Smog over large areas of Southeast Asia and a decline in visitors to Hong Kong after the handover to China were sufficient to reduce load factors in mid-year. In the latter part of the year, the financial crises which rocked several countries led to significant declines in traffic and caused yields to drop precipitously in dollar terms. Even though up to two-thirds of their costs also fell, the combination of currency devaluations and weak traffic decimated revenues and profits for most Asian airlines.

Major markets continue to grow. World airline traffic grew in 1997 by 6.1%, compared to 6.8% in 1996. Results for major intercontinental travel markets were varied, with 1997 growth of 9% in major Europe-Asia markets, 8.6% in the Atlantic, and 6.7% in the Transpacific market. Regional travel in Asia grew by 4%, in Europe by 8.9%, and in North America by 4.6%.

Major airline groups have mixed traffic growth results. For US airlines, systemwide traffic increased 4.7% in 1997. The systemwide traffic of major European scheduled carriers grew by 9.7%—an outstanding performance in view of the rigorous economic discipline in effect as European governments work to meet the criteria stipulated for monetary union.

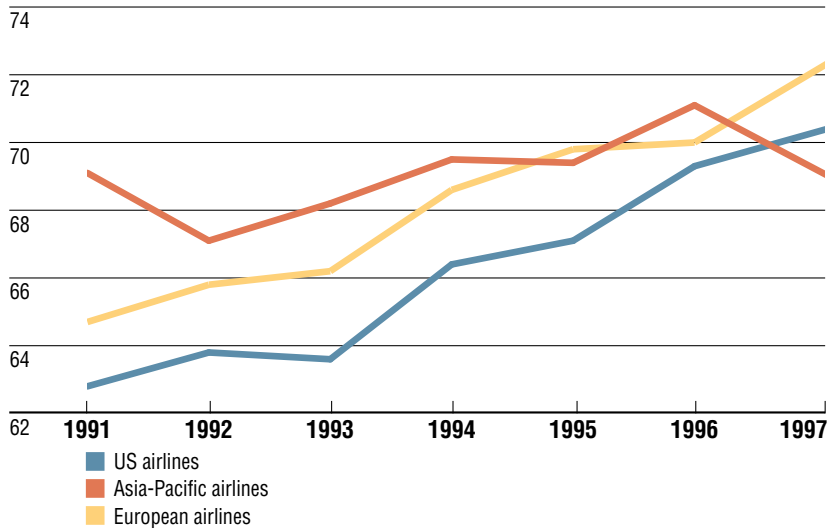
Passenger Traffic
RPK growth (1991 = 1.0)



International traffic of Asia-Pacific carriers grew 4.4% in 1997, down from 10.3% the previous year. Major traffic flows between Asia-Pacific and Europe and North America remained strong through most of 1997 but have weakened in 1998. Certain segments, such as Japanese outbound travel, were slack throughout the year, but business travel held up in 1997. Countries in the eye of the Asian economic storm saw traffic dry up during the fourth quarter as business and consumer confidence plummeted. Deep discounting did stimulate some inbound tourist traffic, but not enough to overcome regional traffic lost because of the economic crisis.

Load factors remain high. Airlines continue to accommodate robust traffic demand with high load factors. This trend is particularly dramatic in Europe and the United States, where airlines have sustained load factors at unprecedented levels. The airlines' ability to integrate scheduling, pricing, distribution, and yield management strategies has allowed them to fill more off-peak seats.

High Load Factors Led to Profits
Load factor, percentage



A somewhat different picture has evolved for Asia-Pacific airlines. They have traditionally enjoyed higher load factors than other airlines, in part because their systems are dominated by long-range routes. Asia-Pacific carriers continued to add capacity as competition

increased in the early 1990s. This drove load factors down until traffic growth caught up with capacity. Asia's current economic problems are causing Asia-Pacific airline load factors to again decline. During the last half of 1997, load factors fell sufficiently to pull the average for the year below 70%.

Load factors are high, in general, because airlines have managed them more effectively and because the supply of airplanes lagged traffic growth. Airlines are just beginning to take delivery of more airplanes. If the amount of capacity being added to the world fleet during this delivery cycle exceeds traffic growth, load factors will drop. Certainly, that is the current situation with the Asian airlines in 1998. These carriers will retire older airplanes, try to sell off surplus equipment, and stimulate traffic with fare discounts until regional traffic growth begins to rebound. Load factors in Europe and North America remain high, but as more capacity becomes available they could ease.

The current order cycle has evolved at a measured pace. Air travel growth and airline profitability over the past several years led to an increase in airplane orders. In fact, the current airplane order cycle began much like the previous cycle at the end of the 1980s, with:

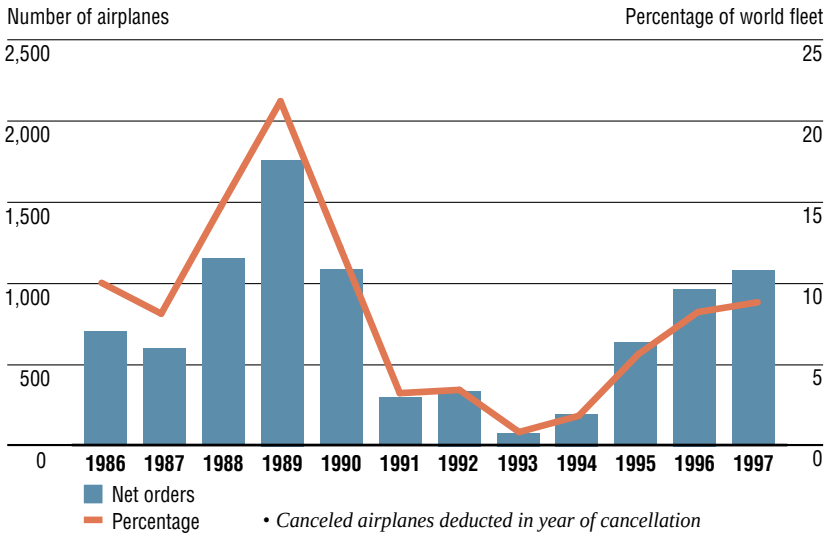
- A couple of years of above-trend traffic growth.
- Several years of strong airline profitability.
- Leasing companies placing the cycle's first large orders.

There are also several differences from the previous cycle:

- A large replacement requirement due to the Stage 3 noise deadline.
- "Catch-up" orders by airlines which needed to resolve pilot contracts or repair balance sheets.
- Airplane pricing strategies.

Despite any similarities, the current cycle has evolved at a more measured pace. Orders booked during 1996 and 1997 have been equivalent to 8% and 9% of the world airline fleet respectively. By contrast, during 1989—the peak year of the prior cycle—orders were equivalent to 21% of the world fleet.

Order Levels—Still Reasonable Relative to the World Fleet



Airlines are showing restraint in their orders. Some airline orders in 1997 raised the first concerns in this cycle about a possible return to the "feeding frenzy" ordering of the late 1980s. Through most of the current cycle, however, airlines have shown restraint and

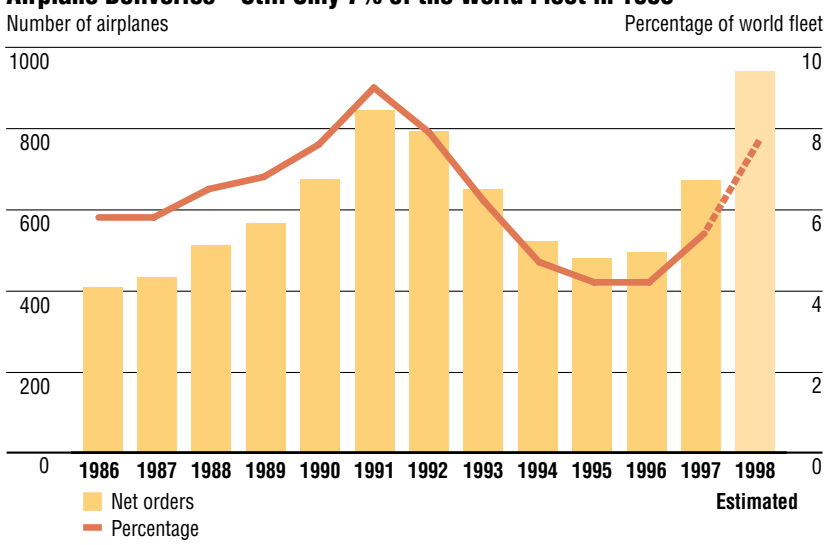
have not seemed compelled to place large orders simply to secure near-term delivery positions. Some have elected to place large orders specifying deliveries over extended time frames, thereby assuring themselves of stable prices. For their part, manufacturers have helped dampen the order cycle by demonstrating their willingness to raise production rates as much as may be required to deliver new airplanes to customers when they need them.

Current trends may smooth future cycles. Several major carriers have entered into long-term airplane contracts to simplify their fleets. This strategy may help smooth future order cycles by spreading airplane deliveries more uniformly over time. Manufacturers, in turn, may ease future cycles by continuing to reduce the time it takes them to build and deliver new airplanes, thereby better synchronizing the order and delivery cycles.

In general, airlines are managing their way through this part of the cycle more effectively than in the past. They are better able to match overall fleet capacity to traffic demand and have improved their ability to level passenger loads on a flight-by-flight basis. These achievements have contributed to today's record airline profits.

Airplane deliveries continue to rise. While airplane orders have increased since 1994, airplane deliveries have increased for only one year. In 1998, approximately 940 airplanes will be delivered as manufacturers continue to raise production rates. Production will likely be sustained at this level through 1999, and possibly into 2000, to fill airline requirements for both replacement and growth airplanes. Thereafter, airplane requirements may decline to a level that more closely reflects passenger and cargo traffic growth rates.

Airplane Deliveries—Still Only 7% of the World Fleet in 1998



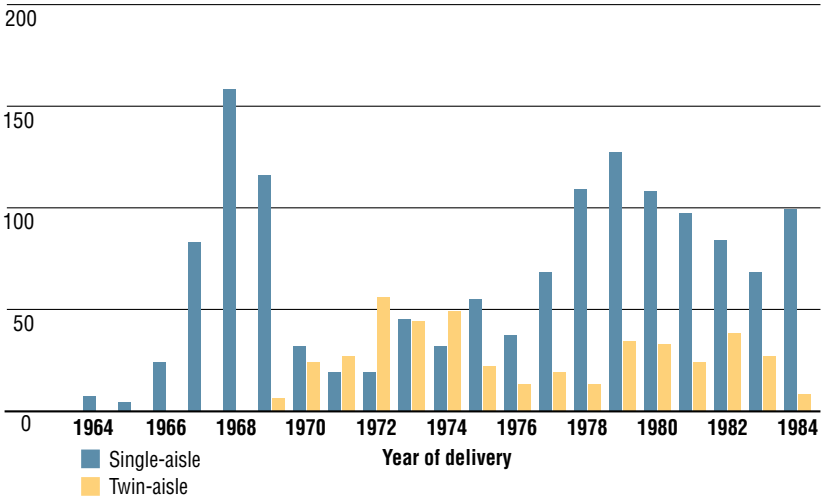
Most replacement orders have been placed. The sharp increase in production is being driven by the need to replace much of today's older jet fleet. In fact, about 60% of units delivered before January 1, 2000, will be for single-aisle airplane replacement. Two factors explain this strong demand for 737- and 757-size airplanes.

The first factor is age. Because of a boom in airplane deliveries to US airlines in the latter 1960s, a large number of single-aisle jets have now completed three decades of service. Although airlines are not required to replace these airplanes, operators have considerable economic incentive to do so because older jets are increasingly uneconomic.

The second and more pressing factor is noise standards. Older single-aisle jets must either be hushkitted—which takes a further toll of fuel efficiency—or be retired from US and European service when Stage 3/Chapter 3 noise limits take effect in 1999 and 2002, respectively. This noise-driven replacement within the single-aisle fleet accounts for the bulk of the current cycle's replacement orders. US operators have by now completed their plans for complying with the coming regulatory limits, as have most European carriers. The jets they have hushkitted will likely be phased out of US and European fleets in the opening years of the coming century.

Replacement Cycle for Single-Aisle Airplanes Peaks in 1998–1999

Age distribution of the US passenger fleet
Number of airplanes



Demand for airplanes in Asia has declined. The anticipated effects of the Asian financial crisis led to a decline in forecasted traffic growth rates over the next five years. Traffic growth on the major travel routes is projected to decline by up to 2½ percentage points for Asian regional travel and by 1 to 1½ percentage points for intercontinental air travel.

This lower rate of air travel growth results in a reduced requirement for worldwide commercial jets for all manufacturers. Over a five-year period, 1998–2002, the delivery requirement declines from 4,150 airplanes to 4,000. One hundred are projected to be widebody airplanes and fifty to be standard-body airplanes. Even with this reduction in demand, the five-year regional airplane requirement exceeds the number of airplanes currently on order. Thus, there is little concern that orders will be canceled on a net basis. Airlines in Asia will still need airplanes currently on order, but at a later date than originally contracted.

Order cycle momentum is slowing. Airlines continued to order new airplanes in 1997 at essentially the same pace as in 1996. Many airlines now have orders in place to support their replacement and growth plans for the next several years. Above-trend traffic growth in Europe and higher-than-expected profits in the United States will sustain this reequipment cycle into 1999 or 2000. However, the current softening of traffic growth in Asia may have a braking effect on orders. So, too, would a deeper recession in Asia or a broader economic downturn. While the current problems in Asia will slow GDP growth in Europe and the United States in 1998, leading indicators suggest this effect will be modest.

Many industry observers are questioning when the current order cycle will peak. Some of the possible indicators that may help answer this question are illustrated here. Of these potential indicators, four now suggest that the cycle is losing momentum. Traffic growth has slowed in Asia-Pacific. Load factors and yields have also declined in that region, reducing Asian airline profitability. Moreover, some Asian airlines have chosen not to exercise option rights and have renegotiated airplane delivery dates.

Early Warning Indicators

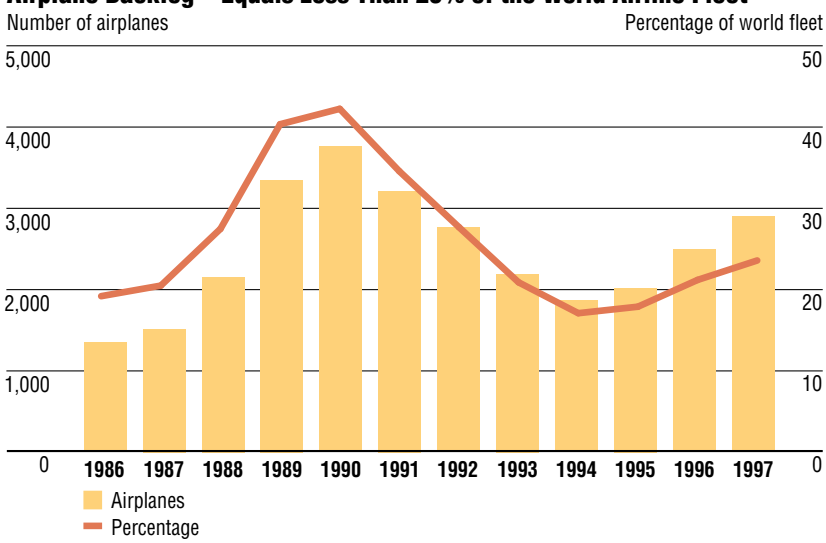
Checklist	
Asia	Traffic growth slowing
Asia	Load factors declining
Asia	Airline profitability decreasing
Asia	Airlines not exercising options

Early indicators do not point to a downturn for other regions. Recent results in Europe, the United States, and Latin America have been exceeding forecasts. European airlines are experiencing traffic growth rates of 10%, which is substantially above projected levels. Travel demand in the United States continues to grow. High load factors and rising passenger yields are resulting in record profits for US airlines. Traffic growth over the North Atlantic is also strong. Domestic and international travel in Latin American markets are projected to increase by two to three percent over the next several years after many years of low growth.

Orders in the second half of 1998 will indicate the longevity of this cycle. Undelivered firm orders currently stand at about 25% of the world airline fleet. This is a very reasonable level for this point in the cycle and evidence that airplane production levels can be sustained in the near term.

Most positions on manufacturers' production lines are committed through 2000. The commitments include firm airplane orders in addition to a large number of airplane options. During the second half of 1998, airlines and leasing companies will make decisions whether to exercise options to purchase these airplanes.

Airplane Backlog—Equals Less Than 25% of the World Airline Fleet



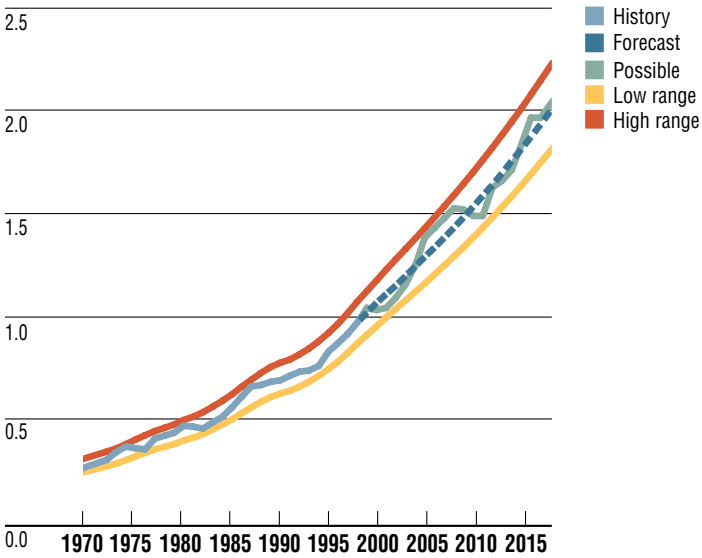
At the same time, the ability of lease companies to find operators for the airplanes they will receive in 1999 and 2000 will become apparent. All of these signals will indicate if manufacturers' backlogs of undelivered airplanes will continue to increase as they have over the past three years, or if they will begin to plateau.

Air Travel and the Economy

World GDP growth will average 2.9% per year over the next 10 years. Air travel will continue to grow as the world economy expands. This forecast includes revisions that stem from the current Asian economic crises. As of May 1998, Indonesia, Thailand, and South Korea are expected to undergo serious recessions. Reduced growth for the larger economies of Japan and China also seems likely, and most other economies in the region are expected to suffer slowdowns as part of regional shocks to flows of investment and trade. All these effects should be over within three years and have a modest effect on 10-year averages.

Asian economic difficulties have little impact on the long-term forecast. GDP projections presented in the *Current Market Outlook* average growth capabilities with occasional disruptions. For most countries, forecast growth rates for 10 or 20 years are below the maximum capabilities demonstrated in the mid 1990s. The long term must capture the average of growth through both good parts of cycles and bad. In mature economies, disruptions typically take the form of recessions related to the business cycle. In the United States, for example, forecasters give a one-third chance of an inflation-recession cycle beginning during the next two years. In Europe, there is a small chance that any slowdown might be prolonged because the European Union's mechanisms for dealing with downturns are as yet untested.

GDP growth Is an Average Over Cycles



Although less subject to business cycles, a fast-developing economy should expect years of high growth to be followed by a pause as economic and social structures adjust to new levels of income. Banking, trade, and monetary institutions are challenged to increase sophistication, while governments struggle to address the changing needs of increasingly skilled and educated citizens. Forecasts for the next 10 years represent a smoothing of high growth and such interruptions.

Asian crises call for downward adjustments, but limited ones. In the broadest sense, the Asian crises directly affect at most 20% of the world's GDP. Most of these countries are experiencing disruptions within the normal expectations of the ups and downs of growth. Only those with major recessions represent downturns below the range of expected

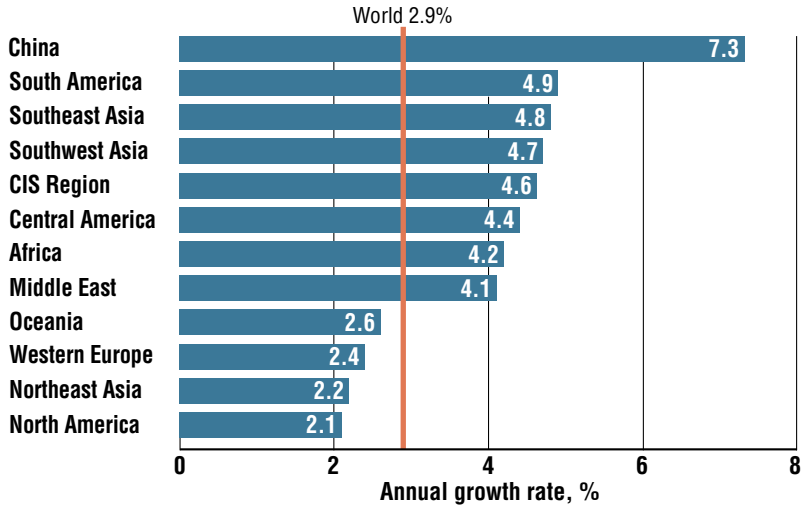
variations. As of May 1998, the financial problems seem largely revealed. The uncertainty is whether the downward revisions of GDPs have been correctly assessed. Much of what is happening is outside the ranges of economic modeling. However, the estimates used here are the best available.

The risks are on the down side. Financial resolutions could come unwound, economic consequences could turn out worse than estimated, and hardships could cause political instability. These things are possible, but less likely than a pause followed by a return to continued growth. These are hard-working economies with high savings rates and governments attentive to the good of their people. They should heal and heal fast.

Forecasts assume that faltering economies return to their previous long-run growth rates after about three years. The restructuring caused by the crisis could improve later growth. On the other hand, the crisis may have revealed unforeseen weaknesses. At present, it seems these opposing adjustments balance each other out. It will take time to know better.

Asia will continue to have the highest GDP growth in the long run. World GDP—which explains two-thirds of air travel growth—is forecast to grow at 2.9% per year over the 10-year forecast period. In mature economies, GDP growth will average between 2% and 3% over the next decade. In developing nations, GDP growth may average above 5% over the long term. Over 10 years, the average for China should be 7.3%, Southeast Asia 4.8%, and Northeast Asia 2.2%.

GDP Growth Rates 1998–2007



Short-term travel cycles are greater than GDP cycles. Long-term forecasts focus on the growth of underlying trends for air travel. In the short-term, air travel is more volatile; it varies around its trend more than GDP does around its own trend. There is evidence that leisure travel behaves like a capital good such as automobiles or refrigerators. Such goods are bought only occasionally, and their purchase may be put off when consumer confidence is low or accelerated when times are good. Air travel in the United States and Europe in 1997 reacted to high levels of consumer confidence. Such confidence is currently missing in Asia, where air travel may drop in 1998 even where GDPs grow slowly. Forecasts of long-term travel needs assume consumer confidence levels at their average over GDP cycles.

GDP growth drives a share of travel growth. Travel grows faster than GDP over the long run. In explaining this fact, past projections of air travel have assumed a "threshold effect." It was expected that as a country's per-capita income rose, it reached a level that supported broad discretionary travel. This traditional view implied that once the threshold was attained, air travel increased as a percentage of a nation's GDP.

Example of Travel Shares of GDP

	Low travel share	High travel share
Low GDP per capita	**Poland Mongolia**	**Bolivia Vietnam**
High GDP per capita	**France South Korea**	**Australia Singapore**

Current analysis does not find a threshold effect. When GDP grows, the GDP-driven part of air travel growth is in proportion and no more. Data show that air travel as a percentage of GDP is not consistently higher for rich countries than for poor ones.

Factors beyond GDP explain some air travel growth. GDP explains two-thirds of air travel growth. Air travel growth in excess of GDP is motivated by other factors:

- Reduced fares as costs decline.
- Improved service offerings as routes and frequencies are added.
- Increased globalization and trade.

The ratio of RPKs to GDP rises over time as fares decline, service improves, and trade increases. Thus, the world's "travel share" of GDP grows with time. This additional growth occurs in fast-growing and mature economies alike. It occurs even where GDP growth is stagnant.

Falling fares stimulate travel. In real terms, fares have declined about 1% per year over the past two decades. Yields have declined even more, reflecting a changing mix of trips. Prices can decline when costs decline. Costs have declined because operators have increased the productivity of both employees and airplanes. The consequence is lower prices that stimulate additional travel.

Increased service is as important as lower fares. Service improvements also increase demand. During the past 20 years, airlines have made travel more convenient by adding flights in existing markets and by instituting more direct flights. Service improvements have increased travel share at least as much as lower prices.

Globalization also spurs air travel. Accelerating globalization also contributes to the one-third of air travel growth that is not attributable to economic expansion. Early indications are that for each additional 1% of GDP devoted to international trade, there is an attendant 1½% increase in air travel. Countries with high levels of trade tend to spend proportionately more of their GDP on travel, while countries with accelerating trade levels have accelerating travel volumes.

Air travel growth should continue to exceed GDP growth. When travel share of GDP ceases to grow, air travel will be "mature." Based on this understanding, commercial aviation will be a mature industry only when airlines can make no further price reductions or service improvements, and when trade no longer continues to grow. At that time, there will be no air travel growth beyond increases in GDP.

Today, improvements continue to be made in all three areas: price, service, and trade. A spectrum of maturity indicators—including fare, yield, and service data as well as trade statistics—provides no hint that air travel maturity is at hand.

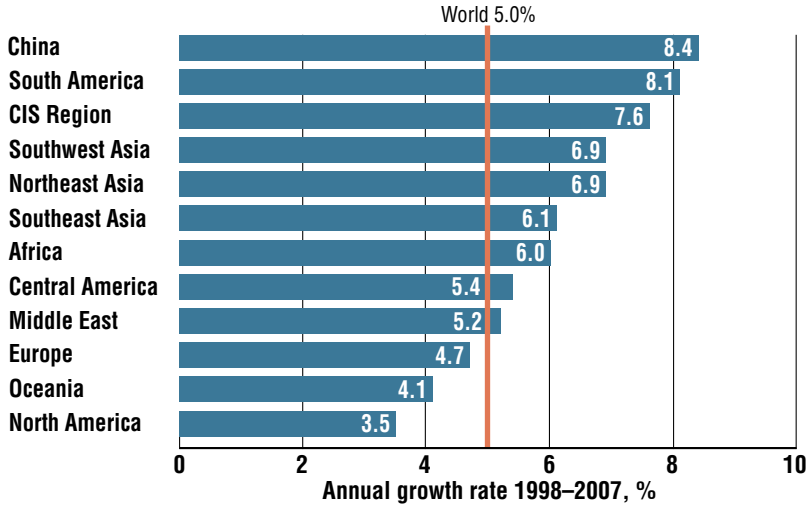
Countries move toward air travel norms. The share of GDP spent on air travel by countries with high travel shares has tended to grow more slowly than the world average. By contrast, travel shares for countries with low initial levels has tended to rise faster than the world average. An example illustrates the case. Country H already has a high travel share, so its travel growth is diminished by 1%. Country L, with low initial travel share, gets an addition to its growth as it catches up to the norm. This example is for two countries with high GDP growth. The same principle would apply if both countries had GDP growths of only 2%.

Sources of Air Travel Growth

	Country H High travel share	Country L Low travel share
GDP growth	5%	5%
World travel-share growth (norm)	2%	2%
Country's movement toward norm	-1%	1%
Total travel growth forecast	6%	8%

World RPK growth will average 5.0% per year. Air travel growth is projected to average 5.0% per year over the next 10 years. Forecasts of travel growth within each region are based on GDP growth and global trends in the travel share of GDP. Forecasts of air travel growth rates for markets linking regions reflect the growth rates of both regions.

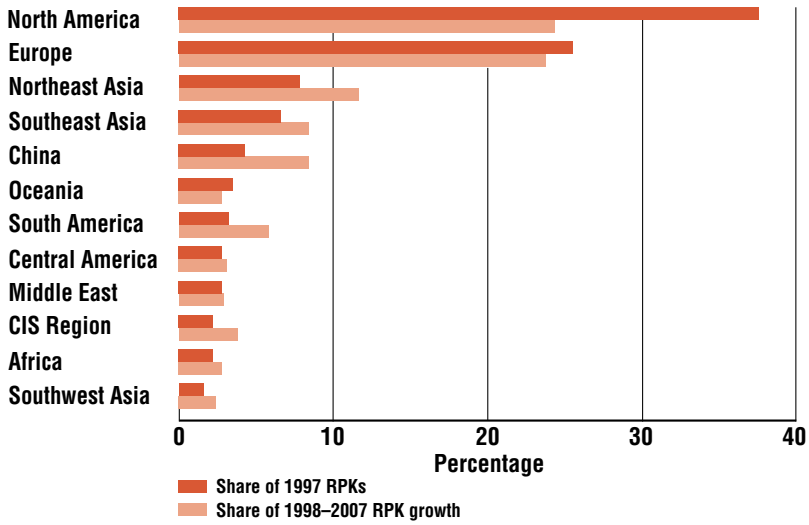
Growth of RPKs by Region



Regional air travel will grow at different rates. The chart at the right summarizes the annualized 10-year forecast of air travel growth by world region. With an annual increase in air travel of 8.4%, the China region leads the world in regional traffic growth because it has the highest forecast rise in GDP. The best available information suggests that the ratio of RPKs to GDP for this region is already at world norms.

At 3.5%, North America has the lowest annual growth rate of any region. The reason is a mature economy that combines low GDP growth with a travel share that is among the highest of any developed country. Europe's projected growth is higher because some European nations currently have low initial travel shares and are expected to catch up. Liberalized rules for air transport throughout Europe will stimulate flows within the region.

Share of RPKs and of Forecast Growth



Asian growth in air travel leads the world. The growth in RPKs by region does not match the current distribution of air travel. North America has 38% of RPKs today, but will realize just 24% of growth. By contrast, Asia-Pacific traffic flows are nearly twice as important in growth than they are in current volumes of air travel. Appendix A provides a detailed list of growth forecasts for the world's air travel markets.

Short-haul growth rates match regional GDP growth. Short-haul air travel can be summarized as four flows: Asia regional, Europe regional, North America, and the rest of short-haul worldwide. Asian regional annualized 10-year growth rates will be 7.6%. North American regional flow will grow at just 2.9%. As more of the world's economies become more open and grow, North American residents will favor international travel at the expense of domestic trips.

Growth Rates for Short-Haul Air Travel

Regional flow	1997 share of RPKs	1998–2007 growth rate	1998–2017 growth rate
Asia regional	15%	7.6%	7.2%
Europe regional	19%	4.2%	4.1%
North America	40%	2.9%	2.9%
Rest of short-haul	26%	6.0%	5.7%
Short-haul total	100%	4.8%	4.8%

Long-haul travel grows faster than short-haul. Long-haul travel may be summarized as Asia-Europe, Transpacific, Atlantic, and the rest of long-distance travel worldwide. The growth rates for flows involving Asia are high, as the Transpacific and Asia-Europe flows clearly show. The Asia-Europe service patterns are still evolving with no clear answer yet as to what airplane sizes and flight frequencies best suit the market. The market across the Pacific continues

Growth Rates for Long-Haul Air Travel

Regional flow	1997 share of RPKs	1998–2007 growth rate	1998–2017 growth rate
Asia-Europe	17%	6.8%	6.4%
Transpacific	22%	5.9%	5.7%
Atlantic	42%	4.3%	4.3%
Rest of long-haul	19%	5.9%	5.4%
Long-haul total	100%	5.4%	5.2%

to grow. It is changing slowly as longer-haul airplanes with smaller-than-747 capacities become available. By comparison, forecast travel growth over the Atlantic is modest because of the mature economies on both sides of the ocean.

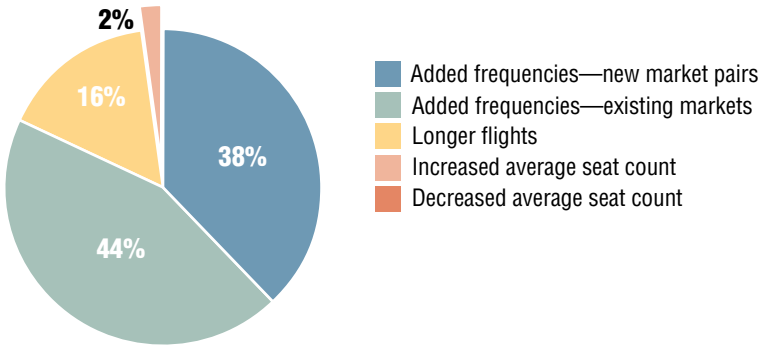
Travel requires new routes and new airplanes. Overall, world air travel should grow at 5% over the next decade and 4.9% over the next 20 years. How this outlook for increased air travel translates into future airline fleet requirements depends on the specific evolution of routes, frequencies, and competition. This evolution is the subject of the next section.

Market Forces and the World Fleet

Increasing demand has led to more flights and new routes. World air traffic has grown by 75% over the past 10 years. This chapter explains how airlines have supplied capacity to accommodate this growth. The record shows growth in demand has led to denser airline networks and new routes. Thus, the mix of airplanes in the world fleet has not changed to favor larger airplanes. Airline competition has been a major driver of these changes and should be at least as strong an influence in the future. Airport congestion has had only a modest influence on airline fleet requirements.

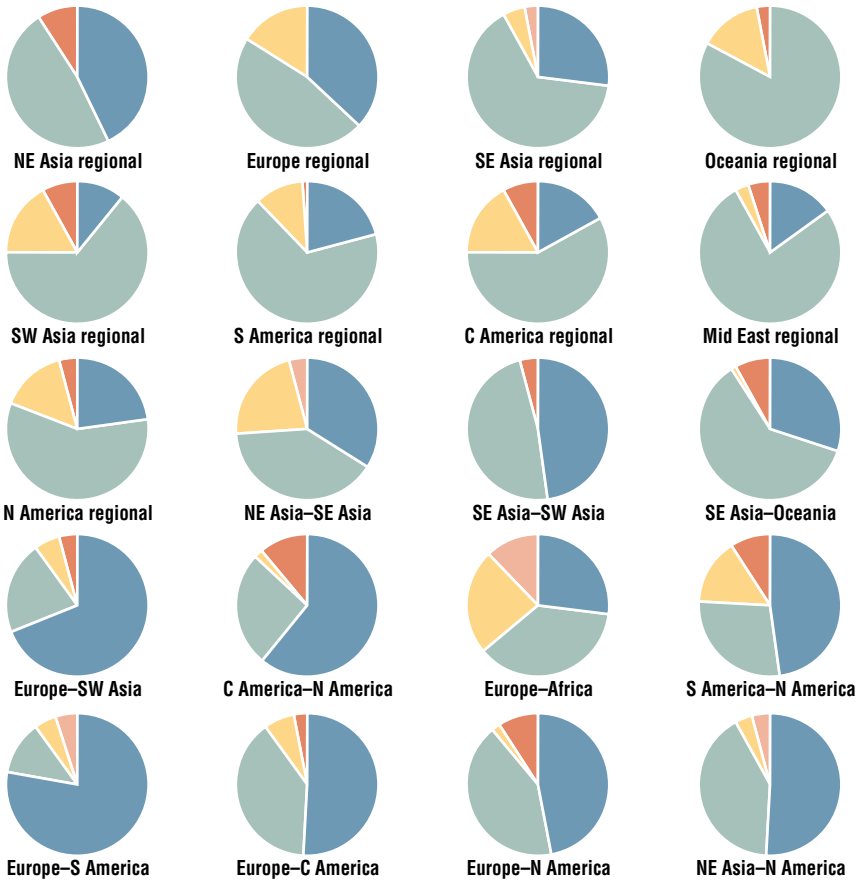
Capacity has been supplied by adding flights. A comparison of scheduled services between 1987 and 1997 shows that ASKs grew by about two-thirds. Thirty-eight percent of new ASKs were produced by new nonstop markets. Additional flights in existing city pairs accounted for 44% of new ASKs. Sixteen percent of ASK growth was the result of average stage lengths increasing. Only 2% of ASK growth resulted from larger airplanes.

Seat Count Only 2% of Growth



Frequency growth has dominated every regional flow. The dominant contribution of additional flights is even more convincing when the data is disaggregated. Analysis of regional or country-pair markets shows that average airplane size decreased in almost all cases. Among the top twenty regional traffic flows, frequency growth dominated everywhere. In fourteen of these twenty markets, average airplane size actually decreased. In one, Europe regional, airplane size made no contribution. In five markets, increases in average airplane size did contribute to ASK growth. However, three of these markets involve Asia, where frequency levels have been tightly constrained.

Frequency Growth Dominates Everywhere



Competition is the driver. Competition forces airlines to make choices about how to supply capacity to accommodate system demand growth. Airlines choose whether

to increase the size of the airplanes they operate on a route, increase frequency of service, introduce direct service between cities that previously did not enjoy it, or add more cities to their networks. In tightly regulated markets, airlines have little incentive to look beyond the option of employing larger airplanes. In competitive markets, by contrast, airlines have every incentive to choose among options that involve adding flights. As mentioned in the previous chapter, airlines can stimulate growth by choosing to add more-frequent service on existing routes and more-direct flights via new routes.

Frequency has increased in existing airport pairs. Almost 45% of the growth in total departures occurs by adding flights to airport pairs that already have nonstop service. Part of this frequency growth is new airline competitors adding their flights to the market total. The rest is incumbent airlines adding flights to improve their competitive position by day of week or time of day. As traffic increases, markets typically gain in frequencies and competitors. Total flights continue to increase and average seat counts decline.

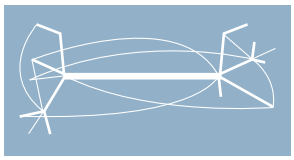
Frequency Grows in Existing Airport Pairs
1987–1997

Traffic flow	Existing pairs' departure growth	Overall ASK growth
Atlantic	43%	73%
Transpacific	46%	112%
Asia–Europe	370%	900%
Asia regional	107%	156%
Europe regional	58%	112%
North America	11%	20%

Network development has increased direct service. The evolution of airline regulation, economic development, and associated travel growth creates a trend away from early dominant airports. Airline networks are skeletal in their initial stages of development when airline competition tends to be regulated. Such sparse networks are designed to build loads and take advantage of the seat-mile cost advantages of larger airplanes. As a consequence, schedules are not the most convenient for a significant proportion of travelers. This is, perhaps, forgotten history in North America and Europe. The jet age began when their GDPs were smaller and the value of time was lower than today. Since then, higher volumes of traffic and greater wealth have created demand for bypass flights. This has diverted traffic off the initial links and diminished the pressure to employ larger airplanes. In other parts of the world, such as Asia and Latin America, the same trends are emerging. Higher demand is developing with increasing wealth. The greater value of direct and frequent service is outweighing the costs.

Network Development
Early skeletal network

Later increased service



The busiest airports have lost departure share. Ample evidence documents the extent of bypass flying in major markets over the last 10 years. In five of six major markets, the top 10 airports have seen their share of departures decline. Seat shares have also declined. The data show the system responds contrary to expectations that airlines plan to grow mostly at the busiest airports. There is no reason to expect that, in the future,

airlines will stop diverting price-sensitive connecting traffic and time-sensitive nonstop traffic from the busiest airports.

Departure Share of Top 10 Airports

Market flow	Share 1987	Share 1997
Asia regional	43%	29%
Europe regional	34%	33%
N America regional	31%	31%
Asia–Europe	89%	60%
Transpacific	80%	71%
Atlantic	54%	47%

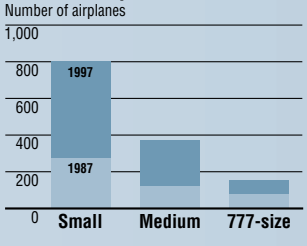
Bypass flying also reduces costs. As route networks mature, airlines extend their services to secondary airports and smaller cities. Networks fill in as flights bypass the busiest airports. Using smaller airplanes to open new routes can reduce costs even more than moving to larger airplanes. Airlines add flights such as Manchester–Chicago that avoid gateway hubs like London. Passengers avoiding a stop in London save more than just time. They are spared the cost of the landing and takeoff in London, that of connecting bags and people between airplanes, and the extra circuitousness of the connecting trip. These savings compensate for the higher seat costs of a small airplane over the bypass route compared to connecting in a larger airplane at the gateway hub.

Gains from larger airplanes diminish with size. Another reason networks develop so many flights, and markets receive so much frequency, is that the economies of bigger aircraft capacities are not as compelling at larger airplane sizes. Boeing life-cycle operating cost values reveal that a 160-seat airplane has roughly 14% lower cost per seat-kilometer than a 108-seat airplane because it is 52 seats larger. However, aircraft 66 to 99 seats larger than a 320-seat airplane have seat costs lower by only 7% to 8%. Therefore, cost savings from switching to larger airplanes diminish significantly as airplane size increases.

Congestion has not forced the use of larger airplanes. Competition, network development, and economics all call for growth in frequencies, not in airplane sizes. Average airplane size has declined even at the busiest airports. The data show average seat count per departure has decreased by 5% to 9% in the busiest airports of most regions. Congestion has not yet forced the use of large airplanes. One reason why is that investment and improved coordination have allowed infrastructure capacities to grow.

Airlines have moved to smaller aircraft in most regional markets. *Airline strategies to satisfy growth by adding flights are reflected in changes to their airplane fleets. In the Asian regional market, the share of small airplanes has risen to 56%, largely due to the growth of the fleet in China. The share of 777-size airplanes declined to 11%. Average seat counts declined from 203 seats to 198 seats.*

Asian Regional Fleet Mix Added Small Airplanes



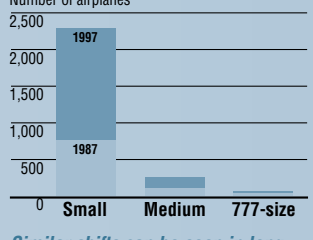
Size categories for World Fleet

Small	*737-size airplanes (100–170 seats)*
Medium	*757- and 767-size airplanes (170–260 seats)*
777-size	*777- and MD-11-size airplanes (260–400 seats)*
Large	*747-size airplanes and above (more than 400 seats)*

In intra-European schedules, 762 of 807 growth airplanes were in the small category, and their share edged up to 89%. Medium-size airplanes also increased their share. The share of 777-size airplanes fell from 4% to 2%. Average seat counts in this market remained steady at 136 seats.

In North America, 592 airplanes were added to the fleet serving regional schedules. Here, 70% of additions were in small airplanes, but the share of this class of airplane declined to 83%. Even so, average seat counts declined by 5 seats to 139 seats.

European Regional Schedules Reached 89% Small Airplanes



Similar shifts can be seen in long-haul fleets. *Intercontinental markets show similar trends. In the Atlantic market, 34% of added airplanes were 777 size, and 64% were medium size.*

Airports will continue to adapt. Airline schedulers and airports will work together to squeeze in more flights. Declared capacities will inch up over time. In the short term, airports will introduce technical improvements that allow more operations. Over longer time frames, some airports will add runways and some cities will build new airports.

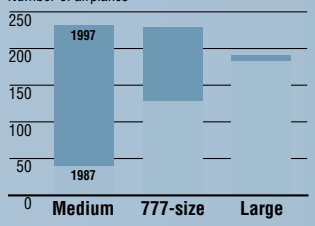
Airport capacities in Europe will continue to grow. Europe is one region where concerns over the availability of sufficient airport capacity are high. More than 450 European airports receive scheduled service. The 20 busiest airports account for about half of scheduled flights, 55% of all scheduled seats, and 90% of scheduled flights beyond 5,000 km. Studies indicate that under current IATA-declared capacities, traffic growth would ensure that every top-20 European airport would be congested by the year 2010. However, IATA-declared capacities can change. As this table shows, several major European airports have experienced significant increases in capacity in the last decade. This has most often been accomplished by incremental improvements in operations management and scheduling. In addition, some new runways and airports have been built. As demand pressure grows, continued improvements will allow the airport system to adjust and provide more runway capacity.

Capacity at European Airports Has Increased
IATA-declared capacity, movements per hour

Airport	1987	1997
Charles de Gaulle	36	82
London Heathrow	72	80
Munich	32	80
Copenhagen	60	76
Frankfurt	64	74
Rome	50	72
Brussels	35	66
Madrid	30	50
London Gatwick	40	42

Similar improvements are expected at slot-restricted airports in Asia. Asia is another region where questions arise about the availability of airport capacity, in particular at Narita, Tokyo. Slot restrictions at Narita are cited as a primary reason why airlines will require larger airplanes. There are reasons to expect that future airplanes larger than the 747-400 will be required by airlines serving Narita. However, it is also clear that the new bilateral agreement with the United States will require the availability of more slots. Japanese and

Atlantic Fleet Added Only 7 Large Aircraft
Number of airplanes

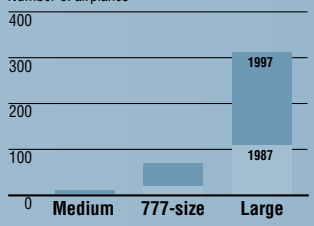


The share of large airplanes decreased from 52% to 29%, while the medium-size airplane share increased to 36%. Average seat count declined by 24 seats to 288.

The fleet serving Asia–Europe nonstop routes has grown dramatically since flight paths over the former Soviet republics became available. This has happened too recently to establish trends in airplane size. In 1997, however, 34% of the airplanes serving routes in this market were 777 size or smaller, and the average airplane had 338 seats.

Transpacific is the exception. *On Transpacific routes, only 29% of added airplanes were 777 size or smaller. Their share of the fleet increased from 17% to 22%. By contrast, 71% of added airplanes*

Pacific Fleet Added More Than 200 Large Aircraft
Number of airplanes



were large. As a result, average seat count grew by 24 seats to 368 seats. Growth was so rapid in this market that, though the network expanded, route development could not keep pace. In this environment, airlines exploited the low seat-mile costs of the 747. Indeed, if an airplane larger than the 747 had been available, airlines would be deploying it in this market. Range limitations of smaller airplanes also mandated the use of large airplanes. However, competition is increasing and smaller airplanes are now becoming available that fly routes previously requiring the range of a 747. For example, the 777 today flies Guangzhou–Los Angeles nonstop, a distance exceeded by just five 747 markets.

US authorities are cooperating to ensure that new services to Narita can be accommodated.

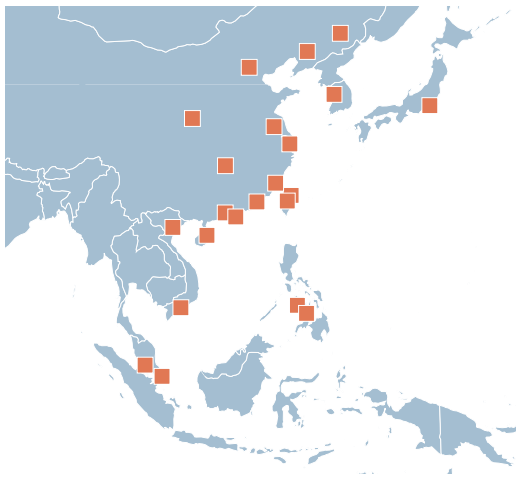
Although Japanese travel demand is highly concentrated in Tokyo and Osaka, several major cities in Japan appear to be underserved by nonstop international flights. Airlines have taken note and increased flights to both Nagoya and Fukuoka from Europe. The many applications for new service to Osaka, Nagoya, and Fukuoka proposed under the new Japan–US bilateral agreement suggest that over time, service to these cities will further increase. In addition, new airplane models with increased range will reduce the need to route as many flights from the United States to Asia through Japan.

Airlines will continue to grow by adding flights. The competitive forces that have driven airline strategies to accommodate traffic growth will intensify. This will require the air transportation system to make adjustments on an unprecedented scale. It will require political commitment and leadership to expand infrastructure capacity to allow airlines to provide the passenger and cargo services that facilitate economic development. In addition, airlines, airports, and air traffic control (ATC) authorities will have to work cooperatively to use existing capacity as efficiently as possible. The air transportation system can adjust to the pressures of growth in many ways. These ways are discussed below. They explain the rationale behind the fleet forecasts presented in this publication.

Competition will also drive increases in infrastructure capacity. Growth will put intense pressure on choke points in the busiest airports, airways, and ATC systems. Funding for airports and airways always seems to lag requirements. Forecasters typically have underestimated the demand for increased departures. Consequently, infrastructure planners and budgeters have been forced to play catch-up in providing required capacity. Funding has often stalled in the political process until crowding became critical. Fortunately, this does not happen at all airports simultaneously. Those airports that best anticipate demand, plan for it, and effectively work the political system will prosper at the expense of those that do not. Air travel is so vital to economic development that infrastructure capacity constantly expands, even if in an uneven manner and at a slower pace than the market might wish.

Secondary airports in Europe can continue to be employed. In Europe, there is the potential to expand at 430 secondary airports. The US experience over the past decade has shown that increased competition from low-cost carriers makes such use more likely. Secondary-airport utilization has in fact been happening in Europe in recent years with the emergence of such airlines as EasyJet and Debonair at Luton, and British Airways' low-cost offshoot GO at Stansted.

New Airports/Expansion Projects in Asia



Significant airport development is planned in Asia. More airport development is being undertaken in Asia than in any other region. Several of Asia's major gateways—Hong Kong,

Kuala Lumpur, and Seoul—will open new airports in the next few years. Changi airport in Singapore plans steady incremental increases that will double its capacity by 2004. Planned improvements at Asia's top 10 international airports will ultimately double those airports' capacities within the next decade. Furthermore, China expects to upgrade 41 airports during the next five years.

Air traffic control systems will also require improvement. Obtaining more airport capacity (runway, terminal, and ground access) is necessary, but it is not the only precondition for airlines to provide capacity for growth. Constraints in ATC capacity for safe operations at peak demand times can affect the availability of takeoff or landing slots, or can occur en route between terminal areas. Reduced operations in poor weather conditions represent a further limitation of current systems. Current radar-based ATC systems and practices are a legacy of the progressive evolution of technology and procedures dating from the 1940s. Fortunately, the air transportation system is evolving towards satellite-based Communications, Navigation, and Surveillance/Air Traffic Management (CNS/ATM). The purpose of these complex, worldwide initiatives are to help more airplanes navigate more precisely as well as to fly more direct routings. The greater precision of CNS/ATM holds the potential for safe air traffic management of a much larger number of airplanes than are flying today, even in congested airspace. Implementation based on the Global Positioning System (GPS) owned by the US government, the similar GLONASS system owned by the Russian federation, or other satellite systems are real possibilities. CNS/ATM will be a vital part of the solution to the challenges of increasing demand for air travel, increasing numbers of flights, and relieving airport congestion. It will expand the network of possible nonstop service by allowing more airplanes to fly safely at any time, anywhere in the world.

Airlines will continue to avoid bottlenecks. Among the strategies that airlines will employ to supply more service is to bypass the most congested hubs and gateways. Another possibility is to add flights at off-peak times, subject to curfew limitations. Yet another is more flights at second or third airports serving major metropolitan areas. As cities expand in area, airports once perceived as too remote from metropolitan areas become more convenient. As primary airports fill up, others are recommissioned that were abandoned because they were poorly located or could not expand.

Airlines will shift slots to long-haul flights. The busiest airports tend to be hubs for both short-haul and long-haul flights. Airlines can reallocate the slots that they control between short-haul and long-haul flights in response to the costs of congestion and slot limits. When demand requires, short-haul frequencies can be sacrificed to allow more long-haul flights.

The economics mean long-haul flights are the last to be affected by congestion. For instance, a $1,000 value for an aircraft slot represents about 10% of the revenue for a small short-haul flight, but less than 1% for a large, long-haul flight. Thus, airlines can

often increase airplane size on slots as they become too valuable for small-airplane, short-haul services. At present, all airports except Narita have significant amounts of short-haul, small-plane service that can give way to free up slots for longer-haul services using larger airplanes.

Major Airports Have Small-Airplane, Short-Haul Flights

Airport	Departures <130 seats	Departures <800 km
Hong Kong	5%	26%
London Heathrow	24%	47%
Los Angeles	45%	52%
Charles de Gaulle	46%	55%
Osaka	2%	33%
Frankfurt	38%	52%
Chicago	53%	39%
Singapore	6%	21%
New York JFK	41%	39%
Bangkok	14%	40%

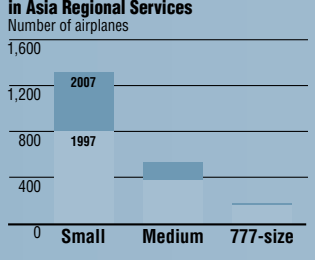
Airlines will increase airplane size in short-haul markets. Congestion drives airlines to larger aircraft and lower frequencies. Ultimately, airlines will adjust their fleets and increase the size of the airplanes they employ on various routes. This is more likely to happen at the bottom of the system than at the top. A modest increase in the size of the average airplane serving short-haul markets will free-up much more airport capacity than a large increase in the average size of airplanes serving long-haul markets. It also makes better economic sense for airlines.

Airlines will offer a broader range of departure times. In general, as networks develop, larger traffic centers—such as Frankfort, Los Angeles, or Tokyo—get their added services at different times of day. Early in their development, however, many gateway airports have traffic peaks at only one time of day. Such peaking results from several factors. It may reflect passenger preferences regarding departure and arrival times. These are affected by the time difference between cities. It may also reflect airline preferences regarding the scheduling of airplanes to maximize utilization and minimize time spent sitting at destination airports. For example, peaking occurs in the mid-afternoon at Narita Airport in Tokyo. Adding earlier departures to serve the west coast of North America is infeasible, as it would result in extremely undesirable arrival times. However, passengers on the fast-growing European routes prefer the morning hours, and both early and late times provide reasonable schedules for serving cities in the eastern parts of North America. Thus, as the

Airlines will add only a few large airplanes in the future. *During the next decade, the fleet serving the Asia regional market will grow by two-thirds. Of the almost 970 airplanes that will be added, 53% will be small, 17% will be medium, and 30% will be intermediate.*

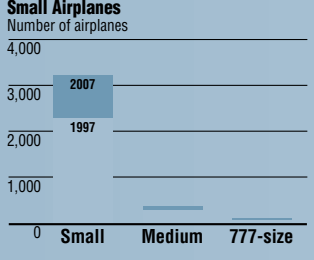
The fleet providing scheduled service in the Europe regional market will grow by 62% in the next 10 years. Of the more than 1,000 airplanes to be added, 87% will be small and 10% will be medium size.

Average Seat Count Up 5% in Asia Regional Services



The North American regional fleet will expand in similar fashion. Over 700 airplanes will be added. Two-thirds will be small, and the rest will be medium size.

European Regional Fleet Remains 87% Small Airplanes



Use of intermediate airplanes may decline as not all retirements are replaced.

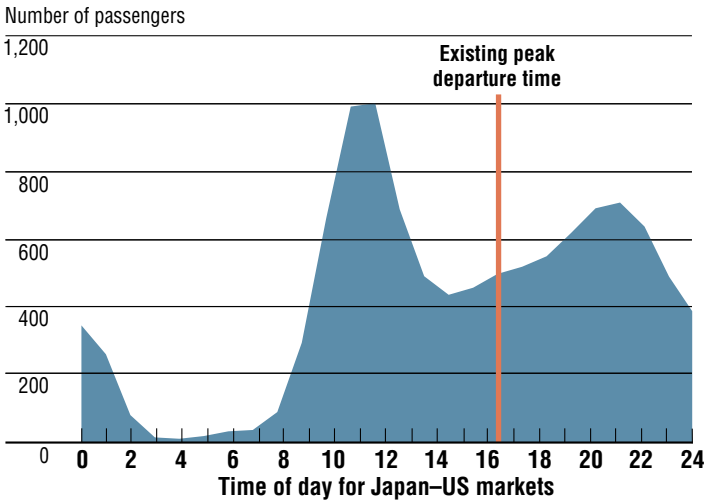
In the Atlantic market, almost 400 airplanes will be added by 2007, an increase of 60%. Just under half will be medium size, and the rest will be 777 size. There may be no net additions to the Atlantic fleet of large airplanes. Atlantic markets are continuing to liberalize, compete, and fragment to additional services.

Size categories for World Fleet

Small	*737-size airplanes (100–170 seats)*
Medium	*757- and 767-size airplanes (170–260 seats)*
777-size	*777- and MD-11-size airplanes (260–400 seats)*
Large	*747-size airplanes and above (more than 400 seats)*

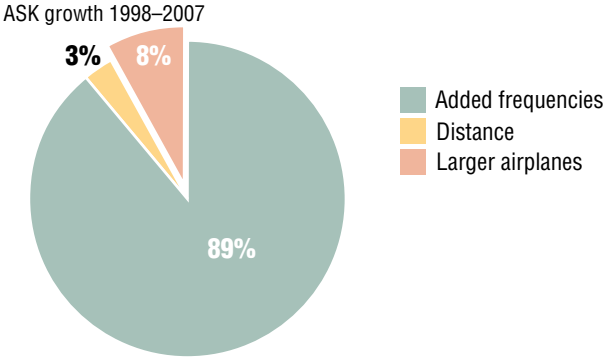
current peak departure window becomes more congested, there would seem to be opportunities to exploit additional departures for these markets in the mid to late morning. The extent to which this is possible may depend on improvements to ground transportation and speedier processing of passengers at the airport.

Existing Peaks Are Not the Only Times for Travel



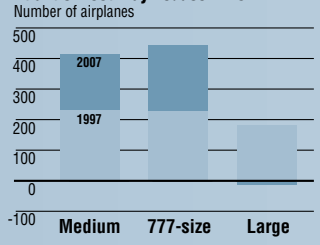
Airlines will increase airplane size only moderately in the next decade. The Boeing forecast projects ASKs to grow by more than 60% between 1997 and 2007. As in the previous decade, by far the majority of ASK growth will be supplied by adding more flights. Increases in average segment length are forecast to contribute 3% of ASK growth. Airlines will produce 8% of this growth by moving to larger airplanes. Even this modest increase is proportionately five times as much as in the last 10 years.

Airlines Will Continue to Supply ASK Growth via Increased Frequencies



Growth requirements are only part of the changes in the world fleet. The "State of the Industry" described how GDP forecasts and changes in travel growth patterns lead to the projections of RPK growth presented in this publication. This chapter shows how the competitive forces driving airline route network development will shape the growth of the world fleet to meet these traffic projections. "World Airplane Deliveries" combines growth requirements with expected airplane retirements to project the total airline fleet. Whereas this chapter emphasized changes to the mix of airplanes in airline fleets relating to growth trends in regional markets, the next chapter will focus on airplane deliveries.

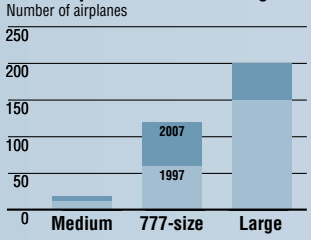
Atlantic Fleet May Reduce 747s



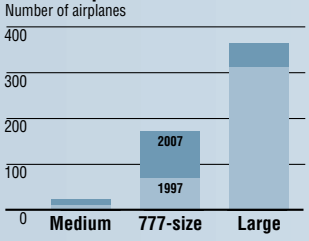
A different picture emerges in the Europe–Asia market, where the fleet will expand by nearly 150 airplanes. Here, 43% of added airplanes will be large.

The Pacific fleet will expand in a similar fashion, but this market will retain a unique identity. It will be home to a quarter of the large airplanes in the world fleet and a third of the ones in long-haul service. More than 160 airplanes will be added, an increase of 62%. In this market, airplanes for growth will be split almost two-thirds to one-third between the 777-size and large categories.

Asia–Europe Fleet Mix Is Stabilizing



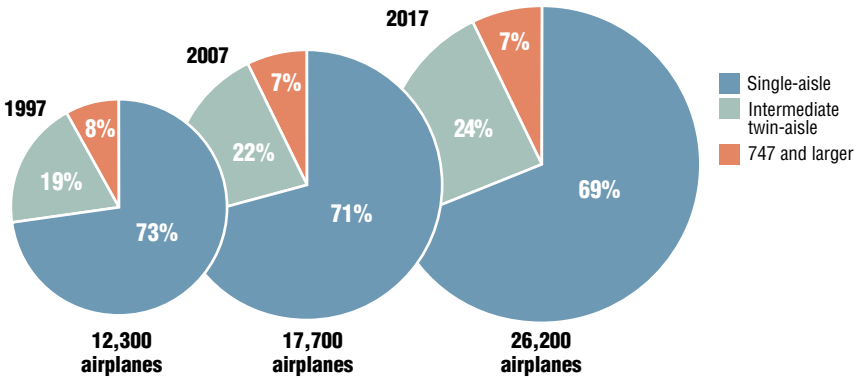
Transpacific Fleet Adds Long-Range 777-Size Airplanes



Worldwide Airplane Deliveries

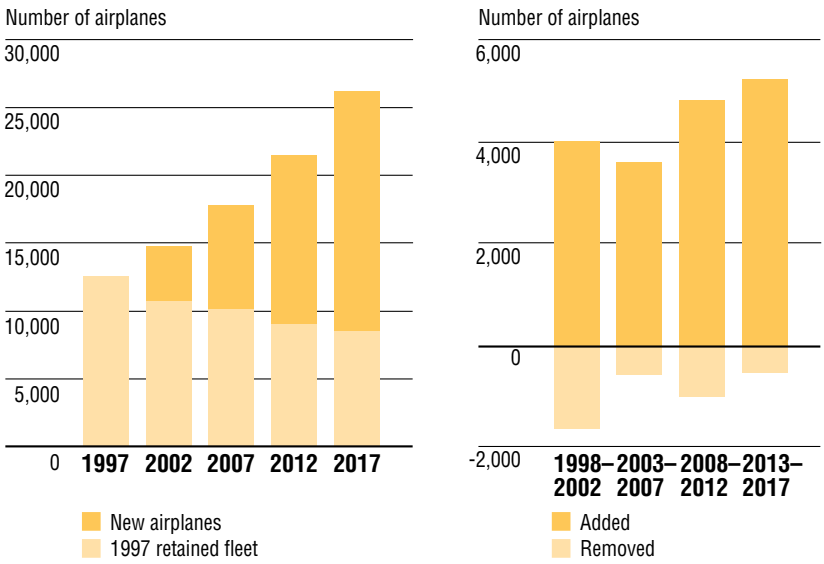
The world fleet will reach 17,700 airplanes in 2007. Over the next decade, the world jet fleet—driven by the 5% per year growth in air travel and greater than 6% growth in air cargo—is projected to grow from 12,300 airplanes at the end of 1997 to 17,700 airplanes in 2007. Single-aisle airplanes currently make up 73% of the world fleet. By the end of 2007, this percentage is expected to decline to 71%. The percentage of intermediate-size airplanes is projected to rise from 19% today to 22% in 2007. As the airlines add more intermediate-size airplanes to the world fleet, the proportion of large airplanes is expected to decline from 8% to 7% over the next decade.

The World Fleet Will More Than Double Over the Next 20 Years



The world fleet will more than double by 2017. World air travel growth is projected to be 4.9% during the second decade of the forecast period. Air cargo is projected to grow at an average annual rate of approximately 6.4%. The world fleet is projected to reach 26,200 airplanes by the end of the 20-year forecast period. By 2017, single-aisle airplanes are projected to represent 69% of the world fleet versus 73% of today's world fleet. The percentage of intermediate-size airplanes is projected to increase from 19% to 24.5% in 2017. The proportion of large airplanes is expected to gradually decline from 8% to over 6.5% over the entire forecast period.

The World Fleet



7,600 new airplanes will be required over the next decade. The world fleet is projected to grow from 12,300 airplanes at the end of 1998 to 17,700 airplanes in 2007. Over the next 10 years, more than 7,600 new commercial jets—7,425 passenger airplanes and 175 new freighters—are forecast to enter service worldwide. The majority of these airplanes will meet industry demand for growth, while the remainder will replace the 2,200 airplanes that are projected to be removed from service.

The removal of airplanes over the next 10 years will not be smooth due to the requirement in the United States that all airplanes comply with the Stage 3 noise standard as of December 31, 1999. Of the 2,200 airplanes projected to be removed between 1998 and 2007, three out of four are expected to be removed during the next five years.

17,650 new airplanes will be required over the next 20 years. In the 20 years between 1998 and 2017, 17,650 commercial jet transports—17,000 passenger airplanes and 650 new freighters—are forecast to enter service worldwide. Over this time period, the world fleet is expected to double, with total fleet size growing to 26,200 by 2017. Two-thirds of the fleet operating today is projected to still be in operation 20 years from now.

Airplanes are replaced in stages. New capacity is added as older airplanes pass through a series of replacement stages. Airplanes often remain in service significantly longer than they are flown by their first operator. The timing of commercial replacement in our forecasts is based upon information from airlines whenever possible. There is significant variation among airlines. Where information is not available, we use the guidelines summarized in the adjoining table to remove airplanes from the active commercial fleet.

Guidelines for Replacement in Commercial Airline Fleets

1. Information from airlines
2. Airplanes designed

	Before 1980	*After 1980*
Single-aisle	25 years	28 years
Twin-aisle	28 years	31 years

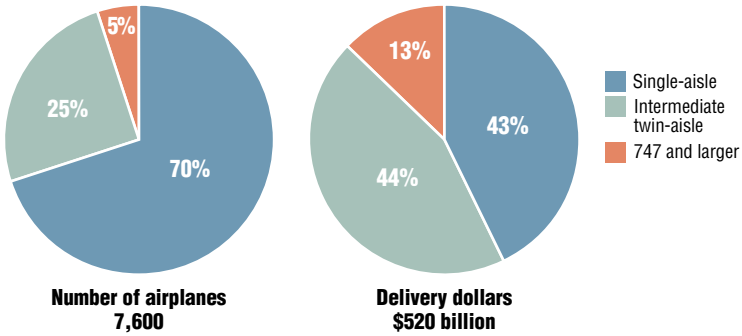
3. Freighters: 35 years or older
4. Extended service lives (hushkit or re-engine): 5 to 10 years

The market for airplanes is $520 billion. The market for new commercial jet airplanes over the next 10 years is $520 billion (1997 US dollars). Seven out of ten of these jets will be single-aisle airplanes, two will be intermediate twin-aisle airplanes, and just one will be equal to or larger in size than the 747.

The largest demand is for small airplanes. The current world fleet of 9,000 single-aisle airplanes is expected to grow to 12,600 airplanes by the year 2007. Airlines are expected to continue to purchase large numbers of single-aisle airplanes to offer more frequencies in domestic service and in short-range international routes.

Airplanes Added to World Fleet

1998–2007



Demand for mid-size airplanes is growing the fastest. Intermediate-size airplanes will be the fastest-growing segment of the commercial airplane market for two reasons. First, some mid-size types are now capable of serving long-range intercontinental markets that in the past could only have been served by 747s. Second, strong regional traffic growth will drive some markets away from single-aisle airplanes to more intermediate-size ones.

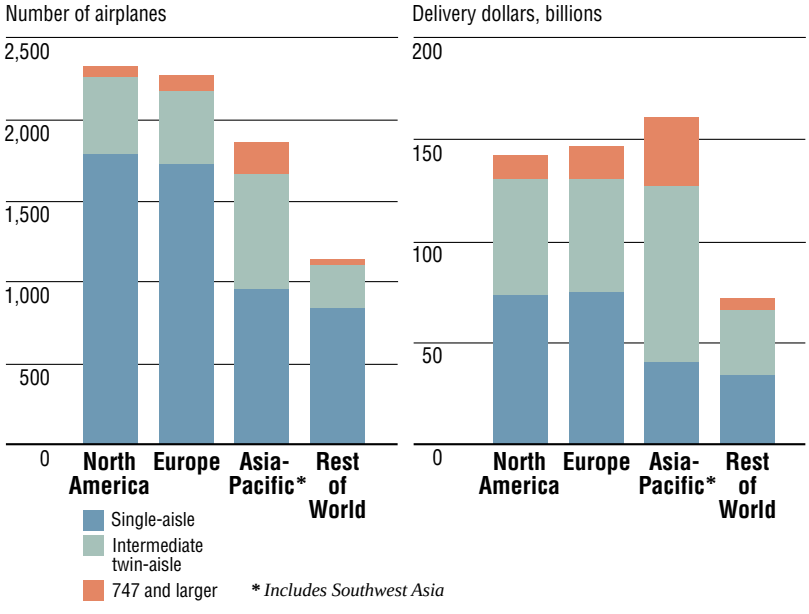
Over the next 10 years, the share of intermediate-size passenger airplanes is projected to increase from 19% to 22% of the world fleet. A total of 1,900 deliveries in this size category are forecast over this 10-year period.

The requirement for 747-and-larger airplanes remains strong. As stated in the *1997 Current Market Outlook*, the large-airplane category includes the 747 and any future airplane larger than the current 747-400. Currently, this fleet of 1,016 all-passenger, combi, and freighter 747s represents just 8.3% of the world fleet but provides one-fourth of all airline capacity. Over the next 10 years, airlines are projected to take delivery of 390 airplanes in this category.

Rapid air travel growth in a few high-density markets continues to point to a future requirement for an airplane larger than the 747-400. The timing of the requirement is dependent on the traffic growth rates in key markets, the pace of market liberalization, and the extent of airport restrictions. Airlines are projected to take delivery of approximately 80 airplanes of this size category over the next 10 years. The requirement for a larger airplane is expected to become more significant during the second decade of the forecast period.

Strong regional differences exist in demand. Strong differences exist in airplane demand and size requirements from region to region. North America, with its large number of experienced travelers and need to replace an aging fleet, will require the most airplanes over the next 10 years, followed by Asia–Pacific, Europe, and other regions of the world. Deliveries to North American airlines are expected to total 2,325 airplanes over the next 10 years. Asia-Pacific's growing airlines will require delivery of 1,860 airplanes from now until 2007. European airlines are projected to take delivery of 2,270

Airplane Deliveries
1998–2007



airplanes, and the airlines of the rest of the world more than 1,150 airplanes.

The airplane fleets of North American airlines have a larger proportion of single-aisle airplanes. Airplane deliveries to these airlines are expected to reach $142 billion over the next 10 years. Airplane investment by Asia-Pacific airlines is expected to reach $160 billion as they are projected to take delivery of nearly three times the number of large airplanes as the airlines of North America. The 2,270 airplane deliveries to European airlines will total more than $146.5 billion. Airlines of the rest of the world are expected to invest $72 billion in new airplanes between 1998 and 2007.

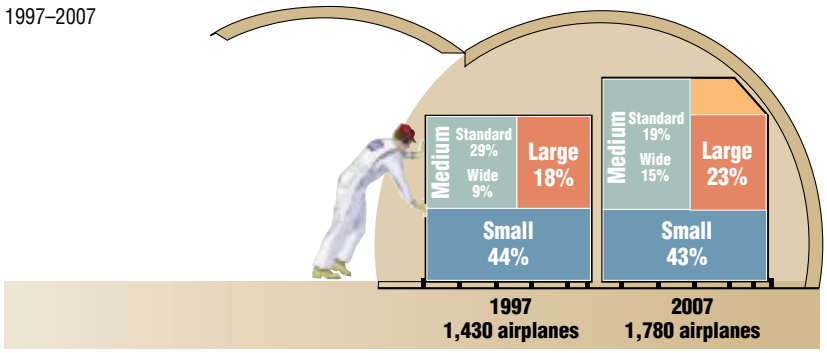
Most freighter requirements will be met by used airplanes. The 1998 assessment of requirements for dedicated freighters projects the fleet to grow by 160 additional large-capacity freighters by 2007. For medium-capacity widebody freighters, the fleet is projected to increase by 135 airplanes; the medium-capacity standard-body freighter fleet will decrease by nearly 100 airplanes, and the small freighter fleet is projected to increase by 135 airplanes.

This year's outlook continues to show a small requirement for new freighters. Large numbers of low-priced used airplanes will be available. Continued increases in the use of lower hold cargo capacity on passenger airplanes will create further downward pressure on cargo yields. This will cause airlines to convert many older airplanes to freighters rather than buy new freighters. The projected requirement is for 650 new freighter airplanes between 1998 and 2017. The value of new freighters totals $77 billion in 1997 dollars.

The market for airplanes is $1.25 trillion over 20 years. Worldwide air travel will

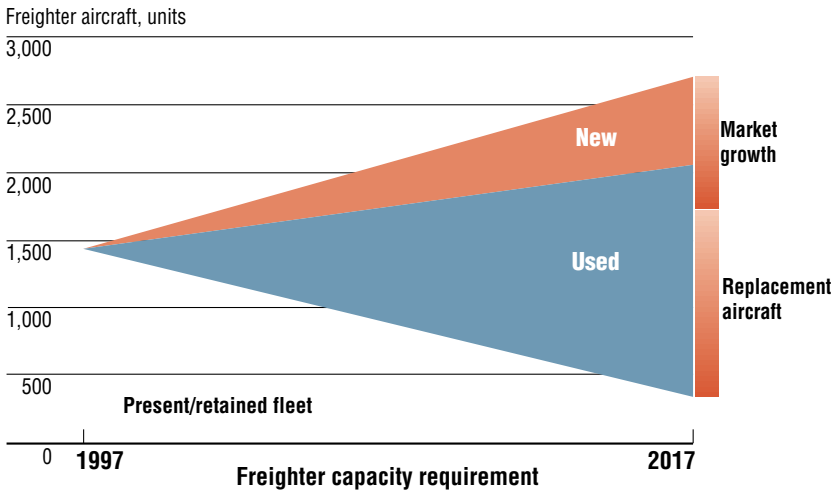
World All-Cargo Fleet

1997–2007



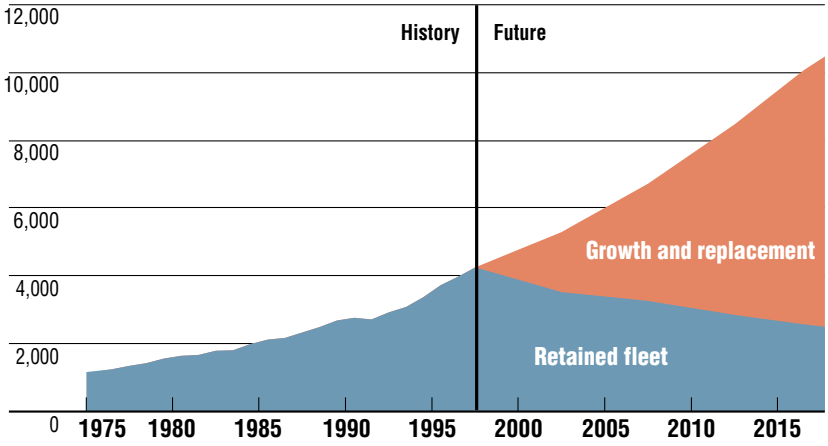
Small (less than 30 tonnes)	Medium Standard (30 to 50 tonnes)	Medium Wide (30 to 65 tonnes)	Large (over 65 tonnes)
727 737 DC-9/MD-80 BAe 146 Caravelle BAC 111	707 DC-8 757	DC-10-10 A300/A310 L-1011 767	747 DC-10-30 MD-11 A340

Over 70% of the Future Fleet Will Be Modified Aircraft



average 4.9% annual growth over the next 20 years. Load factors will rise somewhat, so airplane capacity will grow by 4.6% per year. To accommodate the growth in traffic and replace capacity lost as airplanes are removed from commercial airline service, the industry will require 17,650 new jets. The value of this requirement is $1.25 trillion (1997 dollars) through 2017.

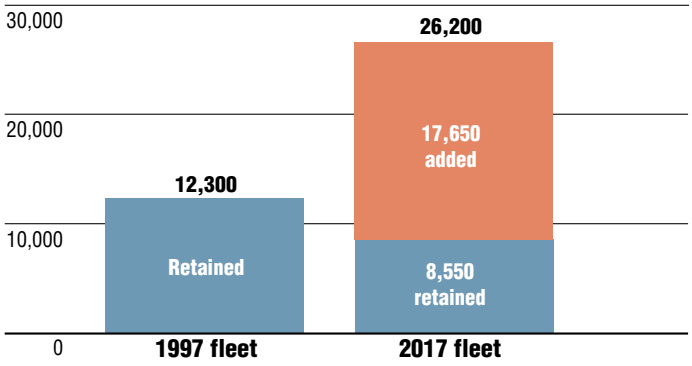
World Airplane Capacity Requirement
1998–2017
ASK, billions



One-third of today's capacity will need to be replaced. The tally of airplanes added and removed is a straightforward exercise. Defining the number of airplanes attributable to growth and those to replacement is not. The reason is that airplanes are not replaced jet for jet, but rather on a seat-for-seat basis.

The 3,730 airplanes removed from the system will be replaced by some airplanes of equal size, but also by both smaller and larger airplanes. For example, an airline might "replace" its 727-200s (156 seats) with 757-200s (201 seats). Only a portion of each 757-200 actually serves as replacement; the rest contributes to growth. Based upon an estimate of the amount of capacity removed from the world fleet, one-fourth of the $1.25 trillion market for new commercial jets can be thought of as replacement for older in-service airplanes, and the remaining three-quarters for accommodation of both passenger and cargo traffic growth.

Growth and Replacement
Number of airplanes

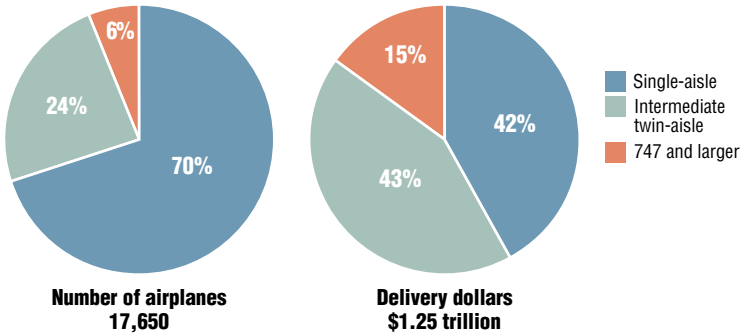


Two-thirds of future deliveries will be single-aisle airplanes. The mix of future airplane deliveries over the next 20 years is considerably different when viewed from the perspective of the number of airplanes versus airplane investment. In terms of investment dollars, the investment in single-aisle and intermediate-size airplanes is equal. Investment in large airplanes is expected to reach 15% of the total investment in new airplanes from 1998 to 2017. In terms of airplane deliveries, 70% of the airplanes required over the next 20 years will be single-aisle airplanes. One-quarter of the market will be intermediate-size airplanes. Just 6% of all future deliveries are projected to be large airplanes.

The market for very large airplanes is small. Summing the projected requirements for 747-and-larger airplanes in all major travel markets reveals a total need for 1,030 airplanes over the next 20 years. Within this size category, more than half the requirement—or approximately 605 jets—is for airplanes having from 400 to 500 seats.

Airplanes Added to World Fleet

1998–2017



Number of airplanes
17,650

Delivery dollars
$1.25 trillion

The market for airplanes larger than today's 747-400 becomes significant during the second decade of this forecast. Only by then, when most major intercontinental routes have daily service and airport capacity problems are more severe, will traffic volumes support an airplane larger than the current 747. The projected requirement for airplanes of 500 seats or greater is estimated at 425 jets over the study period.

World Traffic by Regional Flow

Appendix A

RPKs in billions

Region	1985	1990	1995	1996
Africa–Africa	13.540	14.689	14.775	15.335
Africa–China	0.181	0.311	1.274	1.834
Africa–Europe	43.037	47.732	57.178	66.897
Africa–Middle East	5.156	7.394	6.479	6.973
Africa–North America	1.220	1.298	2.640	3.052
Africa–Oceania	0.354	0.686	1.192	1.633
Africa–South America	0.985	1.000	1.373	1.765
Africa–Southeast Asia	0.280	0.909	3.226	3.623
Africa–Southwest Asia	0.751	0.818	1.025	1.585
Central America–Central America	12.820	14.306	18.267	17.858
Central America–Europe	17.868	27.647	44.193	47.507
Central America–North America	43.339	63.714	71.097	72.625
Central America–South America	3.287	3.499	4.271	4.595
China–China	8.436	18.254	57.509	62.101
China–Europe	9.577	16.927	26.611	29.352
China–Middle East	1.989	2.035	1.432	1.370
China–North America	7.807	13.434	21.630	24.143
China–Northeast Asia	6.754	10.916	15.998	17.343
China–Oceania	3.002	5.810	9.234	10.674
China–Southeast Asia	8.081	14.489	23.032	27.200
China–Southwest Asia	0.776	1.145	1.309	1.799
CIS Region–CIS Region	175.814	224.240	63.395	50.764
CIS Region–International	15.863	24.098	33.918	39.483
Europe–Europe	170.048	258.346	317.065	335.454
Europe–Middle East	43.436	41.512	44.920	47.897
Europe–North America	158.599	230.688	278.895	296.434
Europe–Northeast Asia	17.025	29.347	46.550	54.561
Europe–South America	12.250	22.309	32.930	37.211
Europe–Southeast Asia	26.600	46.386	65.884	72.032
Europe–Southwest Asia	11.859	17.470	20.666	23.353
Middle East–Middle East	17.685	19.462	20.713	21.789
Middle East–North America	5.012	6.560	10.309	11.258
Middle East–Northeast Asia	0.069	0.071	0.328	0.814
Middle East–Southeast Asia	15.136	10.980	20.584	20.442
Middle East–Southwest Asia	14.505	16.583	23.194	23.762
North America–North America	470.633	589.055	680.285	729.521
North America–Northeast Asia	46.880	95.162	121.512	129.111
North America–Oceania	11.008	18.972	25.203	25.916
North America–South America	14.460	19.615	35.885	38.339
North America–Southeast Asia	8.013	15.324	25.886	25.981
Northeast Asia–Northeast Asia	32.273	50.016	67.404	71.708
Northeast Asia–Oceania	6.055	12.879	31.823	35.322
Northeast Asia–Southeast Asia	15.998	32.512	44.335	47.832
Northeast Asia–Southwest Asia	0.464	0.560	0.616	0.623
Oceania–Oceania	18.614	26.241	42.671	44.547
Oceania–South America	0.115	0.688	0.641	0.757
Oceania–Southeast Asia	12.233	24.286	33.065	36.769
South America–South America	29.477	33.841	39.670	42.248
Southeast Asia–Southeast Asia	17.665	29.881	53.811	58.223
Southeast Asia–Southwest Asia	5.658	5.804	8.104	8.873
Southwest Asia–Southwest Asia	10.471	11.602	15.205	16.117
World total	**1573.158**	**2181.501**	**2589.209**	**2766.410**

World Traffic by Regional Flow

RPKs in billions

Region	1997	2002	2007	2012	2017	1998–2007 %/year	1998–2017 %/year
Africa–Africa	16.578	22.925	31.831	42.616	56.785	6.7	6.3
Africa–China	1.900	2.405	3.076	3.869	4.849	4.9	4.8
Africa–Europe	75.259	97.947	129.039	166.955	211.445	5.5	5.3
Africa–Middle East	7.490	10.108	13.584	17.877	23.399	6.1	5.9
Africa–North America	4.039	5.545	7.903	10.762	14.626	6.9	6.6
Africa–Oceania	1.883	2.407	3.035	3.674	4.363	4.9	4.3
Africa–South America	1.464	2.184	3.223	4.376	5.841	8.2	7.2
Africa–Southeast Asia	3.406	4.427	5.947	7.683	9.968	5.7	5.5
Africa–Southwest Asia	1.458	2.119	3.089	4.321	6.017	7.8	7.3
Central America–Central America	18.409	27.525	39.733	53.813	71.204	8.0	7.0
Central America–Europe	51.720	64.113	82.124	104.264	129.841	4.7	4.7
Central America–North America	73.181	89.298	110.685	135.108	163.137	4.2	4.1
Central America–South America	5.269	7.637	10.846	14.489	18.986	7.5	6.6
China–China	62.909	101.316	169.023	264.664	397.397	10.4	9.7
China–Europe	32.407	44.176	62.280	85.260	113.623	6.8	6.5
China–Middle East	1.734	2.269	3.074	4.098	5.476	5.9	5.9
China–North America	27.591	35.154	46.309	59.794	76.225	5.3	5.2
China–Northeast Asia	18.037	24.162	34.099	47.262	63.251	6.6	6.5
China–Oceania	11.102	14.125	18.160	22.600	27.594	5.0	4.7
China–Southeast Asia	28.532	36.331	49.031	65.432	86.273	5.6	5.7
China–Southwest Asia	1.696	2.384	3.400	4.655	6.290	7.2	6.8
CIS Region–CIS Region	44.489	65.855	93.713	125.640	165.402	7.7	6.8
CIS Region–International	42.595	61.152	86.306	114.509	148.560	7.3	6.4
Europe–Europe	365.309	440.313	550.636	681.982	823.677	4.2	4.1
Europe–Middle East	51.861	65.073	83.250	103.693	126.802	4.8	4.6
Europe–North America	322.822	376.196	459.477	554.124	656.634	3.6	3.6
Europe–Northeast Asia	58.381	82.860	122.159	170.526	225.785	7.7	7.0
Europe–South America	40.262	57.491	85.938	119.710	161.412	7.9	7.2
Europe–Southeast Asia	81.483	107.223	148.240	196.610	257.278	6.2	5.9
Europe–Southwest Asia	22.697	31.372	43.675	58.328	76.275	6.8	6.2
Middle East–Middle East	22.373	28.342	36.458	47.269	61.369	5.0	5.2
Middle East–North America	11.097	14.628	19.586	25.659	33.252	5.8	5.6
Middle East–Northeast Asia	0.877	1.222	1.825	2.590	3.583	7.6	7.3
Middle East–Southeast Asia	20.832	25.382	33.354	42.995	55.089	4.8	5.0
Middle East–Southwest Asia	24.261	31.412	41.199	53.095	68.296	5.4	5.3
North America–North America	762.714	866.460	1014.160	1176.996	1360.615	2.9	2.9
North America–Northeast Asia	137.116	180.960	251.057	335.854	434.130	6.2	5.9
North America–Oceania	26.067	30.785	36.860	43.079	49.785	3.5	3.3
North America–South America	44.265	60.894	84.345	110.193	141.663	6.7	6.0
North America–Southeast Asia	28.059	38.420	54.593	74.244	98.177	6.9	6.5
Northeast Asia–Northeast Asia	74.505	104.810	153.113	205.186	262.513	7.5	6.5
Northeast Asia–Oceania	36.383	47.338	64.367	83.324	103.407	5.9	5.4
Northeast Asia–Southeast Asia	50.703	67.028	95.175	131.299	175.255	6.5	6.4
Northeast Asia–Southwest Asia	1.031	1.528	2.274	3.209	4.388	8.2	7.5
Oceania–Oceania	45.808	52.751	61.313	70.339	78.885	3.0	2.8
Oceania–South America	0.756	1.070	1.500	1.996	2.615	7.1	6.4
Oceania–Southeast Asia	38.936	48.607	62.801	77.213	93.377	4.9	4.5
South America–South America	46.600	71.440	107.964	150.740	204.706	8.8	7.7
Southeast Asia–Southeast Asia	61.136	79.618	113.846	157.089	212.229	6.4	6.4
Southeast Asia–Southwest Asia	9.540	12.720	17.533	23.670	31.965	6.3	6.2
Southwest Asia–Southwest Asia	16.130	23.696	35.007	49.900	70.586	8.1	7.7
World total	**2935.150**	**3675.207**	**4791.218**	**6114.634**	**7684.297**	**5.0**	**4.9**

World Traffic by Regional Flow

RPMs in billions

Region	1985	1990	1995	1996
Africa–Africa	8.415	9.129	9.182	9.531
Africa–China	0.112	0.193	0.792	1.140
Africa–Europe	26.748	29.666	35.536	41.577
Africa–Middle East	3.205	4.596	4.027	4.334
Africa–North America	0.758	0.807	1.641	1.897
Africa–Oceania	0.220	0.426	0.741	1.015
Africa–South America	0.612	0.622	0.853	1.097
Africa–Southeast Asia	0.174	0.565	2.005	2.252
Africa–Southwest Asia	0.467	0.508	0.637	0.985
Central America–Central America	7.968	8.891	11.353	11.099
Central America–Europe	11.105	17.183	27.466	29.526
Central America–North America	26.935	39.598	44.187	45.137
Central America–South America	2.043	2.175	2.654	2.856
China–China	5.243	11.345	35.742	38.596
China–Europe	5.952	10.520	16.539	18.242
China–Middle East	1.236	1.265	0.890	0.852
China–North America	4.852	8.349	13.443	15.005
China–Northeast Asia	4.197	6.784	9.943	10.779
China–Oceania	1.866	3.611	5.739	6.634
China–Southeast Asia	5.023	9.005	14.314	16.905
China–Southwest Asia	0.482	0.711	0.814	1.118
CIS Region–CIS Region	109.269	139.366	39.400	31.550
CIS Region–International	9.859	14.977	21.080	24.539
Europe–Europe	105.685	160.563	197.057	208.486
Europe–Middle East	26.996	25.800	27.918	29.768
Europe–North America	98.570	143.373	173.335	184.235
Europe–Northeast Asia	10.581	18.239	28.931	33.910
Europe–South America	7.613	13.865	20.466	23.127
Europe–Southeast Asia	16.532	28.829	40.947	44.768
Europe–Southwest Asia	7.370	10.857	12.844	14.514
Middle East–Middle East	10.991	12.096	12.873	13.542
Middle East–North America	3.115	4.077	6.407	6.997
Middle East–Northeast Asia	0.043	0.044	0.204	0.506
Middle East–Southeast Asia	9.407	6.824	12.793	12.705
Middle East–Southwest Asia	9.015	10.307	14.415	14.768
North America–North America	292.500	366.100	422.800	453.400
North America–Northeast Asia	29.136	59.143	75.520	80.243
North America–Oceania	6.842	11.791	15.664	16.107
North America–South America	8.987	12.191	22.303	23.828
North America–Southeast Asia	4.980	9.524	16.088	16.147
Northeast Asia–Northeast Asia	20.058	31.085	41.892	44.567
Northeast Asia–Oceania	3.763	8.005	19.778	21.953
Northeast Asia–Southeast Asia	9.943	20.206	27.555	29.728
Northeast Asia–Southwest Asia	0.288	0.348	0.383	0.387
Oceania–Oceania	11.568	16.309	26.520	27.686
Oceania–South America	0.071	0.427	0.398	0.471
Oceania–Southeast Asia	7.603	15.094	20.550	22.852
South America–South America	18.320	21.032	24.655	26.257
Southeast Asia–Southeast Asia	10.979	18.571	33.444	36.186
Southeast Asia–Southwest Asia	3.516	3.607	5.036	5.515
Southwest Asia–Southwest Asia	6.508	7.211	9.450	10.017
World total	**977.724**	**1355.812**	**1609.204**	**1719.335**

World Traffic by Regional Flow

RPMs in billions

Region	1997	2002	2007	2012	2017	1998–2007 %/year	1998–2017 %/year
Africa–Africa	10.303	14.248	19.783	26.486	35.292	6.7	6.3
Africa–China	1.181	1.494	1.912	2.405	3.014	4.9	4.8
Africa–Europe	46.774	60.875	80.198	103.763	131.414	5.5	5.3
Africa–Middle East	4.655	6.282	8.442	11.111	14.543	6.1	5.9
Africa–North America	2.510	3.447	4.912	6.689	9.090	6.9	6.6
Africa–Oceania	1.170	1.496	1.886	2.283	2.711	4.9	4.3
Africa–South America	0.910	1.357	2.003	2.720	3.630	8.2	7.2
Africa–Southeast Asia	2.117	2.751	3.696	4.775	6.195	5.7	5.5
Africa–Southwest Asia	0.906	1.317	1.920	2.686	3.740	7.8	7.3
Central America–Central America	11.441	17.107	24.694	33.445	44.253	8.0	7.0
Central America–Europe	32.144	39.846	51.040	64.800	80.696	4.7	4.7
Central America–North America	45.482	55.499	68.791	83.970	101.390	4.2	4.1
Central America–South America	3.275	4.747	6.741	9.005	11.800	7.5	6.6
China–China	39.098	62.968	105.049	164.489	246.984	10.4	9.7
China–Europe	20.141	27.456	38.707	52.990	70.617	6.8	6.5
China–Middle East	1.078	1.410	1.910	2.547	3.403	5.9	5.9
China–North America	17.148	21.848	28.781	37.162	47.374	5.3	5.2
China–Northeast Asia	11.210	15.017	21.193	29.373	39.310	6.6	6.5
China–Oceania	6.900	8.779	11.286	14.046	17.149	5.0	4.7
China–Southeast Asia	17.733	22.580	30.473	40.666	53.619	5.6	5.7
China–Southwest Asia	1.054	1.482	2.113	2.893	3.909	7.2	6.8
CIS Region–CIS Region	27.650	40.929	58.243	78.086	102.798	7.7	6.8
CIS Region–International	26.473	38.006	53.640	71.168	92.331	7.3	6.4
Europe–Europe	227.041	273.657	342.223	423.855	511.918	4.2	4.1
Europe–Middle East	32.232	40.443	51.740	64.446	78.808	4.8	4.6
Europe–North America	200.635	233.807	285.567	344.390	408.101	3.6	3.6
Europe–Northeast Asia	36.284	51.498	75.923	105.983	140.326	7.7	7.0
Europe–South America	25.023	35.731	53.411	74.400	100.318	7.9	7.2
Europe–Southeast Asia	50.642	66.639	92.131	122.194	159.899	6.2	5.9
Europe–Southwest Asia	14.106	19.498	27.144	36.251	47.406	6.8	6.2
Middle East–Middle East	13.905	17.615	22.659	29.378	38.141	5.0	5.2
Middle East–North America	6.897	9.092	12.173	15.947	20.666	5.8	5.6
Middle East–Northeast Asia	0.545	0.760	1.135	1.610	2.227	7.6	7.3
Middle East–Southeast Asia	12.947	15.775	20.729	26.721	34.238	4.8	5.0
Middle East–Southwest Asia	15.078	19.522	25.605	32.999	42.446	5.4	5.3
North America–North America	474.030	538.508	630.305	731.508	845.628	2.9	2.9
North America–Northeast Asia	85.218	112.468	156.033	208.735	269.813	6.2	5.9
North America–Oceania	16.201	19.133	22.909	26.774	30.942	3.5	3.3
North America–South America	27.511	37.846	52.421	68.486	88.044	6.7	6.0
North America–Southeast Asia	17.439	23.878	33.930	46.143	61.018	6.9	6.5
Northeast Asia–Northeast Asia	46.305	65.140	95.160	127.524	163.153	7.5	6.5
Northeast Asia–Oceania	22.612	29.421	40.004	51.786	64.268	5.9	5.4
Northeast Asia–Southeast Asia	31.512	41.658	59.151	81.603	108.921	6.5	6.4
Northeast Asia–Southwest Asia	0.641	0.950	1.413	1.994	2.727	8.2	7.5
Oceania–Oceania	28.470	32.785	38.106	43.716	49.027	3.0	2.8
Oceania–South America	0.470	0.665	0.932	1.240	1.625	7.1	6.4
Oceania–Southeast Asia	24.199	30.210	39.031	47.988	58.034	4.9	4.5
South America–South America	28.962	44.400	67.100	93.686	127.226	8.8	7.7
Southeast Asia–Southeast Asia	37.996	49.483	70.756	97.631	131.901	6.4	6.4
Southeast Asia–Southwest Asia	5.929	7.905	10.897	14.711	19.867	6.3	6.2
Southwest Asia–Southwest Asia	10.025	14.727	21.757	31.013	43.870	8.1	7.7
World total	**1824.208**	**2284.156**	**2977.762**	**3800.270**	**4775.822**	**5.0**	**4.9**

Airplanes Added and Removed

Seat category	1998 to 2002	2003 to 2007	2008 to 2012	2013 to 2017	Total
Single-aisle					
50–90	418	279	439	442	**1,578**
91–120	571	550	608	398	**2,127**
121–170	1,374	914	1,418	1,545	**5,251**
171–240	512	659	895	1,110	**3,176**
Twin-aisle					
Small	449	413	459	578	**1,899**
Intermediate	400	550	577	610	**2,137**
Large	174	163	249	251	**837**
Total passengers	**3,898**	**3,528**	**4,645**	**4,934**	**17,005**
Freighter					
Small	4	9	24	32	**69**
Medium standard	12	10	13	23	**58**
Medium wide	36	20	31	45	**132**
Large	46	40	111	190	**387**
Total freighters	**98**	**79**	**179**	**290**	**646**
Total added	**3,996**	**3,607**	**4,824**	**5,224**	**17,651**
Total removed	**1,619**	**568**	**1,015**	**530**	**3,732**

Number of Airplanes at Year End

Seat category	1997	2002	2007	2012	2017
Single-aisle					
50–90	613	870	1,085	1,502	1,941
91–120	2,489	2,492	2,857	3,010	3,345
121–170	4,031	4,837	5,602	6,664	7,726
171–240	793	1,280	1,944	2,805	3,782
Twin-aisle					
Small	1,194	1,597	1,987	2,368	2,759
Intermediate	885	1,098	1,511	2,045	2,675
Large	840	835	929	1,065	1,264
Total passengers	**10,845**	**13,009**	**15,915**	**19,459**	**23,492**
Freighter					
Small	637	722	773	820	983
Medium standard	420	417	332	234	260
Medium wide	123	173	259	409	659
Large	254	335	416	582	804
Total freighters	**1,434**	**1,647**	**1,780**	**2,045**	**2,706**
Total fleet	**12,279**	**14,656**	**17,695**	**21,504**	**26,198**

World Airline Fleet Distribution

Seat category*	Models	1997 year-end units	Percent	2017 year-end units	Percent
Single-aisle					
50–90	F 28 F 70 BAe 146/RJ70/RJ85 BAC 1-11 DC-9-10 Canadair RJ New “85” Seater	615	5.0	1,941	7.4
91–120	717-200 727-100 737-100/-200/-500/-600 DC-9 MD-87 F 100 RJ100 Caravelle Concorde New “105” seater	2,897	23.6	3,608	13.8
121–170	737-300/-400/-700/-800 727-200 720 A319 A320 Trident-3 Mercure MD-81/-82/-83/-88 MD-90 DC-8-10/-20	4,258	34.7	8,446	32.3
171–240	757 707-300B/C A321 DC-8-30/-40/-50/-60/-70	1,213	9.9	4,042	15.4
Intermediate twin-aisle					
230–310 (181–249)	767 A300 A310 A330-200 777-200/-300	1,273	10.3	3,277	12.5
311–399 (250–368)	A330 A340 L-1011 DC-10 MD-11	1,007	8.2	3,172	12.1
747 and larger					
>400	747 747X A3XX	1,016	8.3	1,712	6.5
Total passengers		**12,279**	**100.0**	**26,198**	**100.0**

**Categories based on 36-/32-in mixed-class configuration (includes freighter and combi airplanes in appropriate passenger category; the intermediate twin-aisle category shows typical three-class configurations)*

Delivery Distribution

History 1952–1997

Appendix B

(Continued)

Seat category*	Models	1997 dollars (billions)	Percent	Units	Percent
Single-aisle					
50–90	RJ 145 BAe 146/RJ70/RJ85 F 28 F70 BAC 1-11 DC-9-10 Canadair RJ	23.2	2.9	1,072	6.8
91–120	727-100 737-100/-200/-500/-600 DC-9-30/-50 Concorde Caravelle F 100 BAe 146/RJ100 880 990	98.1	12.1	3,916	24.8
121–170	727-200 737-300/-400/-700 707-120/-220 720 A319/A320 MD-81/-82/-83/-88/-90 DC-8-10/-20 Trident Mercure	189.7	23.5	5,050	31.9
171–240	757 707-320/-420 A321 DC-8-30/-40/-50/-60	107.5	13.3	2,062	13.0
Intermediate twin-aisle					
230–310 (181–249)	767 A300 A310	118.2	14.6	1,403	8.9
311–399 (250–368)	L-1011-1 DC-10 777-200 A330 A340 MD-11		15.1	1,164	7.4
747 and larger					
>400	747	149.6	18.5	1,136	7.2
Total		**808.7**	**100.0**	**15,803**	**100.0**

**Categories based on 36-/32-in mixed-class configuration (includes freighter and combi airplanes in appropriate passenger category; the intermediate twin-aisle category shows typical three-class configurations)*

Delivery Distribution

Future 1998–2017

Seat category*	Models	1997 dollars (billions)	Percent	Units	Percent
Single-aisle	BAe 146	38.7	3.1	1,578	9.0
50–90	RJ70/85				
	Canadair RJ				
	New “85” Seater				
91–120	737-500/-600	70.6	5.6	2,148	12.2
	MD-87				
	RJ100				
	717-200				
	New “105” Seater				
121–170	737-300/-400/-700/-800	229.8	18.3	5,299	30.0
	MD-81/-82/-83/-88				
	MD-80				
	A319				
	A320				
171–240	757	195.7	15.6	3,234	18.3
	A321				
Intermediate twin-aisle					
230–310 (181–249)	767	207.6	16.5	2,031	11.5
	A300				
	A310				
	A330-200				
311–399 (250–368)	A330	328.2	26.2	2,332	13.2
	A340				
	MD-11				
	777-200/-300				
747 and larger					
>400	747	184.1	14.7	1,029	5.8
	747X				
	A3XX				
Total		**1,254.7**	**100.0**	**17,651**	**100.0**

**Categories based on 36-/32-in mixed-class configuration (includes freighter and combi airplanes in appropriate passenger category; the intermediate twin-aisle category shows typical three-class configurations)*

	Africa		Asia-Pacific and Southwest Asia		Europe	
	1998–2007	1998–2017	1998–2007	1998–2017	1998–2007	1998–2017
Traffic growth to/from:	%/year	%/year	%/year	%/year	%/year	%/year
Africa	6.7	6.3	5.8	5.5	5.5	5.3
Asia-Pacific	5.8	5.5	6.8	6.5	6.8	6.4
Europe	5.5	5.3	6.8	6.4	4.2	4.1
Middle East	6.1	5.9	5.2	5.2	4.8	4.6
Latin America	8.2	7.2	7.1	6.4	6.2	5.9
North America	6.9	6.6	5.9	5.7	3.6	3.6
Airplane deliveries Number of airplanes						
Single-aisle	125	275	955	2,425	1,725	3,655
Intermediate twin-aisle	55	120	710	1,775	450	1,105
747 and larger	10	15	195	560	95	230
Total	190	410	1,860	4,760	2,270	4,990
Delivery dollars, billions						
Single-aisle	5.5	12.0	40.0	107.0	75.5	170.0
Intermediate twin-aisle	7.0	15.0	87.0	218.0	55.0	135.0
747 and larger	1.5	2.5	33.0	102.0	16.0	40.0
Total	14.0	29.5	160.0	427.0	146.5	345.0

	Middle East		Latin America		North America	
	1998–2007	1998–2017	1998–2007	1998–2017	1998–2007	1998–2017
Traffic growth to/from:	%/year	%/year	%/year	%/year	%/year	%/year
Africa	6.1	5.9	8.2	7.2	6.9	6.6
Asia-Pacific	5.2	5.2	7.1	6.4	5.9	5.7
Europe	4.8	4.6	6.2	5.9	3.6	3.6
Middle East	5.0	5.2			5.8	5.6
Latin America			8.5	7.4	5.2	4.9
North America	5.8	5.6	5.2	4.9	2.9	2.9
Airplane deliveries Number of airplanes						
Single-aisle	90	230	630	1,170	1,790	4,500
Intermediate twin-aisle	110	230	100	235	470	890
747 and larger	25	40	5	5	65	190
Total	225	500	735	1,410	2,325	5,580
Delivery dollars, billions						
Single-aisle	4.0	11.0	24.0	47.0	74.0	189.0
Intermediate twin-aisle	14.0	28.0	12.0	29.0	57.0	110.0
747 and larger	4.0	6.0	0.5	1.0	11.0	33.0
Total	22.0	45.0	36.5	77.0	142.0	332.0

Results by Country

Appendix D

1998–2017

Category	Investment 1997 dollars, billions	Airplane deliveries
United States	306	5,200
China	125	1,800
Japan	92	810
Germany	61	780
United Kingdom	60	770
France	48	570
Singapore, South Korea	30–35	230–290
Australia, Brazil, Canada, Italy, Spain	25–30	310–420
India, Mexico, Netherlands, Saudi Arabia, Taiwan	15–25	160–280
Indonesia, Malaysia, Sweden, Switzerland, South Africa, Thailand, Turkey, UAE	10–15	90–290
Argentina, Austria, Belgium, Finland, Greece, Israel, New Zealand, Pakistan, Philippines, Vietnam	5–10	60–130
Algeria, Bangladesh, Bolivia, Brunei, Bulgaria, Chile, Colombia, Cyprus, Czech Republic, Denmark, Ecuador, El Salvador, Egypt, Hungary, Iceland, Iran, Ireland, Jamaica, Jordon, Kuwait, Lebanon, Luxembourg, Mauritius, Morocco, Nigeria, Norway, Peru, Poland, Portugal, Romania, Serbia, Sri Lanka, Trinidad, Tunisia, Venezuela	1–5	10–100

- North America
- Central America
- South America
- Europe
- Africa
- Middle East
- CIS Region
- Southwest Asia
- Asia-Pacific
- China
- Northeast Asia
- Southeast Asia
- Oceania

Market Outlook regions have been formed to best illustrate major world traffic flows. They do not always exactly match political or geographic regions.

ASK	Available seat-kilometers—the number of seats an airline provides multiplied by the number of kilometers they are flown; a measure of airline capacity
ATC	Air traffic control
ATK	Available ton-kilometers—the number of tons capable of being carried multiplied by the number of kilometers they are flown
CIS	Commonwealth of Independent States—states of the former Soviet Union
EU	European Union
GDP	Gross domestic product—the total output of goods and services produced within a country; the broadest measure of economic output with the exception of GNP (gross national product), which includes a country's nationals who work in other countries
Load factor	Revenue passenger-kilometers divided by available seat-kilometers
RPK	Revenue passenger-kilometers—the number of passengers multiplied by the number of kilometers they fly
RPM	Revenue passenger-miles—the number of passengers multiplied by the number of miles they fly
RTK	Revenue ton-kilometers—the number of tons carried multiplied by the number of kilometers they are flown
Stage 2 and Stage 3 airplanes	A measure of noise; newer Stage 3 airplanes are quieter and are allowed to operate into more airports
Yield	Revenues divided by revenue passenger-kilometers; it represents an aggregate of all the airfare and airline charges and is measured on a per-kilometer basis

Current Market Outlook

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Air Travel and the Economy	☐	☐	☐	☐	☐
Market Forces and the World Fleet	☐	☐	☐	☐	☐
Worldwide Airplane Deliveries	☐	☐	☐	☐	☐
Evolution of the World Fleet	☐	☐	☐	☐	☐

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