



COMMERCIAL MARKET OUTLOOK

2018–2037





FOREWORD

By any measure, the commercial aviation sector is soaring.

More people are taking to the air than ever before, as our industry has now recorded eight straight years of steady and above-trend growth. It is commonplace for airline passengers to hear flight attendants announce full flights, and load factors climbed to a record high of 81 percent last year. And airlines are delivering strong financial results, generating more than \$30 billion of profits, unprecedented levels for our industry.

For some, this success is too good to be true. But for those of us who track the commercial aviation market, the continuing growth is less of a recent phenomenon and more of a validation of underlying market fundamentals.

Every year for more than 50 years, a dedicated team here at Boeing has pored over reams of economic, airline, travel, and fleet data to project new airplane demand during the next 20 years. I am proud to say the Boeing market outlook is one of the longest-published and most accurate forecasts in our industry.

This year, we again forecast a growing demand for new jetliners, as airlines and other operators look to renew and grow their fleet to serve more passengers and carry more cargo. These airplanes also give life to a multitrillion-dollar market for services as operators maintain, repair, and overhaul the jets to keep them flying safely and efficiently. This sector also includes the training of pilots and technicians to operate the airplanes and the emerging field of data analytics to further enhance operational efficiency.

So this year, we are providing a holistic view by combining the demand for jets and the services required to operate them into the Boeing Commercial Market Outlook (CMO).

Together, our analysis projects a global demand for \$15 trillion worth of commercial airplanes and services, a truly massive market, in the next two decades. You will see this demand playing out differently in each region as operators cater to different demographic and growth trends.

With air travel becoming an even bigger part of our lives and as the in-service fleet is expected to double by 2037, we hope this outlook continues to be a valuable tool to prepare for the growth that is beyond the horizon.

RANDY TINSETH

**Vice President
Commercial Marketing
The Boeing Company**

EXECUTIVE SUMMARY

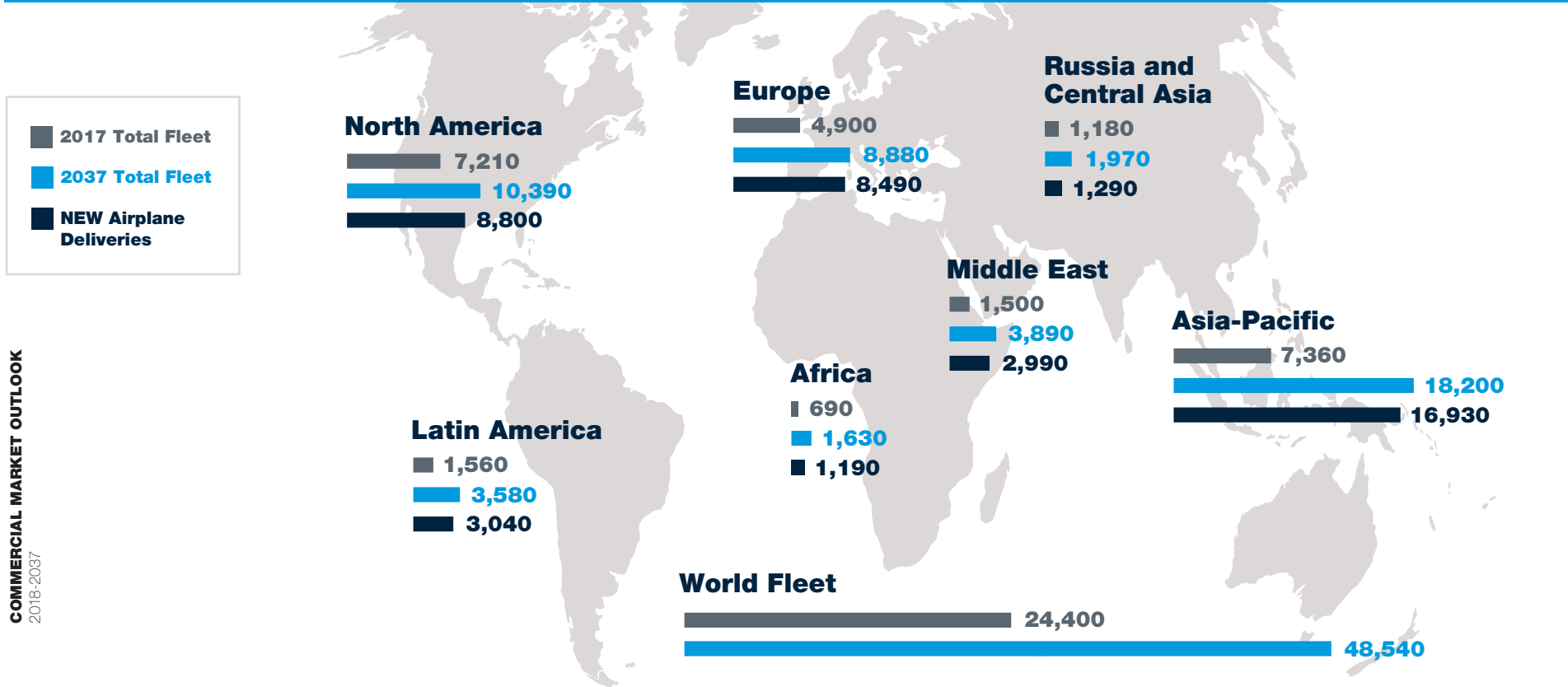
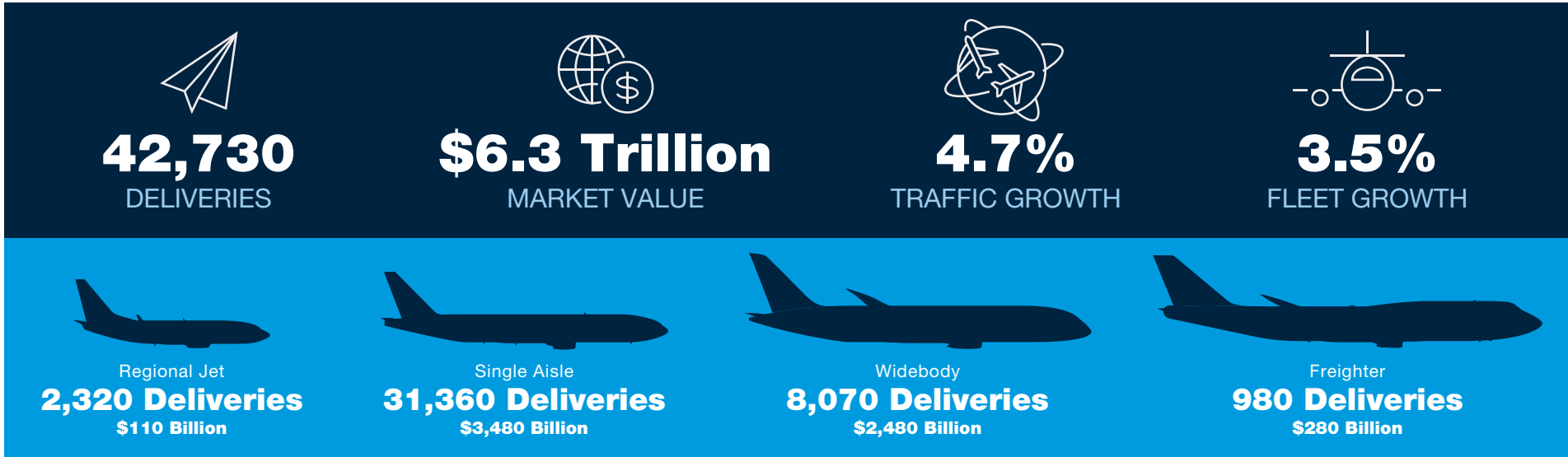


TABLE OF CONTENTS

Commercial Aviation Market Dynamics	6
Commercial Traffic and Fleet Outlook	20
Air Cargo Outlook	28
Services Market Outlook	30
Asia-Pacific	38
North America	42
Europe	46
Latin America	50
Middle East	54
Russia and Central Asia	58
Africa	62
Forecast Methodology	66
Appendix	70

COMMERCIAL AVIATION MARKET DYNAMICS

Aviation is a dynamic industry that continuously adapts to various market forces. Forecasting long-term demand for airplanes requires assumptions and predictions about the macro trends and drivers that will shape this industry far into the future. A multitude of factors are at play, and they often vary from market to market. However, we can broadly categorize three key macro-environment dimensions that drive airplane demand forecasts:

- > The underlying demand for air travel.
- > The regulatory, infrastructure, and technology environment.
- > The strategies and products that airlines offer in the marketplace.

We update our forecast each year to incorporate the effects of current business conditions and developments into our analysis of the long-term industry drivers. In the last year, all three of these categories have seen significant developments that influence our forecast.

STRONG GROWTH IN THE DEMAND FOR AIR TRAVEL

Year-over-year traffic growth averaged 6.5 percent during the past five years, setting a pace that exceeded the long-term average of around 5 percent. Low air fares, higher living standards with a growing middle class in large emerging markets, the growth of tourism and travel relative to total consumer spending in major economies, and new airline business models are all driving this boom in air travel.

ECONOMIC AND INCOME GROWTH ARE KEY DRIVERS

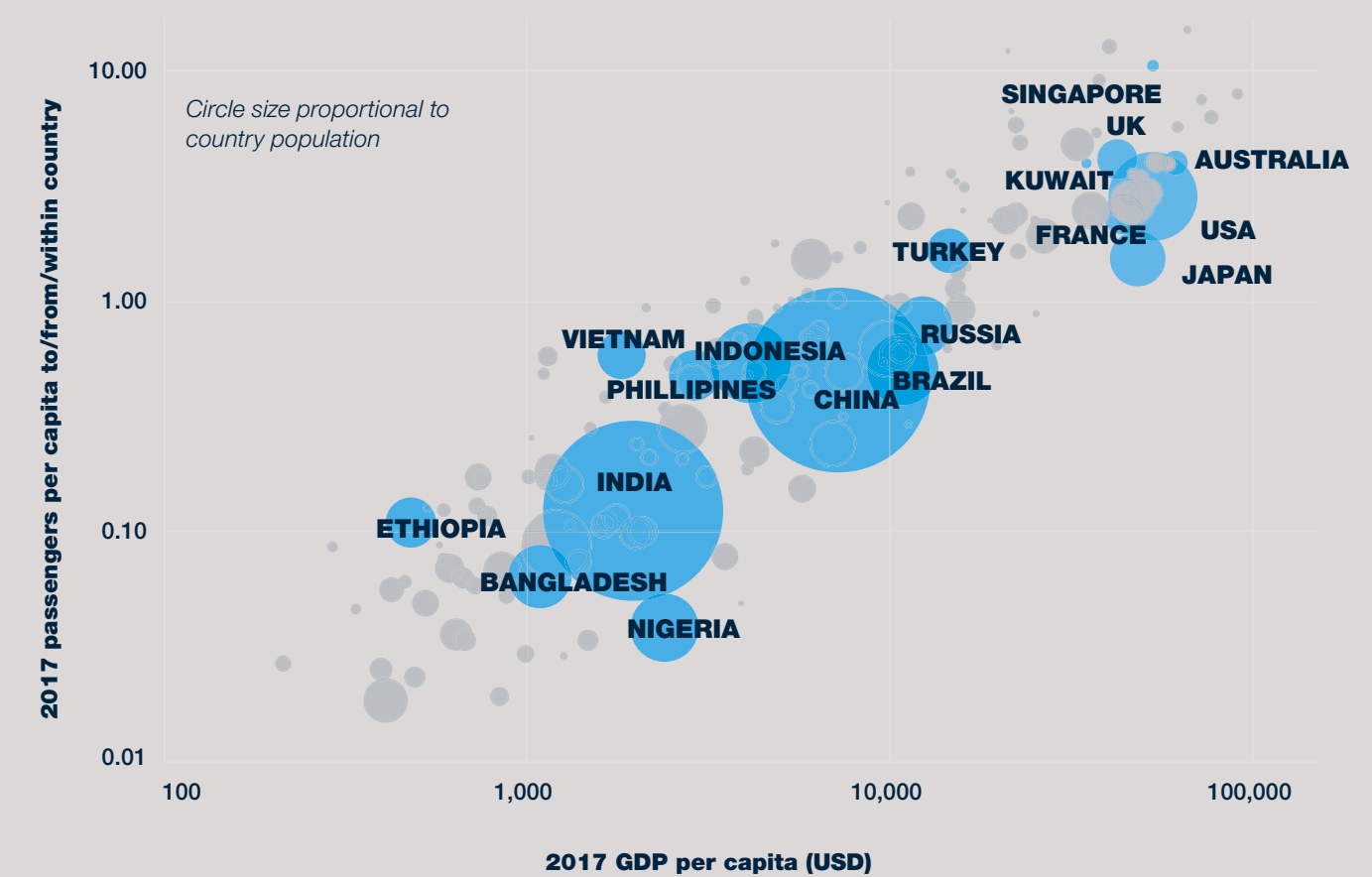
Socioeconomic changes in large emerging markets such as China and India have been primary drivers of both global GDP growth and demand for air travel. The number of air passengers in China has increased at an average rate of more than 10 percent each year since 2011, while India's emergence as a high-growth economy has fueled more than 20 percent passenger growth per year in its domestic market. With these developments, India is expected to become the third largest commercial aviation market by the early 2020s. The middle classes in both countries have developed as well, expanding from a combined 100 million in 2007 to more than 400 million in 2017. In the next 10 years, another 300 million people are expected to enter the middle class in these economies. These changes are important for air travel demand because as people enter the middle class, their propensity to travel increases dramatically. (See figure 1.)

ROBUST CONSUMER SPENDING AND SERVICES GROWTH BOLSTER AIR TRAVEL DEMAND

While global economic growth has lagged the long-term average in recent years, the composition of the growth has supported increasing air travel demand. Continued strong consumer spending has bolstered air travel, and



FIGURE 1: PROPENSITY TO TRAVEL
INCOME LEVELS POSITIVELY CORRELATE WITH AIR TRAVEL VOLUMES



Source: IHS Markit, FlightGlobal, Boeing Analysis

industrial production has recovered, lifting air cargo and some segments of business travel. Furthermore, emerging-market economies such as China are transitioning to more service-based economies, which will support higher air travel demand into the future. This trend is expected to continue as automation increases and the service economy sector grows relative to manufacturing worldwide.

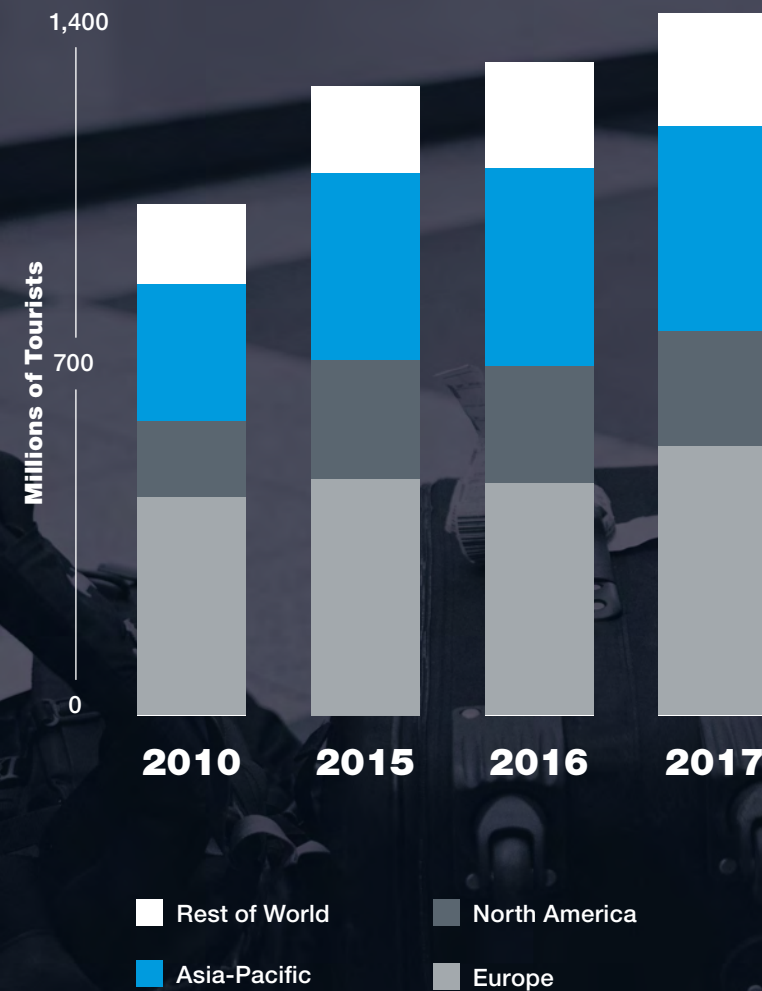
TRAVEL AND TOURISM IS A GROWING PART OF CONSUMER SPENDING

Within the services sector of the global economy, consumer spending on travel and tourism continues to grow. According to the World Tourism Organization, international tourist arrivals grew 7.1 percent in 2017, faster than overall GDP growth. Like air passenger traffic, overall tourism has grown substantially, with almost 350 million more international tourists in 2017 than 2010. This trend is projected to continue, with the direct contribution of tourism and travel to global GDP expected to grow 4 percent per year in real terms in the next 10 years, according to the World Tourism and Travel Council. The outlook for strong air travel demand is consistent with broad consumer demand trends and travel and tourism outlooks. (See figure 2.)

NEW AIRLINE BUSINESS MODELS AUGMENT DEMAND

Innovation and the introduction of new business models enable airlines to provide lower fares and more nonstop services to new destinations. These improvements often stimulate demand for air travel and increase passenger volumes, evident from two recent developments in the

FIGURE 2: INTERNATIONAL TOURISM GROWTH
ARRIVALS INCREASED MORE THAN 7 PERCENT IN 2017



Source: World Tourism Organization

aviation industry. First, the development of the no-frills, ultra-low-cost carrier business model has expanded the number of flying passengers by making air travel more affordable and attractive for many. Second, low-cost, long-haul airlines have grown rapidly in the past few years, expanding the low-cost short- to medium-range business model to now include intercontinental service. This business model is further fragmenting passenger markets and broadening the base of those wanting to travel at fares lower than traditional network carriers may regularly offer.

REGULATORY AND INFRASTRUCTURE DRIVERS

In addition to air travel demand fundamentals, airplane demand is also shaped by regulatory environment, infrastructure requirements, and technology development. Several key elements in this arena are market liberalization, airport infrastructure development, and environmental regulations. These market forces, among others, are incorporated into our long-term forecast.

AIRLINE MARKET LIBERALIZATION—REDUCING FARES AND IMPROVING SERVICE

A key factor in strong passenger travel growth in the past several decades has been increasingly liberalized markets. Dating back to the deregulation of the commercial airline industry in the United States in 1978, market liberalization has been crucial to the substantial growth of

commercial aviation in all regions of the world. Liberalization has allowed entrepreneurs to use people’s creativity to generate new ways to meet market demands and fill market niches previously restricted by government regulations.

Liberalization has encouraged significant traffic growth by removing constraints on route entry, pricing, service capacity, and airline cooperative arrangements. As airline competition and operating efficiency have grown, pricing has decreased in real terms while flight frequencies and product choices have increased for passengers worldwide. In addition, improved air services often directly and indirectly stimulate economic growth, creating a virtuous circle that leads to further air transport growth, which in turn leads to added economic growth.

Prominent industry liberalization examples include the development of low-cost carriers (LCC) and Open Skies agreements. The LCC business model would not have flourished without relaxation of government-regulated airline ticket pricing and heavy new market entrant regulation. Recent strong growth of LCC operators in countries such as Japan and Mexico illustrate the high impact of these kinds of market liberalization, as new entrants into these markets have reduced airfares and increased new services.

Open Skies agreements have also promoted strong growth in the commercial airline industry, extending liberalization and higher levels of competition to international and long-haul markets. Importantly, these trends have withstood rising populism and geopolitical tensions. While the latter have impacted air

traffic regionally, we do not see a broader trend of deviating from the path of air traffic liberalization. A case in point is the renewed commitment to the US–United Arab Emirates Open Skies agreement, which highlights the mutual economic benefits of a healthy and growing aviation market.

The continuation of airline regulatory liberalization worldwide is crucial for the strong health and growth of passenger travel. The expectation is that this trend will continue since consumers have come to expect more choices and low prices for airline travel.

AIRPORT INFRASTRUCTURE AND CONGESTION

AIRPORT INFRASTRUCTURE INVESTMENT CONTINUES AS STRONG PASSENGER GROWTH PRESSURES CAPACITY

After eight straight years of above-trend passenger growth, airports in some regions have experienced pressures on operational capacity. A continual theme for the past two decades has been that airports have experienced congestion challenges, particularly in the context of the worldwide effects of dramatic passenger growth. This is particularly acute—although not exclusively—in high-growth regions such as Southeast Asia, China, and India. (See figure 3.)

AIRLINES AND AIRPORTS HAVE ADJUSTED TO INCREASE CAPACITY

Airlines and airports adapt to accommodate passenger growth in numerous ways. For example, airlines absorb passenger growth through higher load factors and airplane utilization, cabin densification, and sometimes

airplane upgauging. In addition, secondary airport growth has been robust in many regions, absorbing passenger growth from a nearby primary, or hub, airport. LCCs have been a main driver of secondary airport growth, which has allowed them to avoid potential growth limitations because of congestion at primary airports.

Airports also accommodate growth through operational efficiency. Airports absorb capacity increases at existing facilities through improvements in air traffic control, gate efficiencies, and additional runway construction. Improvements to existing facilities are more prevalent in mature aviation markets, while new airport construction garners a larger share of spending in emerging markets. Airports worldwide have invested in both new runways and new terminals during the past several years to respond to sustained passenger growth. The Asia-Pacific region leads this investment boom, accounting for about 40 percent of the \$1 trillion investment in new airports and existing airports worldwide by 2021. An estimated \$2 trillion or more will be invested in airport infrastructure construction and improvements through 2030. (See figure 4.)

AIRLINES AND AIRPORTS WILL CONTINUE TO RESPOND TO THE MARKET

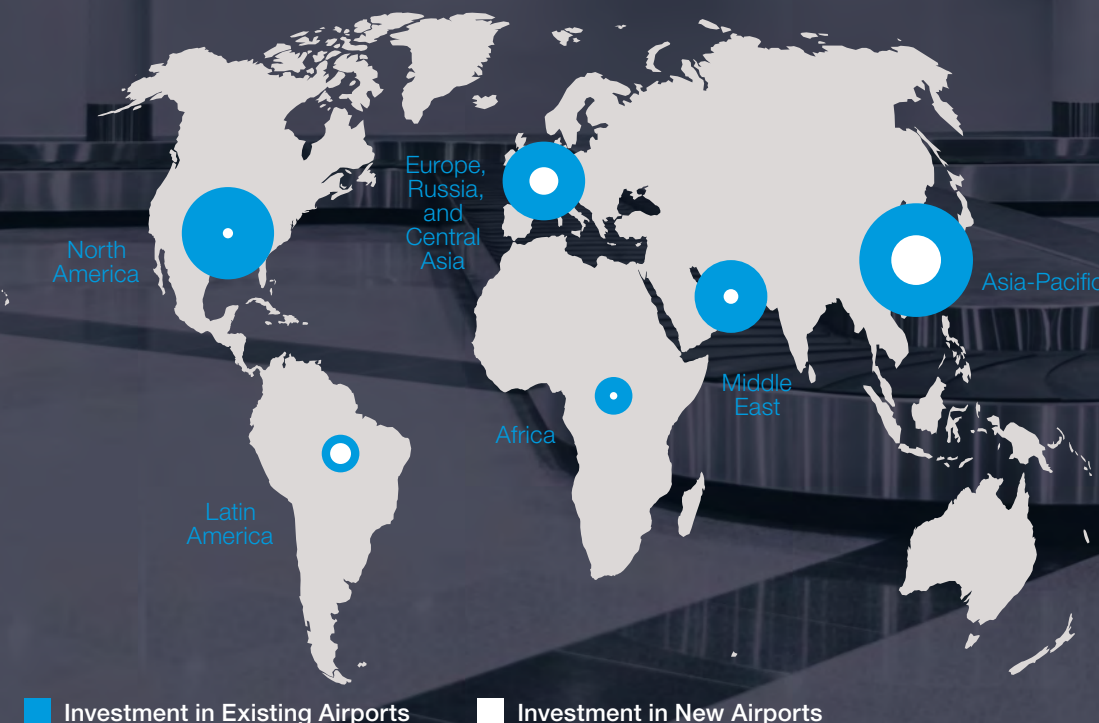
We expect these airline and airport market dynamics to continue in the future. However, as airports and airlines adapt to market conditions, maximize revenue potential, and accommodate passenger growth, there are likely to be short-term capacity challenges at some busy airports.

FIGURE 3: ASIA-PACIFIC IS HOME TO 10 OF THE TOP 15 HIGHEST PASSENGER GROWTH RATES AT LARGE AIRPORTS



Source: Airports Council International

FIGURE 4: REGIONAL AIRPORT INFRASTRUCTURE INVESTMENT



Source: CAPA

SUSTAINABLE GROWTH

COMMITTED TO IMPROVEMENT

The commercial aviation industry currently contributes about 2 percent of global man-made carbon dioxide (CO₂) emissions. The United Nations' Intergovernmental Panel on Climate Change reports that this figure may increase to 3 percent by 2050 without further action. In 2009, The Boeing Company and other industry members, including airframe manufactures, engine companies, and airlines, committed to a set of three ambitious goals (shown in figure 5) to ensure aviation's sustainable future.

DELIVERING RESULTS

As our industry plans for the future, it's also helpful to look back to measure the result of our past strategies. In the last 20 years, the commercial aviation industry has decoupled its economic growth from its CO₂ emissions growth. Figure 6 shows the percent growth of CO₂ emissions versus revenue passenger-kilometers (RPK) since 1995. RPK, a key indicator of airline economic growth, averaged an annual growth rate of more than 5 percent, while CO₂ emissions grew slightly more than 2 percent during the same time period.

This decoupling between RPK and CO₂ can be attributed to several factors, including

- > The entry of new airplane and propulsion technologies into the fleet.
- > Increased efficiencies in global air traffic management systems and airspace administration.

- > Increased cabin utilization strategies by airlines.

THE FUTURE OF GLOBAL AIR TRAVEL

International aviation, including emissions, is governed through the United Nations' specialist aviation body, the International Civil Aviation Organization (ICAO). With the full support of aviation stakeholders, governments formally agreed to adopt the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) at the 2016 ICAO Assembly. As of January 2018, 73 states, representing 87.7 percent of international aviation activity, have agreed to voluntarily participate in the global market-based mechanisms (MBM) scheme from its outset.

With the CORSIA agreement, aviation will have a vital tool for reaching its goal of carbon-neutral growth from 2020. However, MBMs are seen as short-term "gap fillers" while aviation pursues enduring technical solutions. These solutions are broadly organized into three strategic areas: breakthrough airplane design and propulsion technologies, continued advancement in airspace management and airline operational efficiencies, and the continued development and commercialization of sustainable alternative fuels.

FIGURE 5: SUSTAINABLE GROWTH GOALS

GOAL 1

1.5% average annual fleet fuel efficiency improvement from 2009 to 2020

What is the progress?

Currently tracking well above goal, although figure expected to normalize

How is it being achieved?

- > New airplane engine technologies
- > More efficient operations by airlines
- > Better use of air traffic management infrastructure

GOAL 2

Stabilize net aviation CO₂ emissions at 2020 levels through carbon-neutral growth

What is the progress?

Industry is actively supporting global actions at an intergovernmental level

How is it being achieved?

- > All actions for goal 1
- > CORSIA at the ICAO

GOAL 3

By 2050, reduce aviation net CO₂ emissions to 50% of what they were in 2005

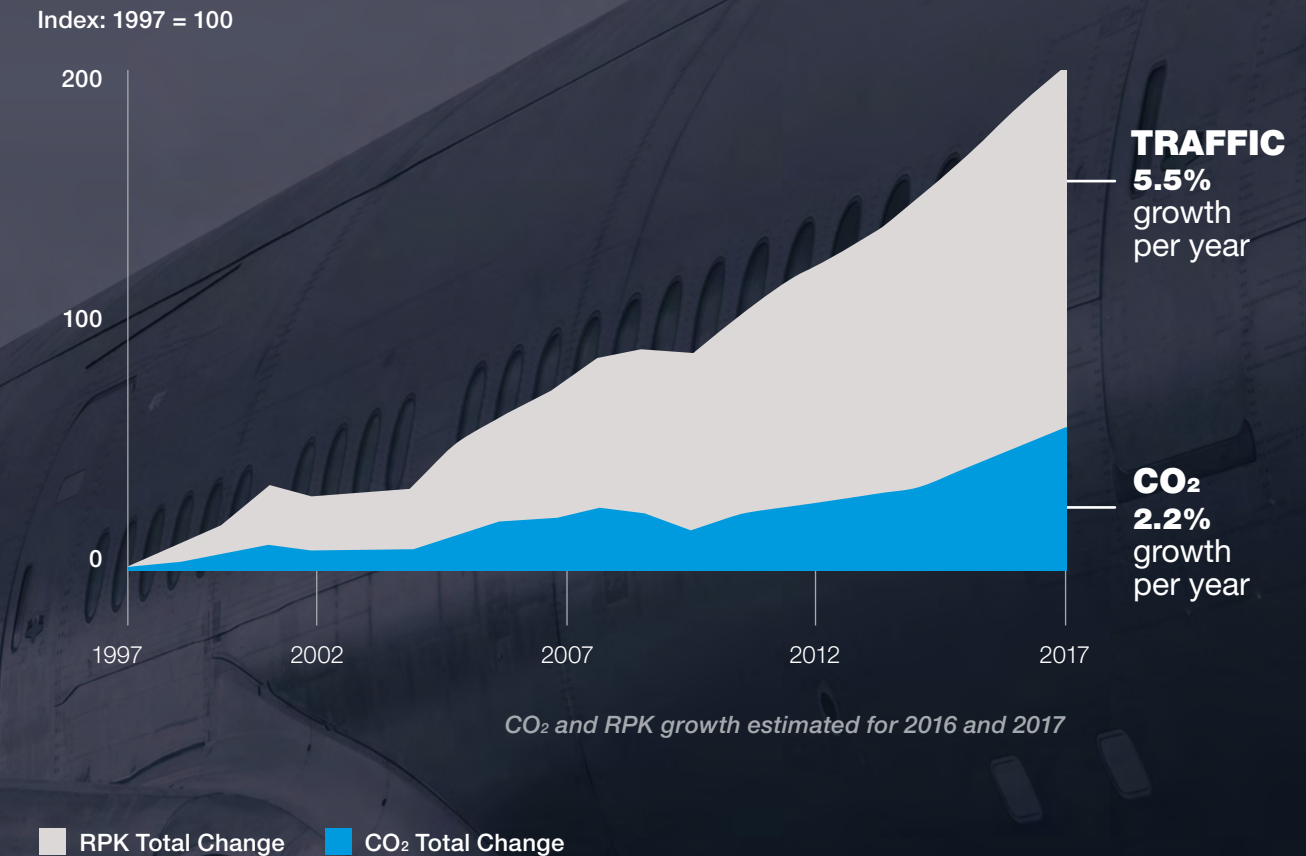
What is the progress?

Significant research and innovation efforts underway

How is it being achieved?

- > All actions for goals 1 and 2
- > Development of sustainable alternative aviation fuels
- > Research into future design concepts by airplane and engine manufacturers

FIGURE 6: DECOUPLING OF TRAFFIC AND CO₂ EMISSIONS GROWTH



Source: ICAO, Boeing Analysis

AIRLINE BUSINESS STRATEGY DRIVERS

Evolving airline business strategies and product offerings are bringing more value to travelers in a range of ways. A wider range of service offerings better matches airlines' products with customer values. These developments include lowering fares, unbundling product offerings to allow customers to pay for only the services they want, and broadening airline networks to increase connectivity and points served.

LOWER FARES BOOST DEMAND

Average airfares have declined in the past 10 years at an average of 0.9 percent per year. The worldwide spread of low-cost carriers (LCC) and ultra-low-cost carriers (ULCC) has been instrumental in enabling this trend. Additionally, the increase in point-to-point flights and flight frequencies has stimulated passenger demand.

Since the original concept was first introduced in the 1970s, LCCs have become a prominent global business method. As the innovative business model has expanded in different parts of the world, several unique business strategies optimized for LCC operations have been developed with a common value proposition: maximize profitability through cost reduction, particularly in the short-haul segment. To accomplish this goal, LCCs have executed some of the following characteristic strategies:

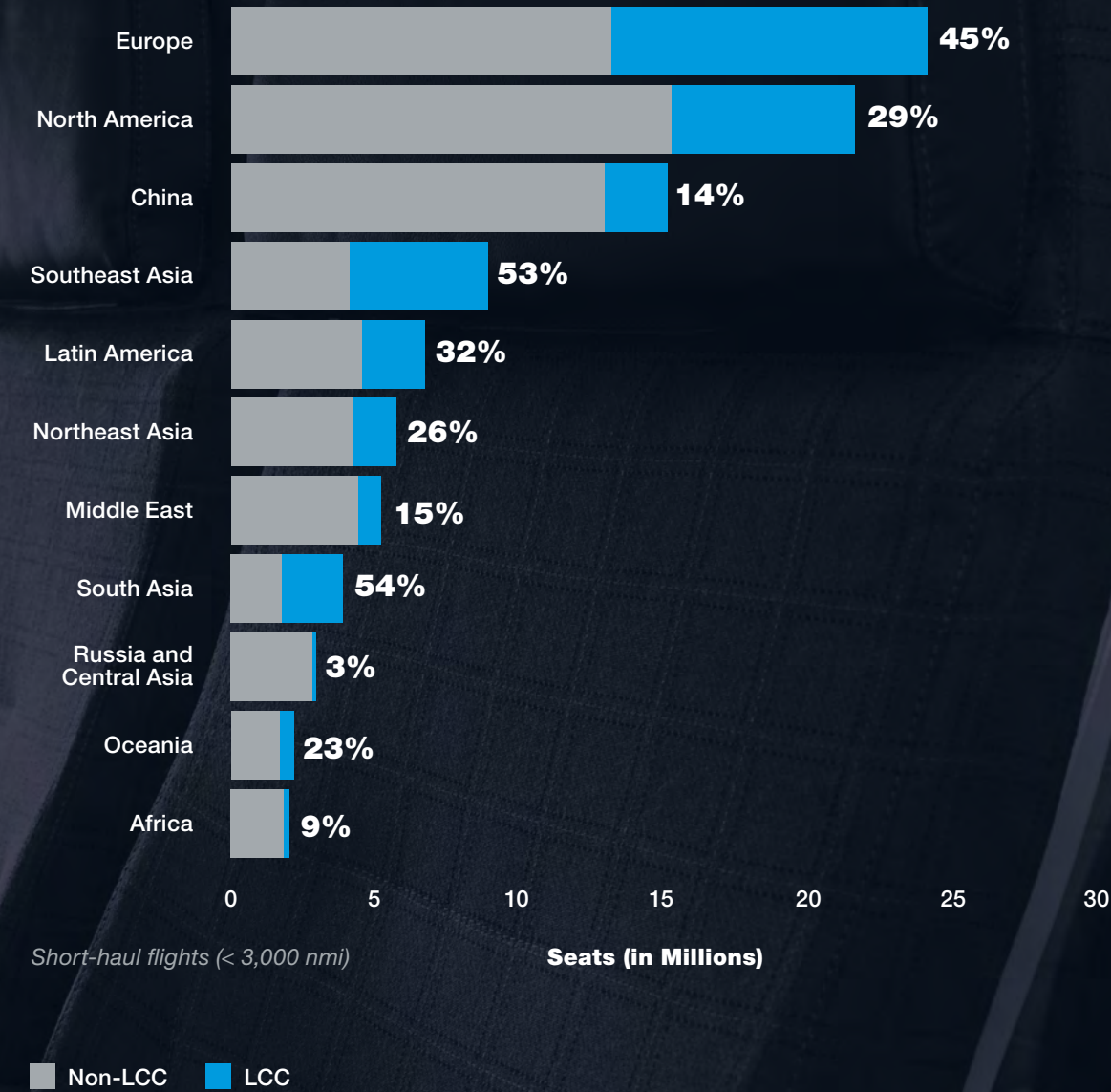
- > Short-haul, point-to-point flights, often with secondary airport operation.
- > Single-aisle fleet standardization.

- > Single-class, higher-density airplanes.
- > Higher utilization and quick turnaround.
- > Lower yield but higher volume concept.
- > Basic services and more ancillary revenue.
- > Technology leveraged to lower costs (now primarily Internet).
- > Lower labor and marketing, overhead, and general administration expenses.

More than four decades after the LCC's emergence, the business model's success for short-haul routes is evident in the current aviation market. Supported by earlier adoption of deregulation policy, North American LCC operators currently provide about 30 percent of seat capacity in the region's short-haul segment, while European LCCs have recently exceeded 40 percent market share in short-haul market segment for the first time. In Asia, rapid expansion of LCCs has been a key driver of overall growth in the short-haul market since the early 2000s, driven in part by liberalized bilateral agreements and the Association of Southeastern Asian Nations, or ASEAN, Open Skies agreement. As a result, the LCC penetration rate in some Asian regions is now more than 50 percent of their home markets, and other regions have been progressively growing LCC capacity at double-digit annual rates during the past decade. (See figure 7.)

Like the LCCs before them, a new breed of even lower-cost carriers—ULCCs—has expanded the total number of passengers by attracting flyers willing to travel because the price is now low

FIGURE 7: LCC SHORT-HAUL PENETRATION DIFFERS BY REGION



Source: FlightGlobal/Diio, Boeing

enough for flying to become more affordable. While established network carriers continue responding to aggressive competition posed by the low-cost business models, our current backlog and forecast project that LCCs and ULCCs will penetrate further into the short-haul market and increase regional connectivity.

Our long-term outlook shows LCCs leading the growth in single-aisle demand. LCCs are projected to add almost 13,000 new aircraft in the single-aisle category. Of our forecast single-aisle deliveries to LCCs, 61 percent will be for growth, both to open new markets and to add frequencies in existing markets, while the remaining 39 percent will replace retiring airplanes.

EMERGENCE OF LOW-COST LONG-HAUL

Historically, short-haul accounts for an overwhelming proportion of LCC capacity. In 2007, less than 1 percent of LCC capacity was on flights of more than 3,000 nautical miles. By 2017, this proportion grew to more than 5 percent. As market structures become more complex and consumer behaviors continue to evolve, hybrid and low-cost long-haul (LCLH) business models are emerging. LCCs are meeting passenger demands by extending more affordable travel to long-haul markets, while network carriers are entering the LCLH market with their own low-cost subsidiaries.

Establishing the low-cost business model for long-haul service is more difficult than it is for short haul. Capital costs for long-haul airplanes and network support are higher. Operational complexity is greater, with additional regulatory compliance requirements as well as the need to establish a feeder network. One of the key short-haul LCC

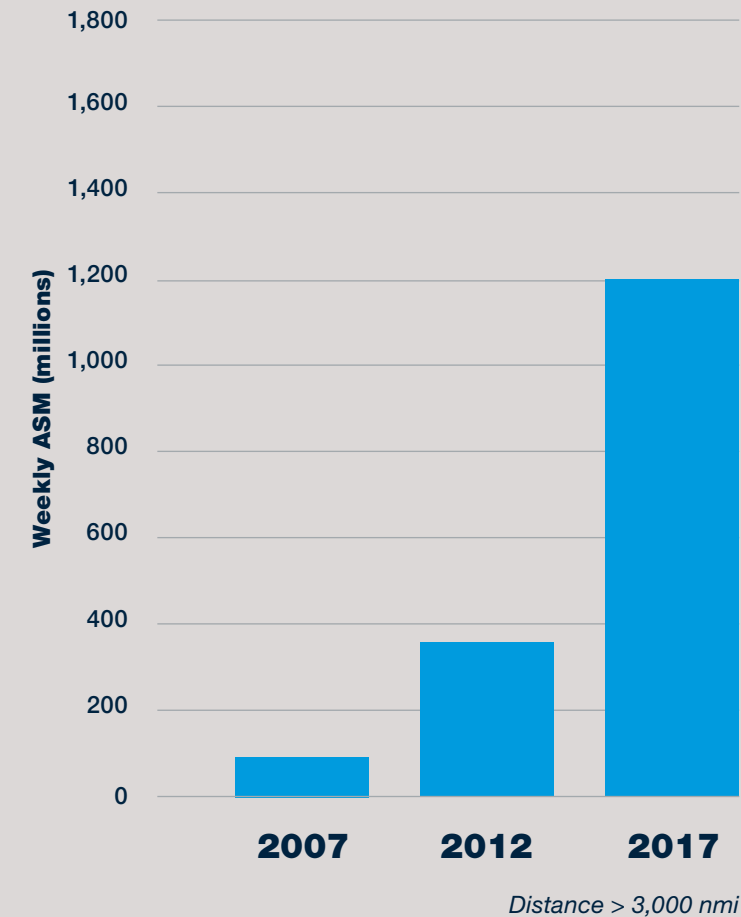
cost advantages is higher airplane utilization rates stemming from shorter turn times. The longer stage lengths of a long-haul operation mean that turn time occupies a much smaller proportion of the total aircraft day, so the cost advantage for LCLH from this factor is reduced. LCLH service also typically provides relatively few premium seats, reducing the revenue potential of the service, especially on routes with significant demand for premium service.

Despite these disadvantages, recent years have seen a substantial increase in LCLH offerings from both short-haul LCCs and LCC subsidiaries of network carriers. Fifteen new entrants to the LCLH market have been introduced since 2007, with the North Atlantic and intra-Asia markets garnering the most attention. While still too early for a definitive judgment of the long-term success of the LCLH model, growth in the segment indicates that many price-sensitive passengers are eager for this type of offering. (See figure 8.)

NETWORK AIRLINES OFFER UNRIVALED CONNECTIVITY AND RANGE OF SERVICE CHOICES

As the LCC business model develops across the globe, network carriers are adapting their business strategies to boost competitiveness. In the past decade, as consolidation and network restructuring have occurred, most notably in the United States but also in other regions, balance sheets have strengthened and many network carriers are better financially positioned to withstand the increasingly competitive environment. Global airline networks are well positioned for future growth at their hub locations because of extensive regional and domestic services that feed their long-haul markets. Other amenities that enhance the value

FIGURE 8: LCLH HAS SEEN 15 NEW ENTRANTS IN THE LAST DECADE



Source: FlightGlobal/Diio, Boeing

proposition of the global network carriers versus LCCs include differentiated cabin offerings, extensive frequent-flyer programs, and expanded route networks through alliance partnerships. In addition, network carriers have countered with their own low-cost, no-frills ticket options on selected competing routes with limited seats. This is adding a new dimension to the ever-changing competitive landscape of the network carriers versus the growing LCC market segment.

NETWORK CARRIERS ENTER LOW-COST LONG HAUL

Network carriers have also begun to develop LCLH offerings of their own that allow them to better compete with independent long-haul LCCs. Typically, as in LEVEL from IAG, Jetstar from Qantas, and Eurowings from Lufthansa, these products take the form of independent brands. This segmentation serves both to set passenger expectations that the on-board experience will not be comparable to that of the full-service parent and to minimize fare dilution to the premium brand. Network LCLH operations are most common on leisure routes where yields are not sufficient to support the full-service carrier or to smaller cities that can only support a smaller number of weekly frequencies than is usual for a full-service offering. These airlines can benefit from the parent carrier's feed traffic, alliance arrangements, and financial stability to provide significant competitive advantages.

GLOBAL HUB EVOLUTION

Airline network hubs serve as the portals to any region in the world, and the new generation of widebody aircraft contributes to the fragmentation of international networks by opening new markets or time-of-day windows that are not financially

FIGURE 9: TOP 20 AIRPORTS BY WEEKLY SEATS

1997



2017



Source: OAG/FlightGlobal/Dio

viaible with older-generation aircraft. The 787 continues as a prime vehicle in opening new non-stop markets, including the recently announced Perth–London service, San Francisco–Chengdu, and Melbourne–Vancouver, and this trend will only continue.

The network hub has become a more global phenomenon in the last 20 years. Figure 9 illustrates the location and size of the top 20 hubs by passenger volume in 1997 and in 2017. In 1997, the hubs centered on North America and Western Europe, with 17 of the top 20 hubs located in those regions. By 2017, the map became more geographically balanced, with 12 of the top 20 hubs located outside these areas. This broadening of the network hub model points to the increasing geographic diversity of air travel demand.

Global “superconnector” carriers are a subcategory of the network carrier business model. These carriers focus on providing connection opportunities between markets to the west of their hubs and markets to the east. This “one stop to anywhere” business model has become increasingly popular with passengers looking for efficient ways to traverse these long routes. Growth of this business model has been enabled in the past decade by the introduction of then-new technology airplanes with improved range sufficient to travel nonstop to destinations as far from the Middle East as the US west coast and Australia.

Network carriers continue to grow long-haul services from their large hubs. Overall long-haul capacity and frequency from the 20 largest hub airports increased more than 67 percent between 2000 and 2017, while the number of cities served from these hubs increased almost 20 percent.

Airplane size on these routes has remained fairly constant, increasing by 0.5 percent during the same period. Fears of capacity constraints at large hub airports leading to concentrations of very large airplanes there have not materialized, and growth, even at the largest of hub airports, continues to follow the fragmentation pattern of the industry at large.

NETWORK AIRLINES LEAD GROWTH IN NEW AIRCRAFT DEMAND

Our long-term outlook shows network carriers leading the growth in new aircraft demand. Network carriers are projected to add more than 18,000 new aircraft, with the vast majority of demand—11,000 units—in the single-aisle category. Widebody passenger aircraft at network airlines are forecast to increase by 6,500 units. About half of our forecast deliveries to large network carriers will be for growth, both to open new markets and to add frequencies in existing markets, while the remaining half will replace retiring airplanes.

COMMERCIAL TRAFFIC AND FLEET OUTLOOK

LONG-TERM PASSENGER TRAFFIC RESILIENT

Air travel has proven to be a resilient market, and robust growth is expected to continue in the future. As the industry evolved from its infancy in the 1940s through the dawn of the jet age, the number of passengers traveling annually grew from about 100 million in 1960 to just over 1 billion in 1987. It took 18 years to double to 2 billion passengers, and only 7 more years to grow to 3 billion. The upward trajectory is expected to continue, especially in regions such as China, India, and Southeast Asia as these economies expand and more people begin to travel. (See figure 10.)

AIR TRAVEL GROWTH 'ABOVE TREND' DESPITE OBSTACLES

The years since 2010 have been marked by terrorism, sluggish economies, exchange rate and commodity price volatility, and concerns about international trade and the free movement of people. While these developments might suggest lower air travel growth, the opposite has been the case. Starting in 2010, as the world began its recovery from the global financial crisis, global revenue passenger-kilometers (RPK) have grown

FIGURE 10: ANNUAL PASSENGERS IN MILLIONS

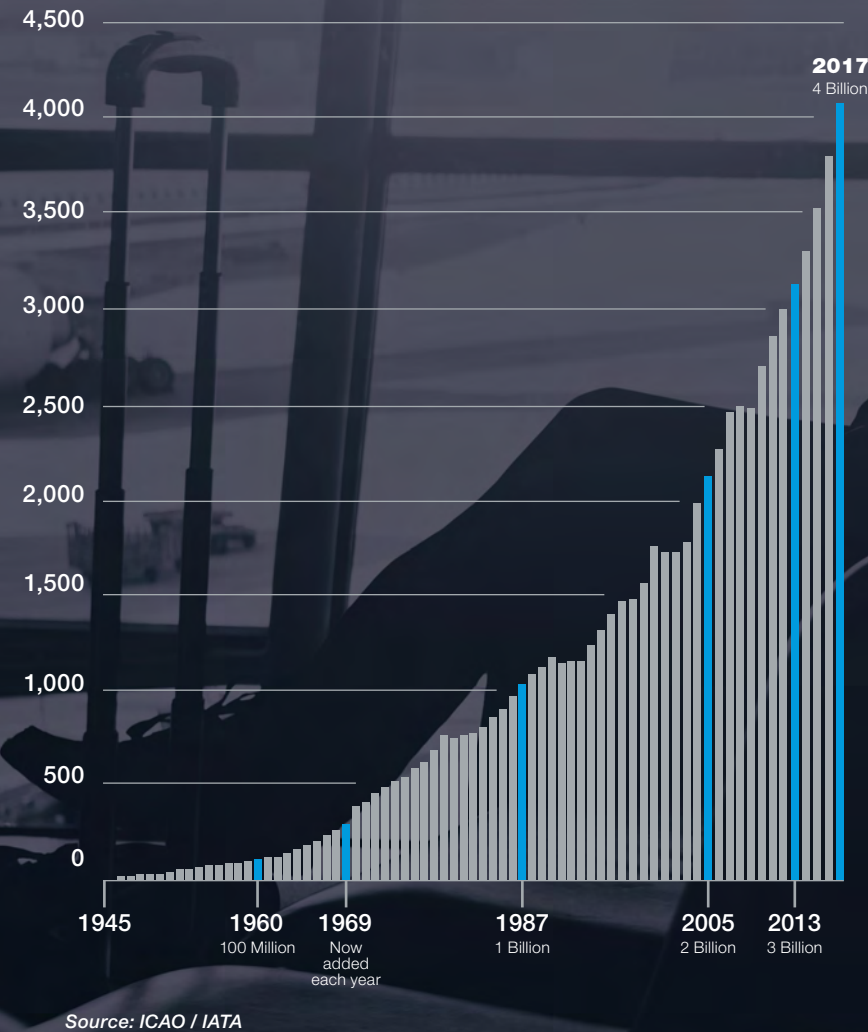
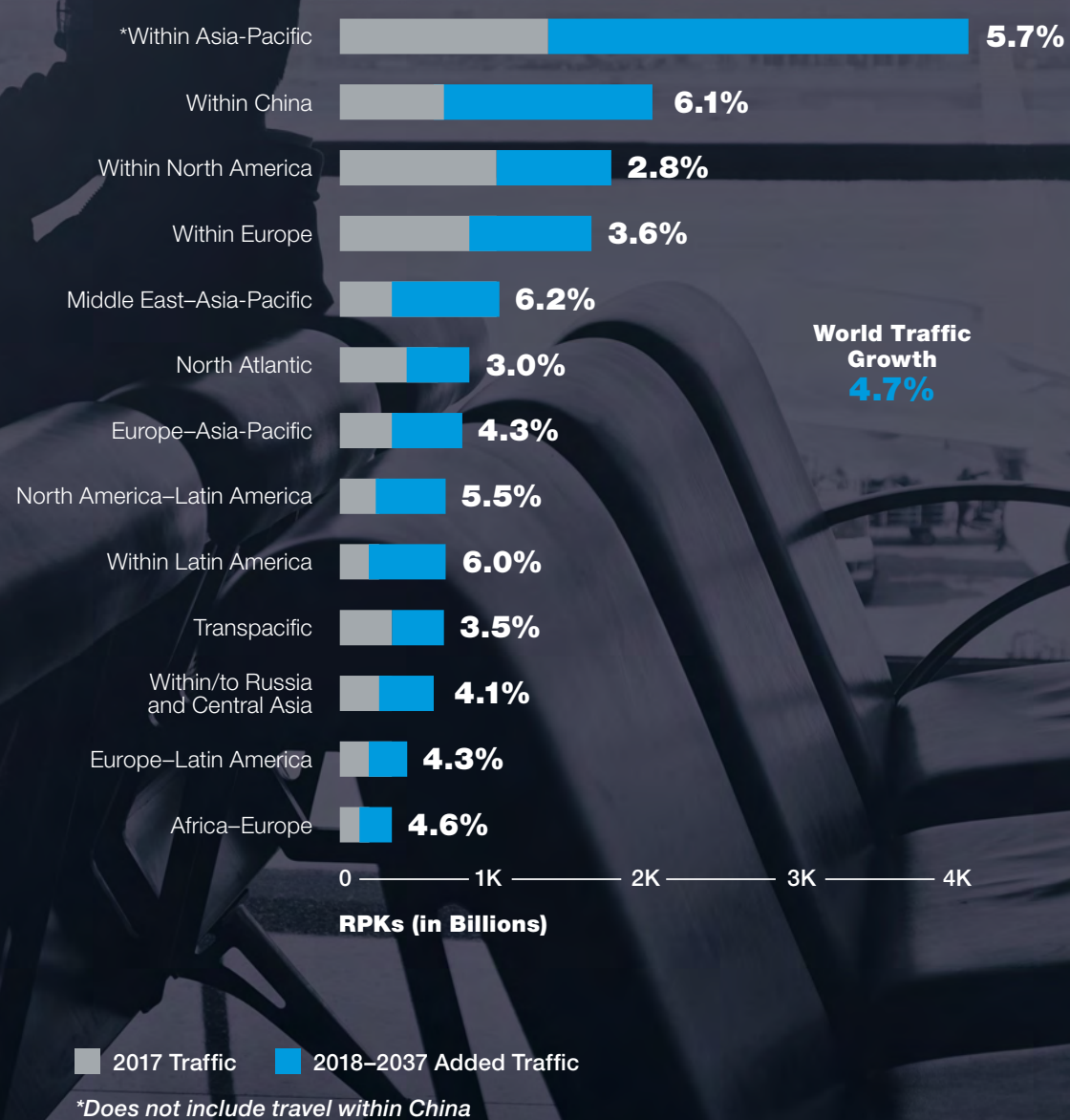


FIGURE 11: TOP GLOBAL TRAFFIC FLOWS



at an average pace of 6.5 percent, well above the widely used 5 percent per year benchmark established by global industry performance in the past 25 to 35 years. The trend accelerated in 2017, with global RPKs up 7.5 percent from the prior year.

Some industry commentators and stakeholders look at recent above-trend growth in the industry and question whether it is sustainable. While we acknowledge risks in the business environment, we remain confident in the strength of commercial aviation for several reasons.

Strong consumer spending is driving economic growth in many parts of the world. Although industrial weakness lowered overall economic growth in certain markets, notably the United States and China, the slowdown concentrated in sectors such as mining and heavy industry that have a relatively small effect on overall passenger traffic. The maturation of many emerging market economies will further increase the share of consumption in overall GDP, bolstering traffic growth.

People in emerging markets have new opportunities to travel because of rising incomes, accompanied by improved service and lowered prices resulting from increased competition in the airline sector. This expansion, tied to structural changes of these economies and their air transport industries, is relatively resistant to cyclical fluctuations. Twenty years ago, the majority of passengers traveled on airlines based in Europe or North America, but today that number has declined to 47 percent. By 2037, it will be 37 percent.

While terrorism remains a concern in certain markets, its effect on air travel at the regional level

is mainly substitution rather than reduction. We have seen slow traffic at affected airports and regions, but alternative destinations have seen stronger growth. At the global level, terrorism has only a minimal impact. Moreover, that impact is transient: according to evidence from the World Tourism Organization, the regional recovery cycle averages just 13 months.

OUTLOOK FOR 4.7 PERCENT AVERAGE ANNUAL PASSENGER TRAFFIC GROWTH IN THE NEXT 20 YEARS

In light of the above factors, we view recent performance as evidence of real demand, not a bubble prone to burst in subsequent years. Our forecast traffic growth remains healthy, with an average RPK growth rate of 4.7 percent per year over 20 years. Like the global economy, world traffic varies by market. In the next two decades, fast growth in China's domestic market will make it the largest domestic market in the world, and traffic within Asia is set to become the largest travel market. The central location of the Middle East airlines allows them to link many parts of the world with one-stop flights, which will help drive higher-than-average growth on those routes. In the more mature aviation markets such as North America and Europe, while domestic growth rates are below the global average, increasing connections to faster-growing emerging markets provides more opportunities for growth. These differing growth profiles result in an increasingly diverse global air travel market. (See figure 11.)

NEW AIRPLANE DEMAND TOPS 42,000 DELIVERIES THROUGH 2037

Demand in the commercial market is forecast to more than double in the next two decades. To

meet this demand, we forecast the number of jet airplanes will nearly double to 48,000, at an average annual growth rate of 3.5 percent. To support this fleet growth, Boeing forecasts a need for more than 42,700 new deliveries, valued at over \$6 trillion, for growth and replacement in the next 20 years.

Single-aisle airplanes command the largest share of new deliveries at more than 70 percent, with airlines needing more than 31,300 in the next 20 years. These new airplanes will continue to stimulate growth and provide required replacements for older, less-efficient airplanes. In addition, more than 9,000 new widebody airplanes will be delivered, allowing airlines to serve new markets—passenger and cargo—more efficiently than in the past.

Consistent with air travel demand growth trends, we forecast that by 2037, approximately 40 percent of all new airplanes will be delivered to airlines based in the Asia region. An additional 40 percent will be delivered to airlines in Europe and North America combined, with the remaining 20 percent delivered to the Middle East, Latin America, Russia and Central Asia, and Africa.

AIRLINE PRODUCTIVITY INCREASES MODERATE AIRPLANE DEMAND

Air travel growth can be accommodated in two primary ways: increasing passenger load factors (capacity utilization) and increasing overall capacity. Airlines have been remarkably effective at increasing load factors over time. The average load factor of 65 percent in the early 1990s has steadily increased to levels at or exceeding 80 percent today, and this represents average systemwide load factors that include seasonal fluctuations, time-of-day and day-of-week variations, and differences in regional travel demand characteristics. Many

FIGURE 12: PRODUCTIVITY GAINS PROVIDED 40 PERCENT OF RPK GROWTH FROM 2007 TO 2017

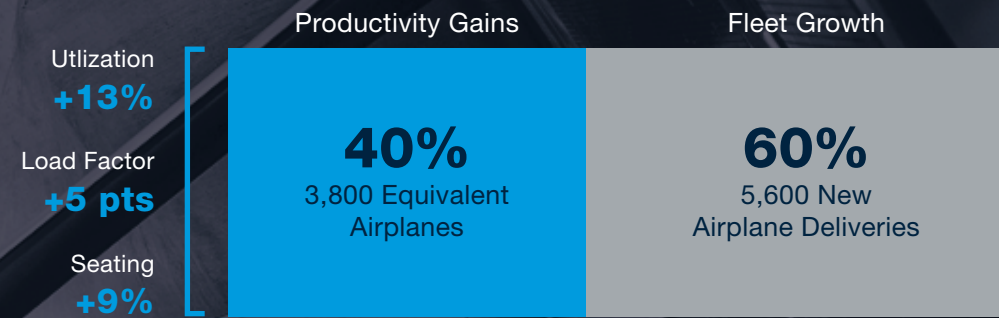
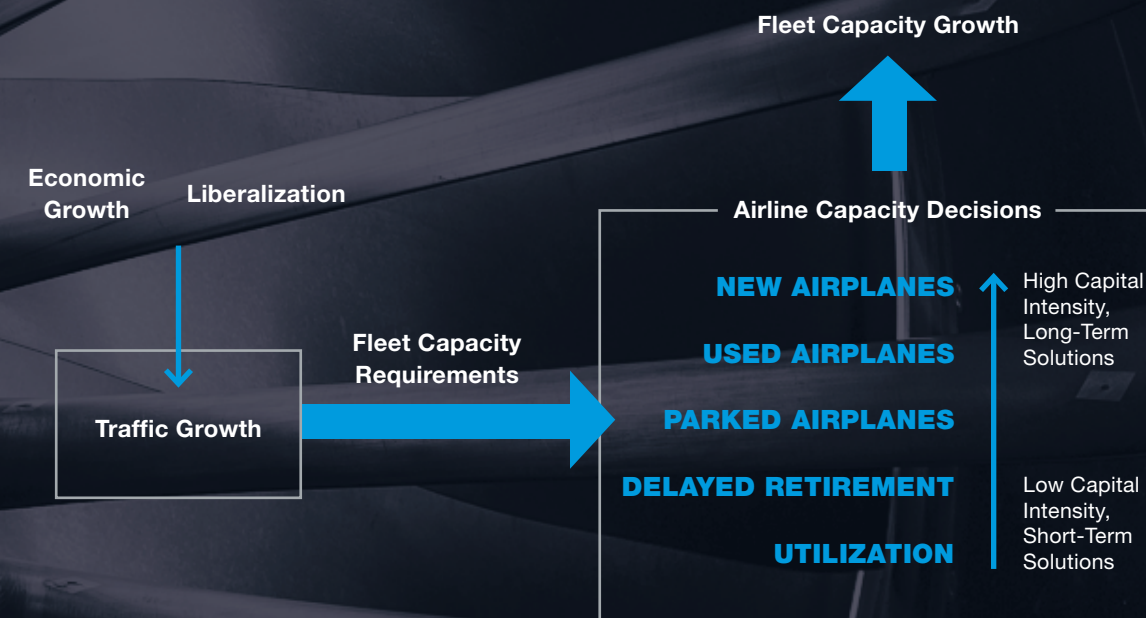


FIGURE 13: DELIVERIES AND DEMAND GROWTH



factors have enabled this trend, including improved scheduling and yield management systems as well as information technologies that make travel simpler and more transparent for passengers. While there is opportunity to further improve load factors, achieving and consistently sustaining ever-increasing levels will be challenging.

Airlines have also found other ways to increase capacity without adding airplanes. Increased flying hours per aircraft per day have added to available capacity. Upgauging and cabin densification through the use of slimline seats, shorter seat pitch, smaller galleys, and space-saving lavatories have also added to capacity without adding airplanes. In fact, if 2007 load factors, utilization rates, seat density, and airplane gauge had been in effect in 2017, 3,800 additional equivalent airplanes would have been required to accommodate the traffic flow. (See figure 12.)

Airlines can also manage their fleets in the short term to accommodate surges in demand. Delaying aircraft retirements, reinstating parked airplanes, and acquiring additional capacity from other operators and leasing entities can increase capacity. But these short-term measures have their limits. In the longer term, the aviation industry will require new airplanes in order to provide the capacity needed to keep up with travel demand. (See figure 13.)

GROWING IN-SERVICE FLEET DRIVES DEMAND FOR AIRPLANE REPLACEMENT

Airplanes are durable assets and typically remain in service for two to three decades or longer. As airplanes approach the end of their useful lives, they must be replaced. Airplanes are retired when

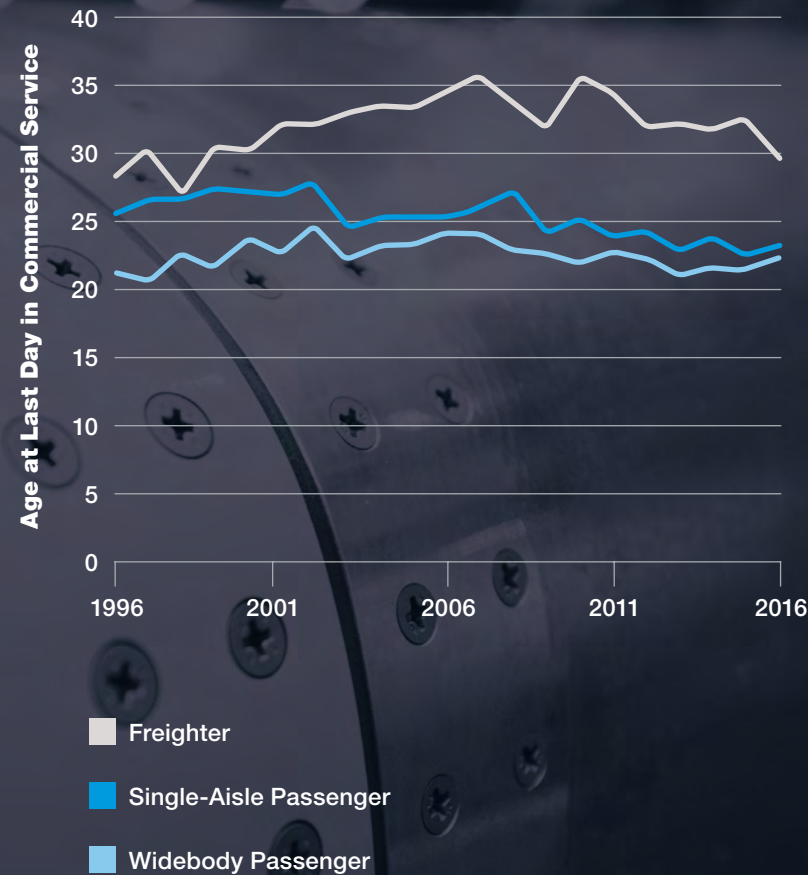
they reach the end of their economic life; that is, the cost to retain and operate the airplane exceeds profits generated. Replacement includes a number of considerations, including age, the number of flight hours and pressurization cycles the airplane has undergone, and increased maintenance requirements. New-generation equipment can provide improved range and payload capability, allowing airlines to serve markets not possible with older equipment. And newer airplanes provide better fuel economy than the airplanes they replace, sometimes providing significant cost savings compared to older equipment.

Boeing research has shown that airplane retirement ages have been very stable during the past 20 years. We have observed a small difference of about 2 years between single-aisle and widebody passenger airplanes. We have also observed a difference of about 7 years between the retirement ages of freighters and passenger airplanes. The passenger-freighter difference is due primarily to the lower, more volatile revenues in the cargo sector along with the lower-utilization business model of many cargo operators. These differences point to the need for a lower-capital-expenditure business model for cargo operators, hence the longer airplane lives in that sector. Retirement ages do show some short-term fluctuation because of economic conditions, passenger demand, new model timing, and oil prices. However, these perturbations tend to even out over time. In the long run, retirement ages are quite steady. (See figure 14.)

OIL PRICE DYNAMICS

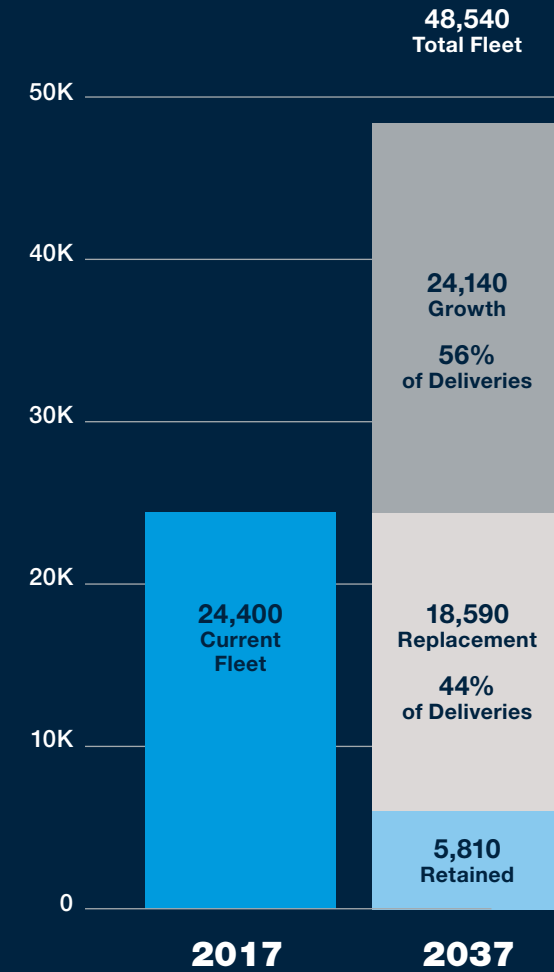
Replacement demand remains important despite fuel prices that have moderated during the last few years. While the fuel cost advantage of a new-generation airplane is reduced somewhat relative to the post-financial crisis period, it is important to consider other factors.

FIGURE 14: COMMERCIAL AIRCRAFT ECONOMIC LIVES STABLE RETIREMENT AGE OF COMMERCIAL JETS



Source: FlightGlobal Flight Fleets Analyzer, Boeing Analysis

FIGURE 15: A NEWER GENERATION OF MORE EFFICIENT AIRPLANES WILL REPLACE OLDER AIRCRAFT AND PROVIDE CAPACITY FOR GROWTH



Historically high oil prices: Oil prices today are in the \$60 to \$80 per barrel range. In the early 2000s, the price of oil was in the \$30 to \$40 per barrel range (in today’s dollars). This doubling of fuel prices means the improved fuel efficiency of new airplanes remains compelling.

OIL PRICE VOLATILITY: Fuel is a large share (20 to 30 percent or more) of an airline’s operating costs, and volatility in such a major cost component creates uncertainty in the airline’s profitability outlook. By reducing the requirement for fuel, newer, more efficient airplanes can act as an effective operating hedge on the airline’s profits.

CONTINUED FLEET GROWTH: More than 24,000 jets are in service today, which means more reach retirement age every year. Satisfying the replacement demand requires an increasing number of new airplanes. While replacement varies year to year due to cyclical conditions, average long-term replacement is about 3 percent of the fleet per year, which means more than 18,000 retirements in the next 20 years. Our long-term view of global market replacement demand is that airplane replacement will comprise 44 percent of demand during the next 20 years. (See figure 15.)

LOW UTILIZATION FOR OUT-OF-PRODUCTION MODELS: We have seen that when airlines retain older, less-fuel-efficient models, they tend to use them at lower rates. These older airplanes can provide inexpensive “surge capacity” for airlines that retain them, flying relatively few hours in peak season to provide extra lift when oil prices are sufficiently low. The presence of these older models does not reduce the need for core fleet replacement; it provides a way to make a bit of extra profit in high season.

Competitive market: When airlines compete head to head in a market, the airline with the lowest unit cost can set the price. If the cost differential is large enough, the price set by the lowest-cost competitor may be insufficient to yield a profit for the higher-cost competitor. When one airline begins operating a newer, lower-unit-cost airplane on a route, its competitors risk facing prices that are unsustainable in the long term and thus have an incentive to also upgrade to the lower-unit-cost equipment.

Replacing an airline’s fleet is not a short-term decision driven by oil price fluctuations but rather a long-term investment based on multiple factors. While lower oil prices make the short-term economics of fleet renewal somewhat less compelling, the long-term dynamics of fleet management make a strong case for airlines to continue replacing older airplanes.

SINGLE-AISLE AIRPLANES MAKE UP THE MAJORITY OF THE GLOBAL MARKET

Today, single-aisle airplanes comprise 69 percent of the global passenger jet fleet. In the next 20 years, this share will increase to nearly 75 percent, or more than 33,500 passenger airplanes. (See figure 16.)

A number of factors drive the robust global demand for new single-aisle airplanes. First, single-aisle airplanes are the backbone of the LCC business model strategy that continues growing around the world. In addition, strong replacement needs in more mature aviation markets and robust overall growth in emerging markets are driving increased demand for single-

aisle airplanes. Asia-Pacific, Europe, and North America, which account for almost 90 percent of global LCC capacity, are the three largest market regions for new single-aisle airplanes, representing over 80 percent of all single-aisle demand.

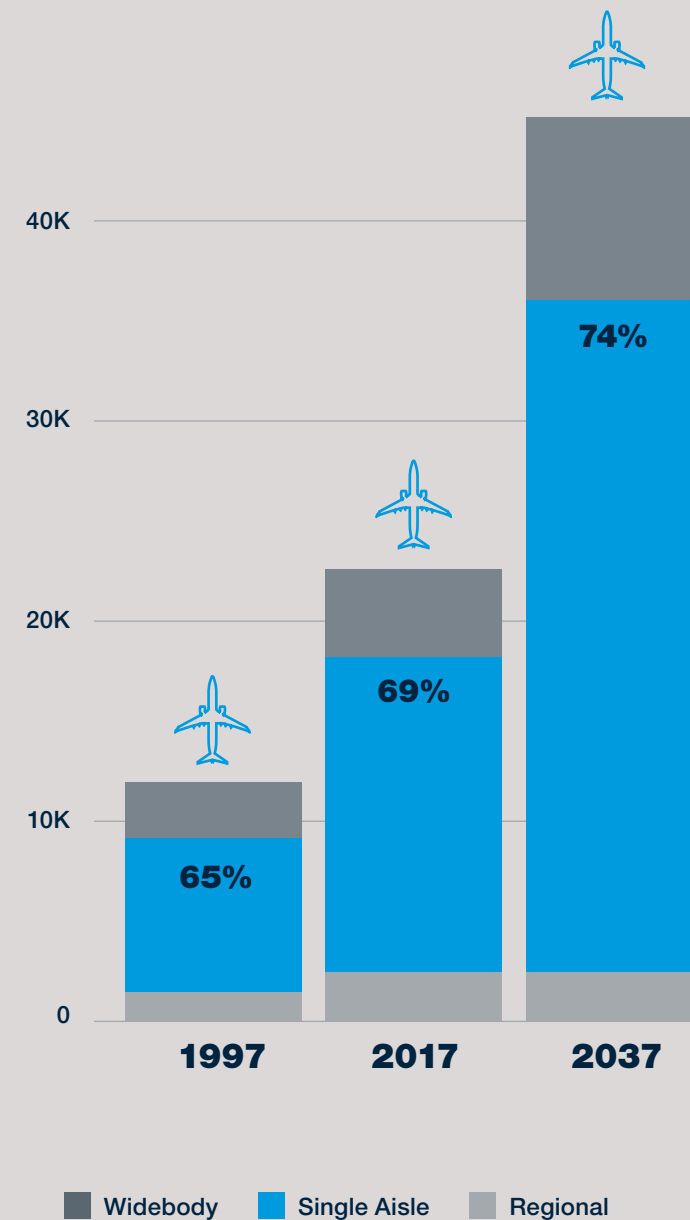
LCC expansion is anticipated to increase their global commercial fleet share in the single-aisle category from roughly one-quarter to one-third, representing more than 12,000 single-aisle jets in the next 20 years. Nevertheless, network carriers will continue to drive more than 55 percent of new passenger airplane demand, representing almost 20,000 airplanes in the fleet in 2037.

As airplane technology improves, more efficient and capable single-aisle airplanes connect city pairs that have not been reachable or profitable in the past. While shorter-haul segments continue to be the backbone of single-aisle route networks, newer single-aisle airplanes are frequently utilized on longer-haul routes today. In the last year, almost 40 new single-aisle routes of longer than 3,000 nautical miles have been introduced. The 737 MAX, first delivered in 2017, accounts for more than 70 percent of these new longer routes.

NEW TECHNOLOGY, MORE FRAGMENTATION IN THE WIDEBODY MARKET

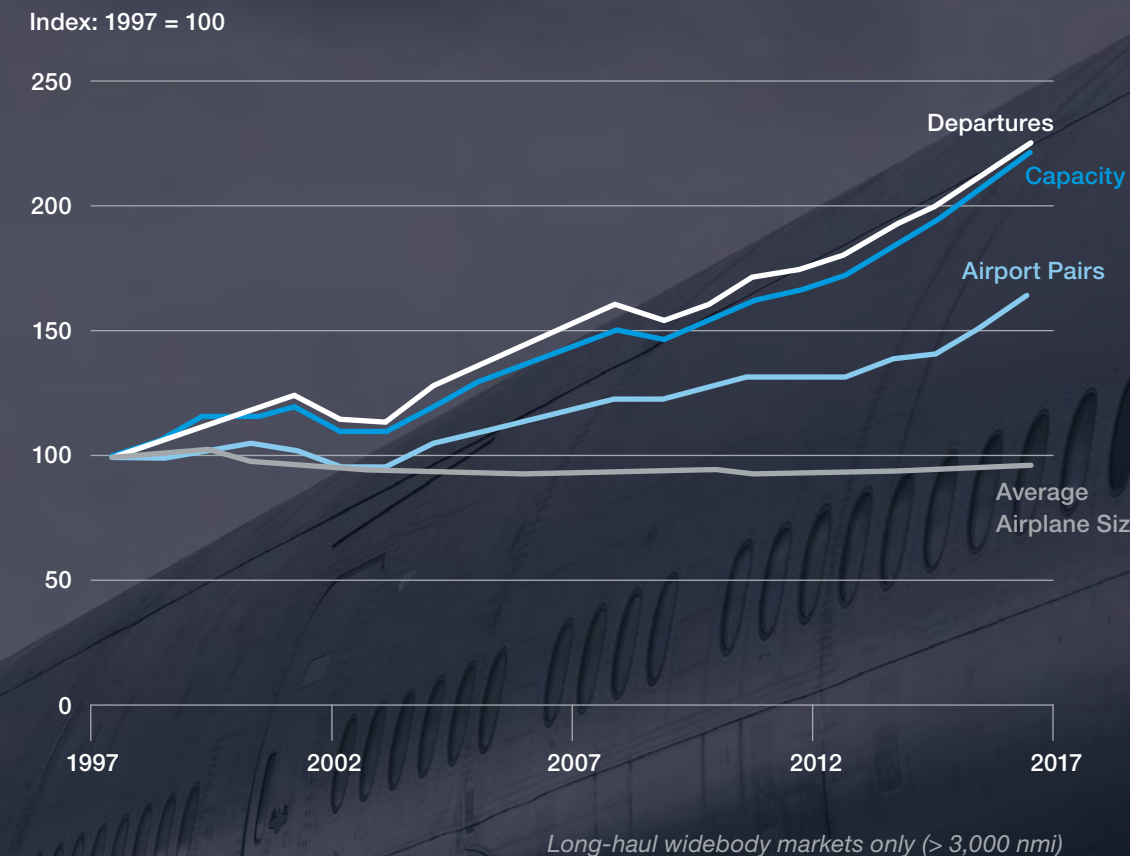
As air travel continues to grow, airlines have a choice about how they want to grow their businesses. They can accommodate that growth with increases in airplane capacity and size, or they can add more frequencies and nonstop markets to their networks. Passengers prefer the latter because of the increased flexibility and more direct itineraries

FIGURE 16: PASSENGER FLEET COMPOSITION



Source: FlightGlobal Flight Fleets Analyzer, CMO 2018

FIGURE 17: WIDEBODY FRAGMENTATION OFFERS MORE FREQUENCIES AND NONSTOPS



Source: OAG/FlightGlobal

offered. This trend is reflected in the profile of the widebody fleet and delivery forecasts.

The long-haul market has become increasingly fragmented as airlines respond to passenger preferences with smaller, more efficient widebody airplanes serving an increasing number of long-haul city pairs. This rising market fragmentation is boosting demand for smaller widebody passenger airplanes. (See figure 17.)

While preference for smaller widebody airplanes is expected to continue increasing, the larger segment of passenger widebodies will still have a significant role to play in worldwide fleets. Very high demand markets, the global superconnector business model, airport congestion, and airspace constraints all drive the need for larger airplanes. In addition, these effects are compounded in markets where time differences between cities restrict the marketable time windows for flight departures. Overall, the forecast sees demand for almost 8,100 new passenger widebody deliveries by 2037.

AIR CARGO OUTLOOK

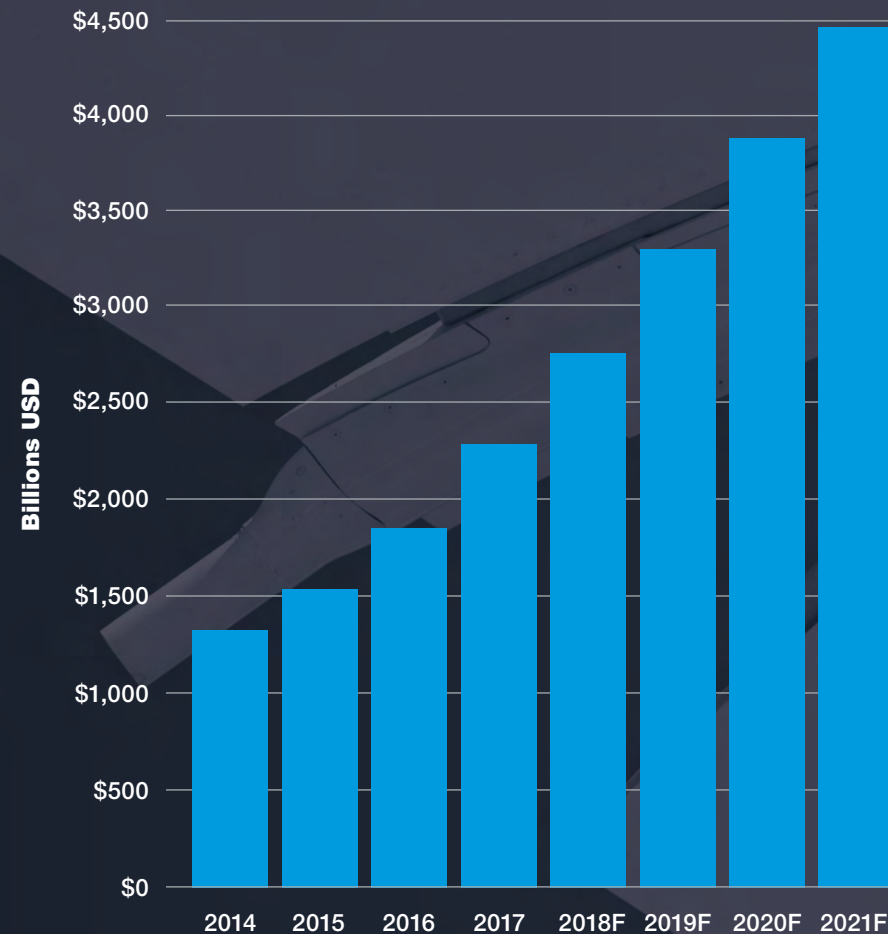
STRONG RECOVERY IN 2017 WITH OPTIMISM FOR ROBUST FUTURE GROWTH

In 2017, air cargo finally recovered fully from several years of lackluster performance. Year-over-year growth registered an impressive 10 percent, making 2017 the best year since 2010, which was the bounce-back year from the Great Recession. This followed below-trend growth of 3.8 percent in 2016 and a compound annual growth rate of less than 2 percent for 2011 through 2015. First quarter 2018 air cargo traffic increased faster than trend at 5.8 percent.

IMPROVED WORLD ECONOMY, RISE OF E-COMMERCE AND CONSUMER EXPECTATIONS IMPROVE AIR CARGO PROSPECTS

Air cargo's brisk recovery resulted from an improved world economy, where all regions are participating in synchronized growth, industrial production is strong, and world trade has been robust. In addition, strong growth in e-commerce has bolstered the vital role that air cargo plays in transporting goods, as consumers and cargo

FIGURE 18: E-COMMERCE CONTINUES RAPID EXPANSION
GLOBAL RETAIL E-COMMERCE SALES

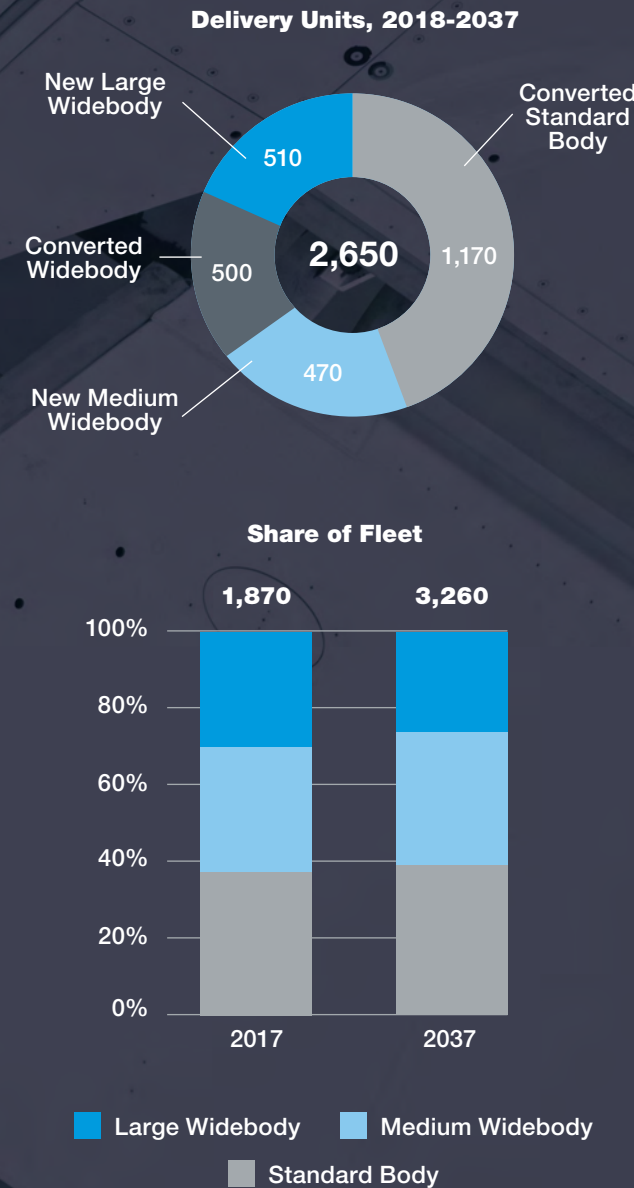


Global retail e-commerce sales expand to \$4.5 trillion in 2021

More than 19% per year growth since 2014

Source: Statista (www.statista.com)

FIGURE 19: FREIGHTER DEMAND
980 NEW, 1,670 CONVERTED



operators expect speed, reliability, and security more than ever. The restructuring of logistics chains to serve the rapidly growing e-commerce industry also requires the unique capabilities that air cargo provides and offers a new area of growth. Industries that require transport of time-sensitive and high-value commodities such as perishables, consumer electronics, high-fashion apparel, pharmaceuticals, industrial machinery, and automobile components recognize the value of air freight, and this value will continue to play a significant role in their shipping decisions. (See figure 18.)

FREIGHTERS WILL CONTINUE TO BE CRUCIAL TO AIR CARGO TRANSPORT

Passenger airplanes and dedicated freighters both carry air cargo. Lower-hold cargo capacity on passenger flights has been expanding as airlines deploy new jetliners with excellent range and cargo capability, such as the 777-300ER. However, the addition of passenger widebody airplanes and their associated belly cargo capability does not mean that the cargo volume can be utilized to the fullest, as payload restrictions can factor in on many routings.

Furthermore, dedicated freight services offer shippers a combination of reliability, predictability, and timing and routing control that is often superior to that of passenger operators. Passengers do not necessarily travel to where cargo needs to go. As a result, freighters are expected to continue carrying more than half of global air cargo to satisfy the demanding requirements of that market.

As global GDP and world trade growth continues, air cargo traffic, measured in revenue tonne-kilometers, is projected to grow an average of 4.2 percent per year in the next 20 years. World air cargo volume, in spite of external shocks arising from economic and political events and natural disasters, has grown an average of 5.3 percent per year since 1980. Replacement of aging airplanes, plus the industry's growth requirements, will create a demand for 2,650 freighter deliveries in the next 20 years. (See figure 19.) Of these, 1,670 will be passenger airplane conversions. The remaining 980 airplanes, valued at \$280 billion, will be new freighters. The overall freighter fleet will increase by more than half—from 1,870 airplanes in 2017 to 3,260 by 2037.

SERVICES MARKET OUTLOOK

GROWING GLOBAL FLEET DRIVING INCREASING NEED FOR AVIATION SERVICES

As the worldwide airline fleet continues to grow, demand for services designed to increase efficiency and extend the economic lives of airplanes is also rising. Growth in air traffic also creates demand for the development of innovative infrastructure and technology solutions to manage air traffic more effectively. Operators are investing in services that increase the productivity and capability of their platforms in addition to decreasing their operational costs. This document summarizes the outlook for this commercial support and services market. A more in-depth look at these markets is covered in the Services Market Outlook (SMO).

SCOPING THE AVIATION SERVICES MARKET

According to the International Air Transport Association (IATA), global airline operating expenses totaled \$787 billion in 2017. Airline operating expenses include all activities designed to attract customers and deliver passengers and cargo to

FIGURE 20: COMMERCIAL AVIATION SERVICES MARKET OUTLOOK

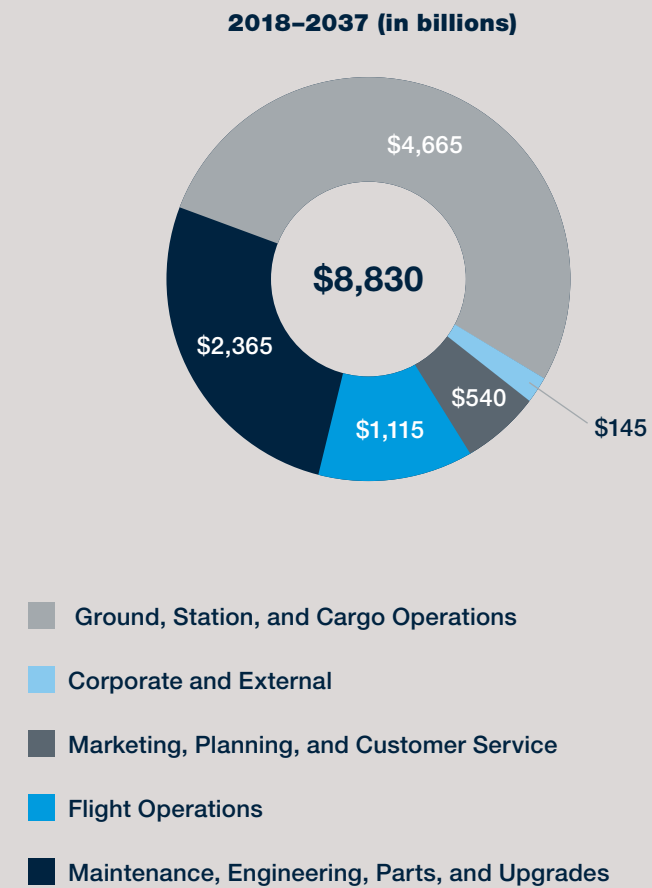
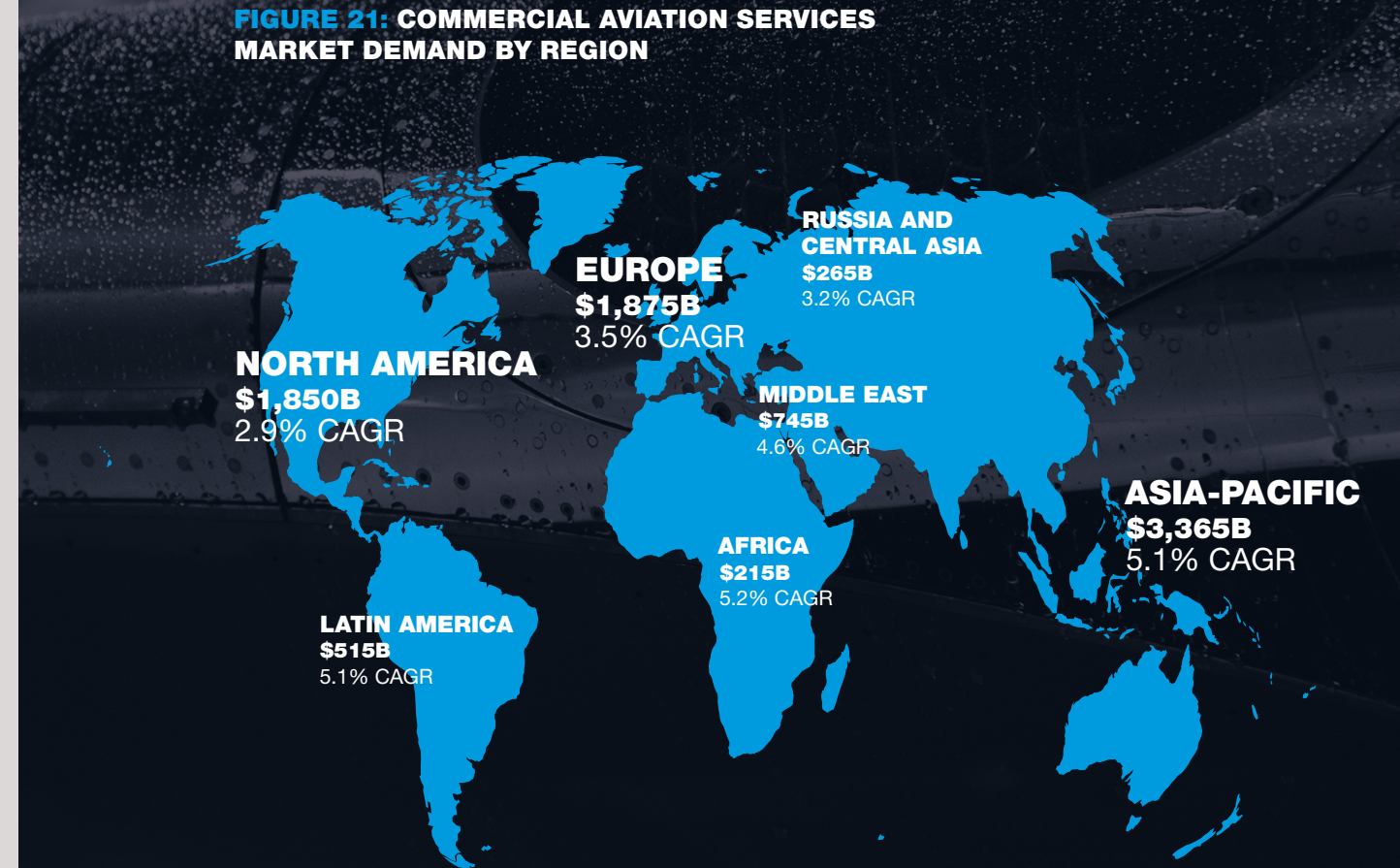


FIGURE 21: COMMERCIAL AVIATION SERVICES MARKET DEMAND BY REGION



their destinations. Embedded in these activities is a set of support services necessary to operate commercial fleets effectively. These aviation services account for approximately one-third of airlines' total spend. This commercial aviation services market is forecast to grow slightly faster than the overall commercial fleet at 4.2 percent in the next two decades, representing a market of more than \$8.8 trillion. Regionally, the demand for aviation services closely follows fleet size and growth. The Asia-Pacific region leads the demand for aviation services, representing almost 40 percent of the 20-year demand. (See figures 20 and 21.)

Three key market forces are driving growth in aviation services.

NEW BUSINESS MODELS

Airlines and airports are adopting business models that take advantage of growing services options and the rising "sharing economy" business environment. For example, there is a growing trend for airlines, particularly startups and low-cost carriers, to forgo the expense of setting up full-service maintenance departments, opting instead to outsource some or all of these services. At airports, pooling arrangements for ground support equipment can free up apron space and allow airlines to save on purchasing and maintenance costs.

INCREASED PRODUCTIVITY AND EFFICIENCIES

As e-enabled aircraft have become more common, the number of sensors on aircraft have increased from a couple hundred per aircraft a decade ago to thousands today. Each sensor collects a unique datum that can be used to perform real-time analysis and reporting on a factor such as the condition of aircraft parts, fuel consumption during flight, and engine performance.

INNOVATION AND TECHNOLOGY

Technology developments today will change the formula and timeline for innovation within and beyond the aerospace industry, including in aviation services. The aviation industry is using predictive analytics to increase efficiency in maintenance, improve safety and fuel performance, manage maintenance records, and lower operating costs. On the horizon, additive manufacturing can transform supply chains for greater flexibility and reduced cost and risk.

FOUR PRIMARY MARKET SEGMENTS IN THE AVIATION SERVICES MARKET

Commercial aviation services market segments in the forecast are grouped by function: corporate overhead; marketing and planning; flight operations; maintenance and engineering; and ground, station, and cargo operations. While these segments are diverse in terms of sales, activity scope, capital intensity, and competitive environment, we expect growth to generally approximate the fleet growth rates.

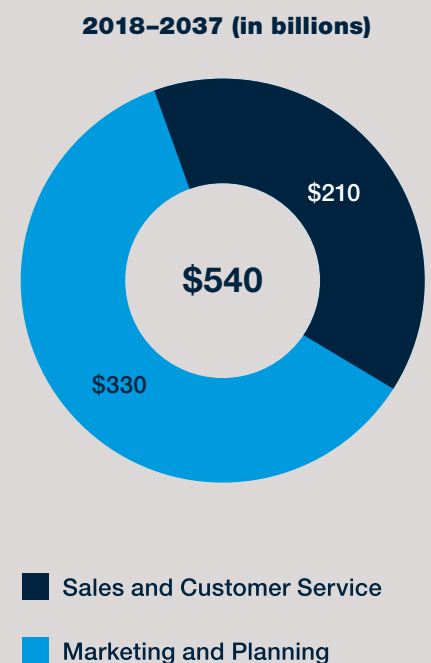
While our SMO includes the values of commercial aviation services purchased for corporate overhead functions as well as air traffic management, those segments are not covered in detail in this document. Following are key trends driving demand in the four largest market segments.

MARKETING, PLANNING, AND CUSTOMER SERVICE

Marketing, planning, and customer service is the area of airline activity that manages customer relationships, captures travel reservations and payments, and uses that information in planning activities that

FIGURE 22: MARKETING, PLANNING, AND CUSTOMER SERVICE MARKET OUTLOOK

Globally, airlines are estimated to have earned \$67.4 billion from ancillaries last year, representing about 9.1 percent of airline revenue, up from 4.8 percent in 2010.



ultimately drive airline operations. Airlines may obtain these services in house, through outsourcing, or through some combination of the two.

Most of the activities in marketing, planning, and customer service rely heavily on both in-house and vendor-provided IT systems. Nearly 50 percent of the total spend for airlines' marketing, planning, and customer service functions will be on IT systems and support. These systems are often complex and highly integrated with other airline systems. We also see them evolving to use analytic and prognostic algorithms to enhance their planning capabilities and outcomes. (See figure 22.)

GROWTH OF UNBUNDLED SERVICES: The growing appetite for ancillary revenues continues to dominate the trends in this sector. Airlines are introducing customization to more and more facets of service. Seat location, food and beverage, checked baggage, and boarding priority all continue to grow as significant revenue sources. Some of the more innovative services include bidding for an adjacent open seat and mobile notifications for last-minute seat upgrade opportunities.

While airlines have introduced new and lucrative unbundled services, they have also added new services back into the price of a "seat" to compete for business. Low-cost offerings such as free in-flight text messaging and complimentary premium beverages for premium economy allow free marketing at relatively little expense. In addition, more airlines are offering free entertainment with a BYOD (bring your own device) environment

onboard. This allows airlines to offer passengers a benefit they have become accustomed to paying for and reduces in-flight entertainment system cost.

END-TO-END CUSTOMER EXPERIENCE: Today's traveler is more connected than ever before thanks to growth in smart wearable technology, IoT (Internet of Things), and social media. Airlines are increasingly adapting to their technology-savvy customers who expect the travel experience to be just as seamless as online shopping.

Airlines are now connecting with passengers to integrate all touch points of their travel experience. From transit to and from the airport, to airport food mobile ordering, to hotel and car rental services, airlines aim to keep customers on their platforms for the entire journey. This twofold benefit allows airlines to collect and utilize much more data for new marketing opportunities as well as offer new customer service solutions.

DIGITAL TRANSFORMATION WITH BLOCKCHAIN IN MIND: The advancement of digitalization to create an improved passenger experience continues to be a top priority for airlines. Airlines have replaced staffed ticket counters with self-check-in kiosks, and many have replaced printed boarding passes with at-home check-in, mobile check-in, mobile boarding passes, and self-bag-tagging. Routine issues and questions are being addressed with artificial intelligence chatbots. This self-service trend will increase, and by 2020, more than 80 percent of all global passengers will be offered self-service opportunities, especially at the airport.

Rising in the background is the maturing technology of blockchain. While more associated with cryptocurrency, industries from automotive to health care are exploring ways of taking advantage of its benefits. This is no different for the airline industry, which can capitalize on its secure transfer and data recording. From ticketing to loyalty programs to identity protection, this segment of an airline's operations is ripe for disruption from blockchain.

FLIGHT OPERATIONS

Flight operations includes services associated with the flight deck, cabin services, crew training and management, airplane operations while in flight, and the airline operations center. Growth in the flight operations services market is highly correlated with the commercial fleet and passenger traffic growth rates. Technology and the introduction of e-enabled aircraft into the fleet are also driving growth in flight operations services, specifically with respect to passenger service, flight deck tools, flight and crew planning software, and airplane health and systems management. (See figure 23.)

DIGITAL ADVANCES: Airlines have adopted tools such as performance-based navigation, trajectory-based operations, dynamic airborne rerouting planning, collaborative decision making, crew scheduling optimization, and fuel efficiency software to lower fuel and labor costs and minimize flight disruptions.

GROWTH IN MOBILE AND DIGITAL SOLUTIONS: Mobile and digital solutions have replaced many of the paper-intensive and time-consuming processes of the past. Text-based communication systems between pilots and air traffic controllers are being tested to eliminate miscommunications resulting from

FIGURE 23: FLIGHT OPERATIONS MARKET OUTLOOK

Pilot and cabin crew training demand will exceed \$110 billion in the next 20 years.

2018–2037 (in billions)

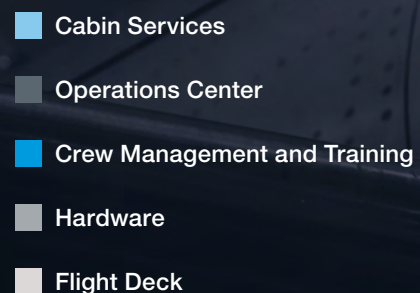
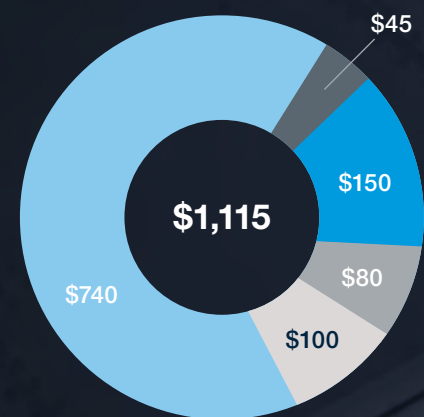
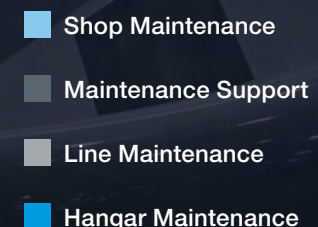
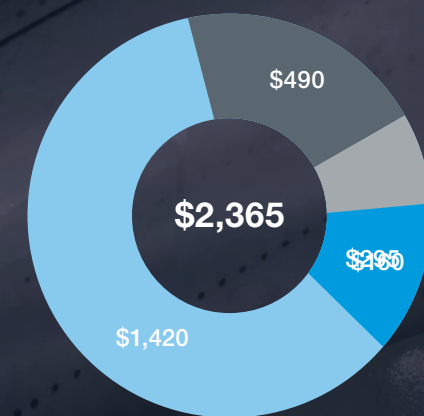


FIGURE 24: MAINTENANCE, ENGINEERING, PARTS, AND UPGRADES MARKET OUTLOOK

During the next 10 years, airlines will spend almost \$4 billion to retrofit more than 9,000 airplanes with satellite connectivity.

2018–2037 (in billions)



noisy radio channels and blocked transmissions. Cumbersome paper manuals have been replaced with connected electronic flight bags, which not only reduces weight but also allows pilots to quickly access, update, and share real-time information between the flight deck and ground crew. Airlines are embracing blended e-learning and classroom solutions to increase scheduling flexibility for flight crew, encourage continuous learning, and reduce travel costs. These digital trends are expected to become even more widespread as technologies including artificial intelligence, augmented and virtual reality, and smart devices become more mature.

INCREASING COMPETITION IN THE PILOT LABOR MARKET: The pilot labor supply has continued to tighten amid strong global air traffic growth, leading to challenges for the industry in recruiting and retaining qualified pilots and flight instructors. Pilot provisioning services can fill temporary shortfalls in staffing, while crew planning and scheduling tools can assist in ensuring an adequate number of flight crew are available at the right time and location.

Regional markets that have relied heavily on recruiting pilots from outside their home location are increasingly seeking to recruit, train, and develop locally sourced pilots through increased investments in educational outreach and ab initio programs (full pilot training including ground school). Rising training costs coupled with a tight labor market will spur changes to how pilots are trained and retained.

MAINTENANCE, ENGINEERING, PARTS, AND UPGRADES

Maintenance includes those tasks required to upgrade, maintain, or restore the airworthiness of an aircraft and its systems, components, and structures. Regulators require that an operator establish a maintenance and inspection program to accomplish those tasks, carried out by certified personnel. There is a growing trend for airlines, particularly startups or low-cost carriers, to forgo the expense of setting up full-service maintenance departments, opting instead to outsource some or all of these services. (See figure 24.)

AIRLINES RACING TO ROLL OUT PASSENGER CONNECTIVITY: The past year saw large increases in the number of airlines offering in-flight Internet connectivity. Globally, one-third to one-half of airline capacity now offers some level of connectivity, and fast broadband connections via satellite are rapidly replacing earlier and slower systems. Most of the activity taking place now in connectivity occurs in aircraft modification. More than a thousand airplanes are upgraded annually, and this pace will continue a few more years and then slow as the number of new airplanes delivered with installed connectivity increases.

However, the evolution of this technology ensures that a modest level of modification will continue indefinitely. On the horizon are next-generation systems based on constellations of lower-orbit satellites and 5G wireless technology. These

technologies are expected to offer global coverage, faster response, and greater bandwidth but will require significant aircraft modifications.

PREDICTIVE MAINTENANCE BECOMES ROUTINE:

New-technology airplanes such as the 737 MAX and 787 Dreamliner generate exponentially more data per flight to monitor the airframe, systems, and engines. The data fuel analytical efforts to help airlines identify developing problems and avoid the operational disruptions that occur when components need unplanned maintenance.

As these analytical efforts have matured, airlines have gained confidence in these predictions and now regularly replace components before they generate a fault indication or cause schedule delays or cancellations. The positive impact to airline operations is magnified when the analytical outputs are combined with maintenance-planning and route-planning systems so that an airplane's technical status is considered in assigning it to particular routes, ensuring the airplane is at the proper station for its next maintenance check or for replacement of problematic components.

GROUND, STATION, AND CARGO OPERATIONS

The operations segment captures the key elements of airport operations required to receive an airplane, turn it around for the next flight, and release it for departure. We group this market into three categories: ground operations, station operations, and cargo operations. The ground, station, and cargo services market has a close correlation to the number of passengers served at an airport. (See figure 25.)

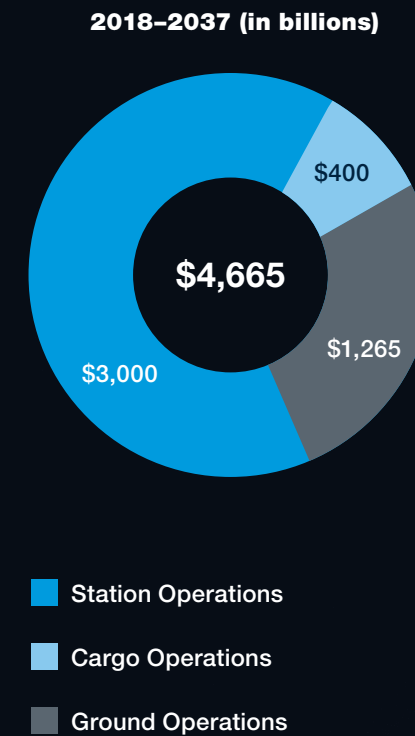
ROBUST CARGO VOLUME GROWTH: According to IATA, 2017 was the strongest year for air freight growth since 2010. The surge in cargo volumes is increasing airport congestion and placing greater demand on ground-handling assets. As a result, airports and operators are seeking creative solutions to maximize resources.

POOLING: Pooling arrangements for ground support equipment can free up apron space and allow airlines to lease equipment such as dollies or push-back trucks. Recent outsourcing trends have moved 50 percent of handling to independent handlers, up from 35 percent in 2007, by IATA estimates. This outsourcing trend will continue, with the market seeing up to 60 percent of ground handling outsourced by 2020, providing greater labor flexibility and lower costs at spoke stations.

AIRPORT PRIVATIZATION: Airports are attractive assets to a wide range of investors, and governments are seeking new ways to finance infrastructure improvements. Airport privatization is escalating competition among players in the ground, station, and cargo operations market and further driving the move to outsource these services for cost improvements.

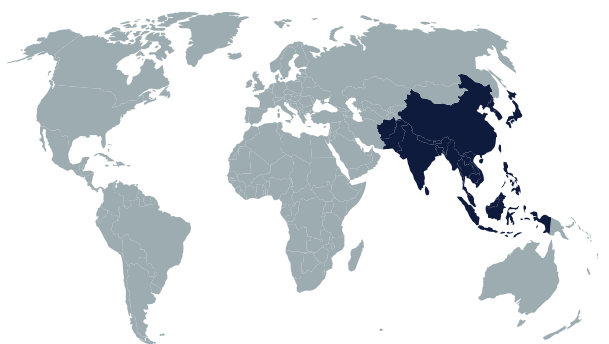
FIGURE 25: GROUND, STATION, AND CARGO OPERATIONS MARKET OUTLOOK

Passenger station operations represent about 64 percent of the segment, driven by baggage handling, required rentals, and the complexities of taking care of airline passengers.



ASIA-PACIFIC

16,930
DELIVERIES



3.9%

GDP

5.7%

TRAFFIC

4.6%

FLEET

\$2,670B
MARKET VALUE

航班号 Flight	计划时间 Scheduled	始发站/经停站 From/Via
FM9362 / MU9362	21:00	长沙 CHANGSHA
MF8178 / MU8178	21:00	北京首都 BEIJING
MU5318 / CZ9368	21:00	广州 GUANGZHOU
MUS354	21:00	深圳 SHENZHEN
MU5124 /	21:10	北京首都 BEIJING
MU5125 /	21:15	昆明 KUNMING
FM9362 / MU9362	21:15	宜昌 YICHANG
CZ3547 / MF1379	21:25	广州 GUANGZHOU
FM9418 /	21:30	连云港 LIANYUNGANG
H01256 / MU3988	21:30	乌鲁木齐 URUMQI
KN2317 / MU3713	21:35	
MU5434 /	21:35	重庆 CHONGQING
MU5550	21:40	临沂 LINYI
FM9064 / MU9064	21:45	天津 TIANJIN

The Asia-Pacific region continues to demonstrate that it is a primary driver of the strong global passenger growth observed since 2010. The region's passenger growth rate, fleet growth, and available seat-kilometer growth will continue to lead the world during the next 20 years.

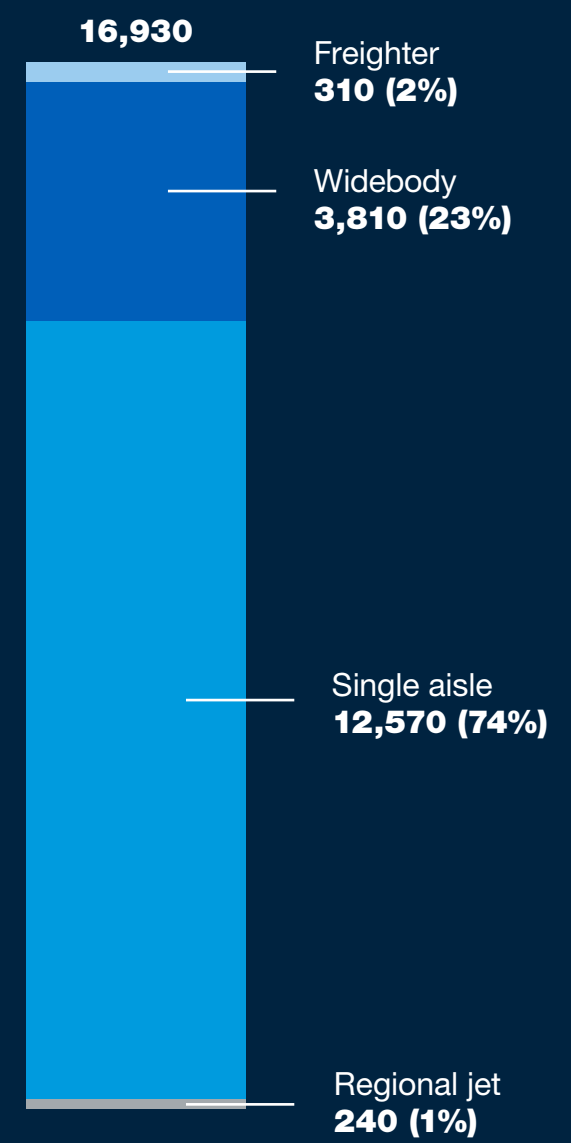
A key driver of this growth is that Asia-Pacific is home to more than half of the world population. In addition, Asia-Pacific's economic growth has been robust during the past decade, a trend expected to continue in the next two decades. Rising income levels have fueled expanding middle classes in many Asian economies, which in turn has provided the opportunity for a rising share of the population to travel by air.

As is the case in many regions of the world today, market liberalization is also playing a key role in Asia-Pacific's strong passenger growth. Low-cost carriers are flourishing in numerous Asia-Pacific markets, which has brought in new, competitive travel service resulting in traffic stimulation.

The region does face some long-run challenges, such as addressing infrastructure and regulatory constraints. However, these are expected to be manageable against the backdrop of strong structural demand drivers in the region and the economic benefits of comprehensive air traffic networks.

DELIVERIES 2018-2037

Of all new jet passenger airplane deliveries worldwide in the next 20 years, 40 percent will be delivered to airlines in the Asia-Pacific region—double the quantity of new deliveries to any other region—reflecting Asia-Pacific's strong growth prospects.



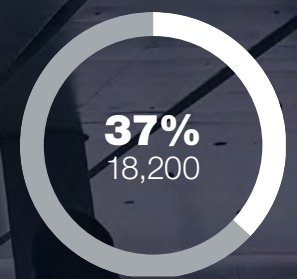
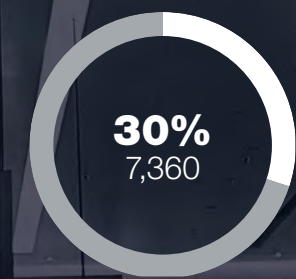
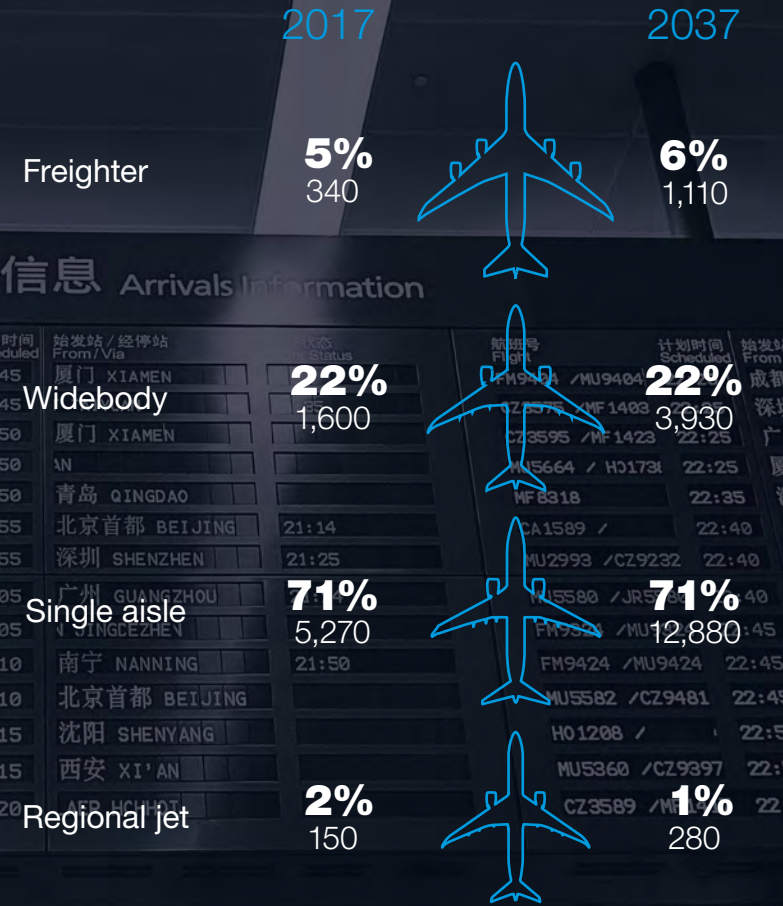
FLEET COMPOSITION

Widebody airplanes will continue to represent more than 20 percent of the Asia-Pacific fleets. Driven by continued market fragmentation, the widebody airplane fleet is forecast to more than double in the next 20 years.

Single-aisle airplanes will continue to be the backbone in the Asia-Pacific market, representing nearly 40 percent of the global single-aisle fleet in the next two decades. The strong demand is supported by robust growth of low-cost carriers, especially on intraregional routes.

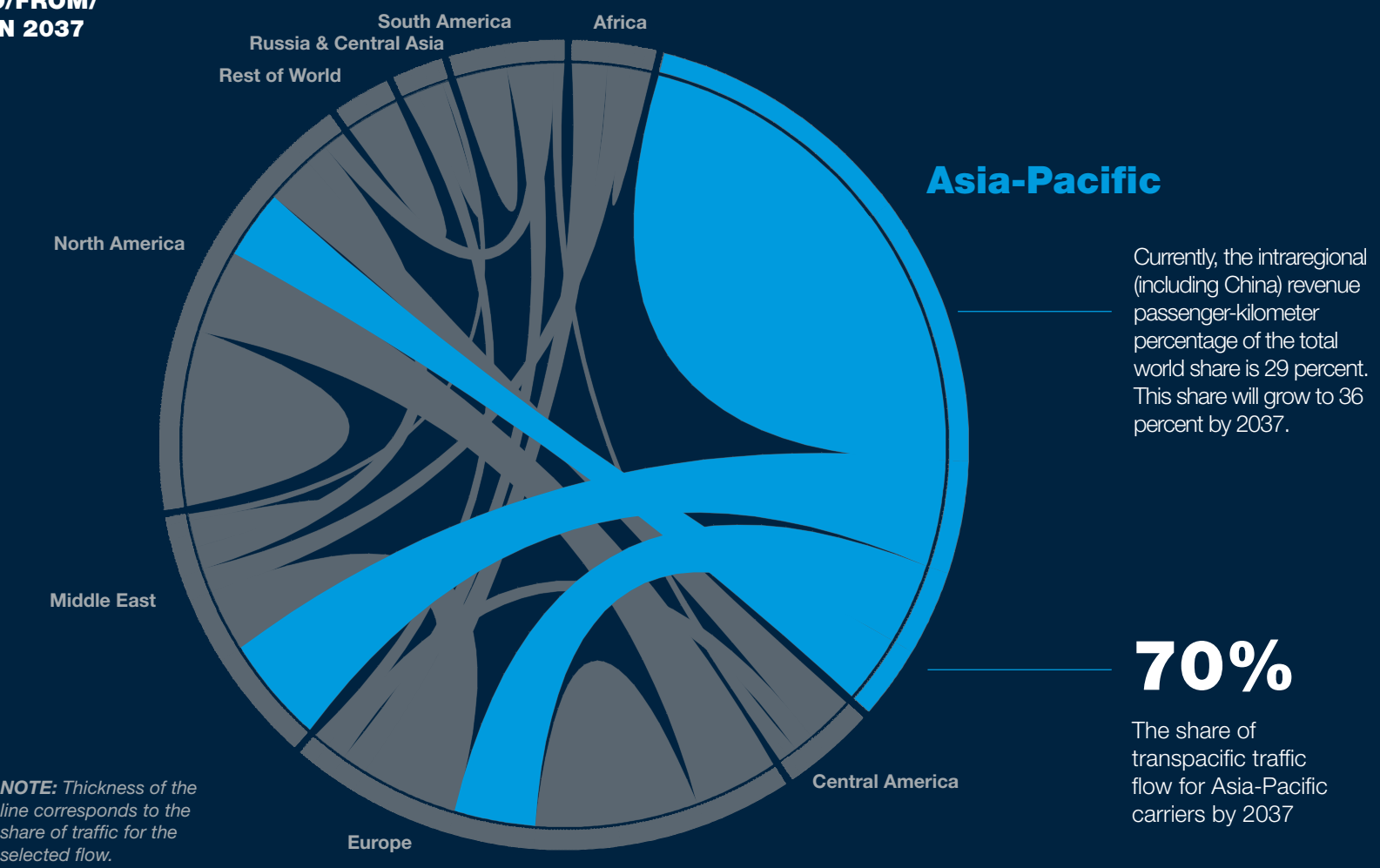
SHARE OF WORLD FLEET

The growth in the world share of Asia-Pacific carriers is largely attributed to the expected growth in low-cost carrier fleet share, from 28 to 41 percent in the next 20 years.

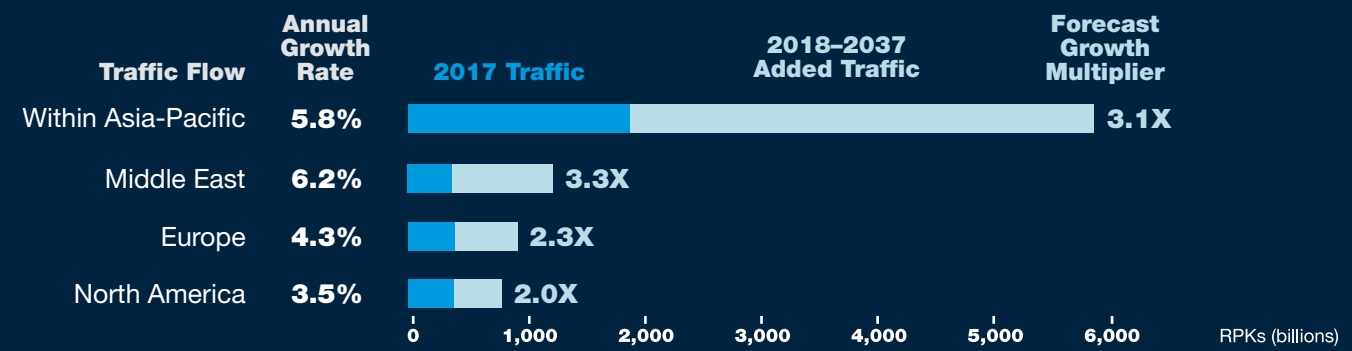


航班号 Flight	计划时间 Scheduled	始发站/经停站 From/Via	航班号 Flight	计划时间 Scheduled	始发站/经停站 From/Via
HA	20:44		FM9404	21:45	成都 CHENG
JING	20:39		MU2410	21:45	深圳 SHEN
OU	20:31		FM9262 / MU9262	21:50	广州 GU
V	20:31		MU2470 / CZ9161	21:50	厦门 XI
ING	21:08		AN	21:50	青岛 QINGDAO
	21:09			21:55	北京首都 BEIJING
	20:57			21:55	深圳 SHENZHEN
	21:09			22:05	广州 GUANGZHOU
ANG	21:08			22:05	连云港 LIANYUNGANG
	21:22			22:10	南京 NANNING
	21:19			22:10	北京首都 BEIJING
	21:19			22:15	沈阳 SHENYANG
	21:19			22:15	西安 XI'AN
	21:19			22:20	

**TRAFFIC FORECAST TO/FROM/
WITHIN ASIA-PACIFIC IN 2037**



NOTE: Thickness of the line corresponds to the share of traffic for the selected flow.

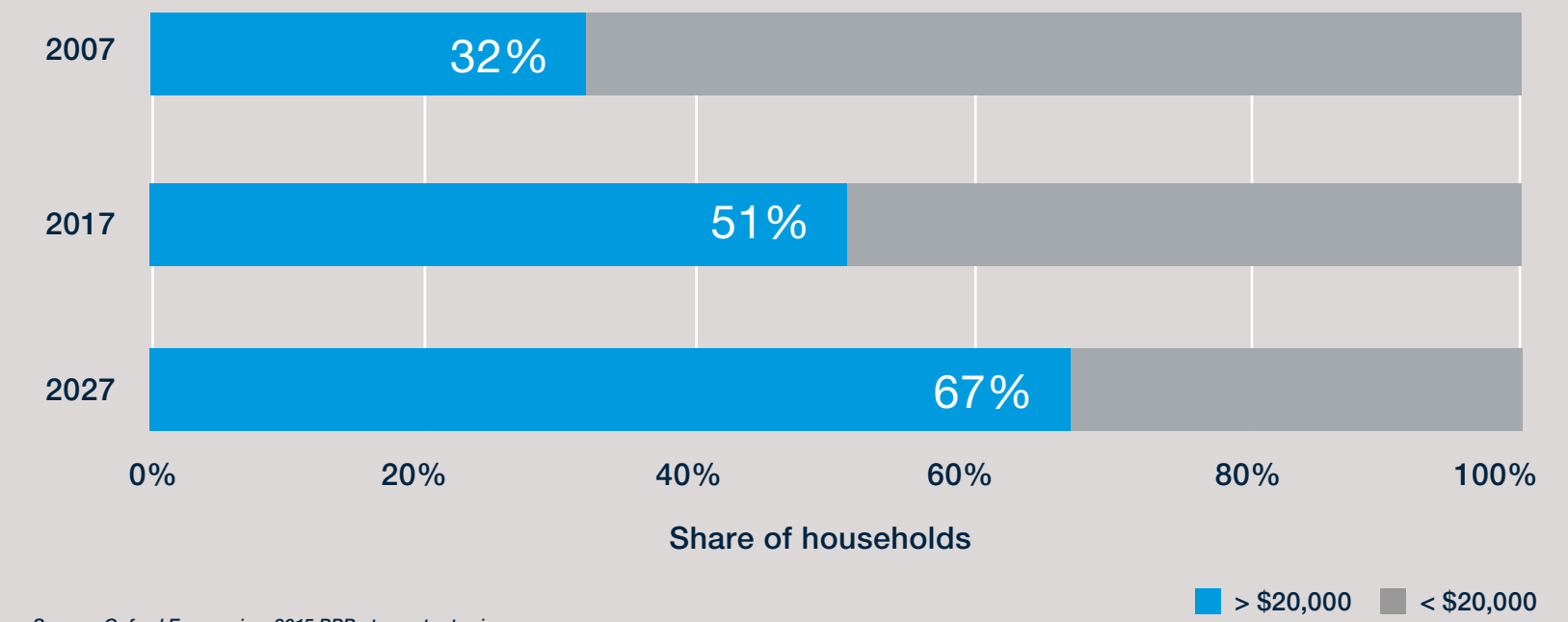


WORLDWIDE REAL GDP FORECAST

Asia-Pacific currently accounts for 33 percent of world GDP. The share will expand to 41 percent by 2037.



ASIA-PACIFIC HOUSEHOLDS BY INCOME LEVEL



2/3

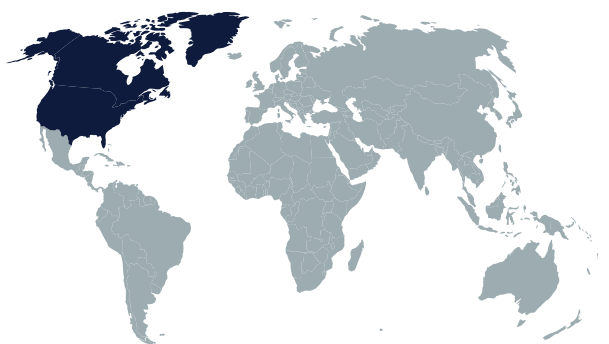
The share of households in Asia-Pacific earning at least \$20,000 (purchasing power parity) a decade from now, up from just one-third a decade ago.

A growing middle class in the region is a key driver of demand for air travel.

Source: Oxford Economics, 2015 PPP at constant prices

NORTH AMERICA

8,800
DELIVERIES



2.0%
GDP

3.1%
TRAFFIC

1.8%
FLEET

\$1,100B
MARKET VALUE

North America continues to be a dynamic market. The region has evolved after a period of bankruptcy, consolidation, and economic recession. Stronger operators have emerged with an increased focus on improved productivity and cost reduction, and some have prioritized optimization programs to simplify fleets and subfleets. Aircraft utilization has improved and load factors remain at or near record highs.

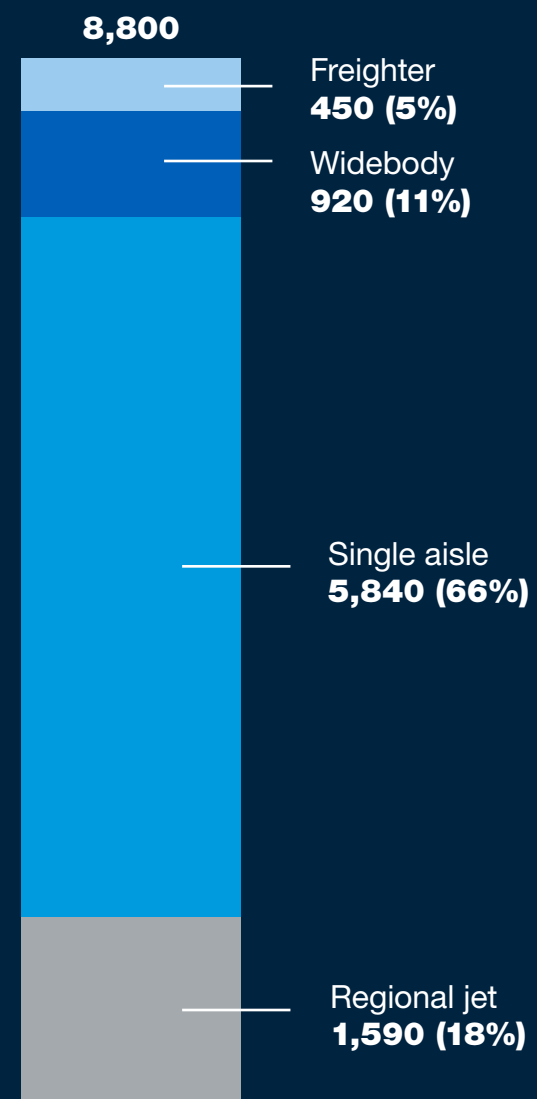
These changes have contributed to a period of unprecedented financial prosperity. The region has accrued more than half of global industry profitability in the last five years. Airlines are making more equity investments to acquire stakes in other operators, leveraging those investments and alliance or joint venture partners to align economic incentives and cover a larger global footprint. These changes are considered when making strategic fleet decisions.

Single-aisle airplanes comprise the vast majority of the current fleet and future deliveries. Capacity growth is outpacing fleet growth, in part because of the trend of single-aisle aircraft cabin densification and upgauging. Network operators continue to focus on and invest in hub strength by increasing capacity and improving airports. The widebody segment's heightened preference for small twin-aisle aircraft with greater operational flexibility is reflected in the order backlog.

DELIVERIES 2018-2037

64%

The share of deliveries during the forecast period for replacement of existing airplanes, with the other 36 percent for growth.



FLEET COMPOSITION

91%

The share of growth in the passenger fleet from single-aisle airplanes, despite capacity growth through upgauging and cabin densification in the category.

SHARE OF WORLD FLEET

44%

The increase in the total fleet during the next 20 years. The region is mature with more modest fleet growth rates in comparison.

2017 2037

Freighter

12%
850



11%
1,100

Widebody

9%
660



10%
1,050

Single aisle

55%
3,970



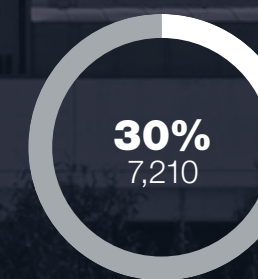
64%
6,650

Regional jet

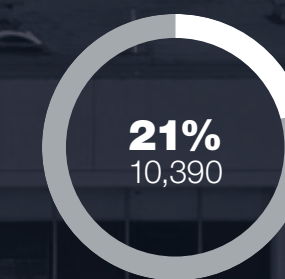
24%
1,730



15%
1,590



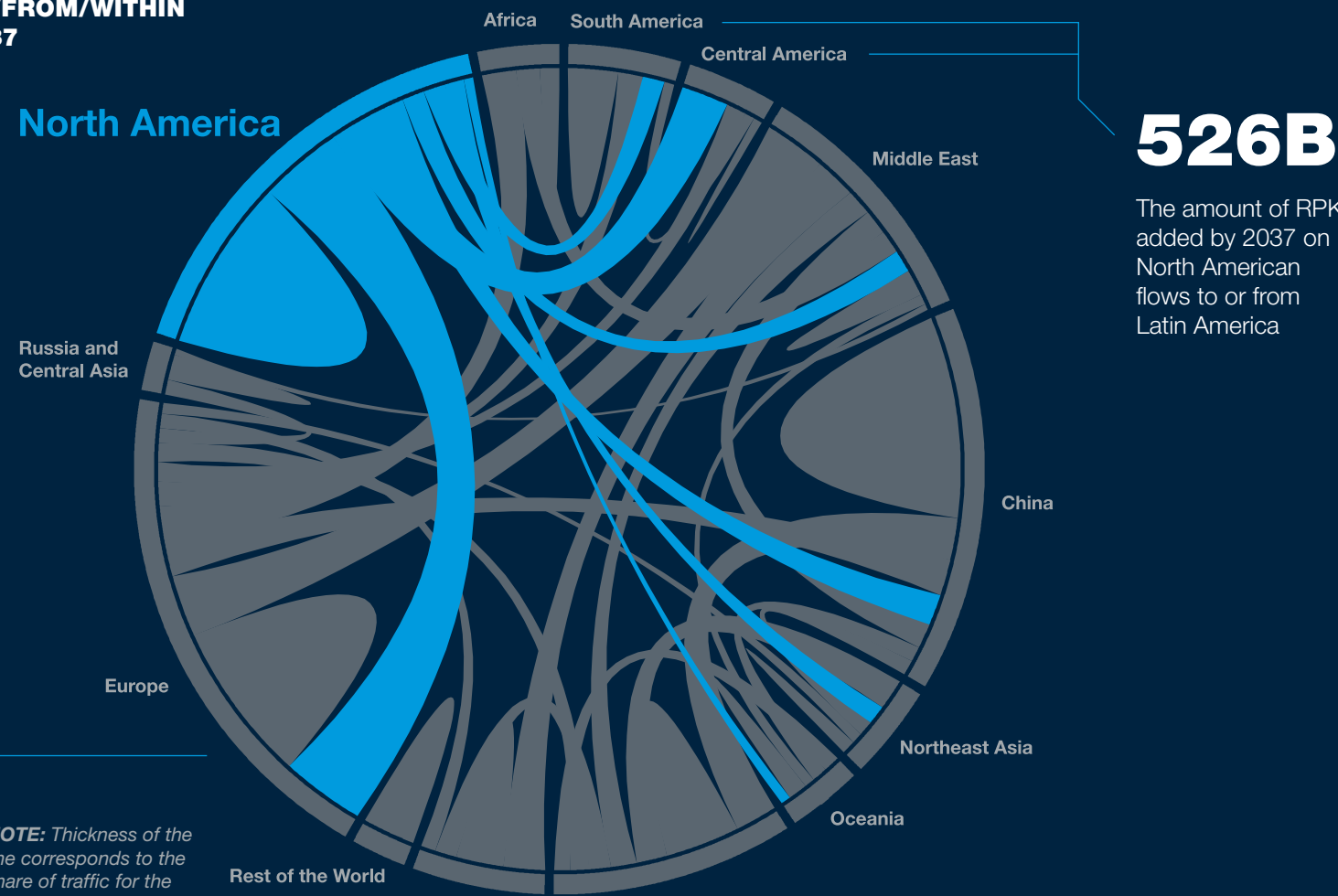
2017



2037

TRAFFIC FORECAST TO/FROM/WITHIN NORTH AMERICA IN 2037

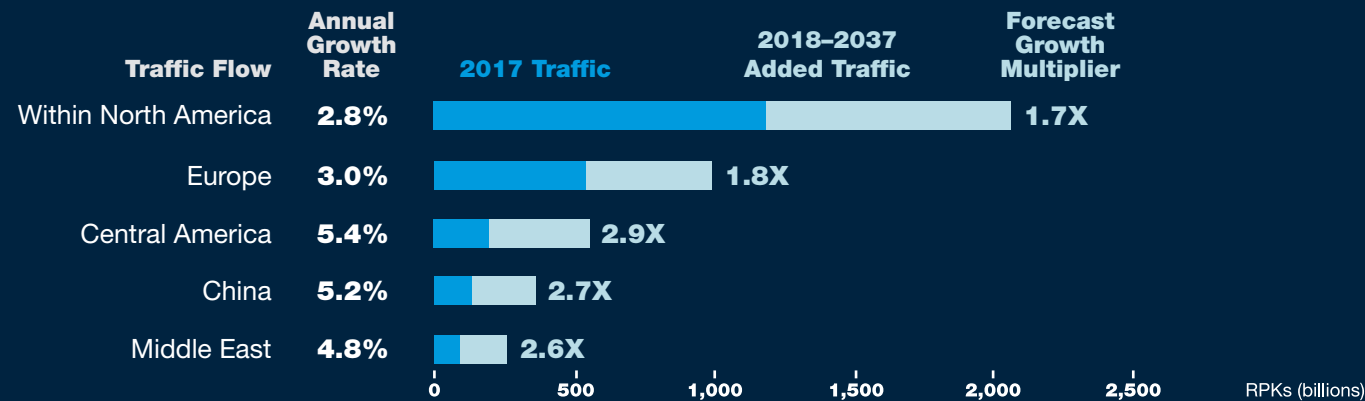
North America



41%

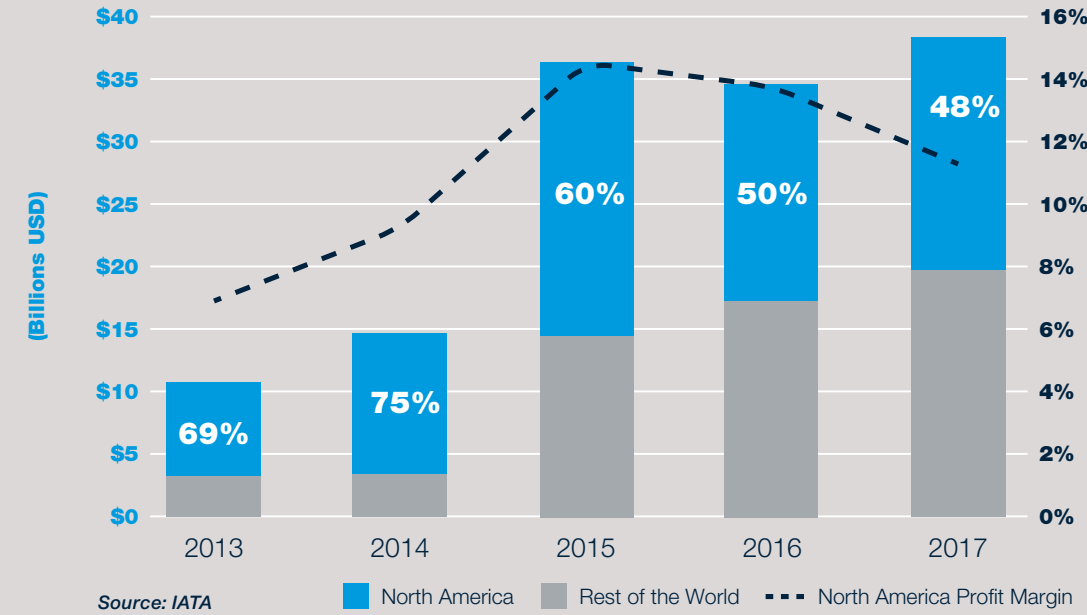
The 2017 share of transatlantic traffic for North America-domiciled operators

NOTE: Thickness of the line corresponds to the share of traffic for the selected flow.



COMMERCIAL MARKET OUTLOOK 2018-2037

GLOBAL AIRLINE PROFITABILITY



56%

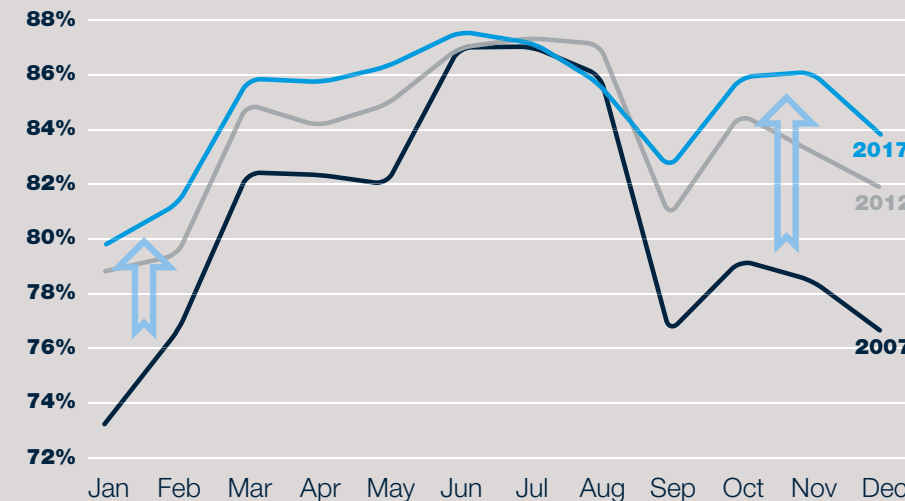
The share of global industry profitability North America has accrued the last five years

2.5X

The increase of widebody deliveries in North America in the last five years compared to the previous five-year period

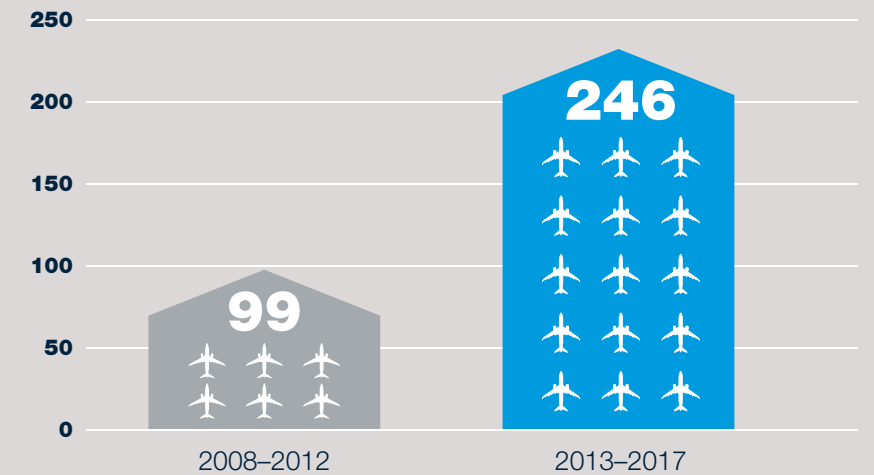
SIGNIFICANT OFF-PEAK LOAD FACTOR IMPROVEMENT

Deploying capacity sensibly to match market demand, North America operators have shown significant improvement of load factors in off-peak periods.



Source: IATA, airline reports, Boeing Market Analysis

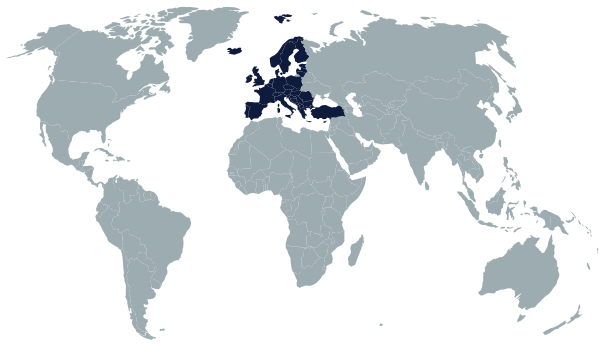
WIDEBODY DELIVERY GROWTH



Source: FlightGlobal Flight Fleets Analyzer

EUROPE

8,490
DELIVERIES



1.7%
GDP

3.8%
TRAFFIC

3.0%
FLEET

\$1,240B
MARKET VALUE

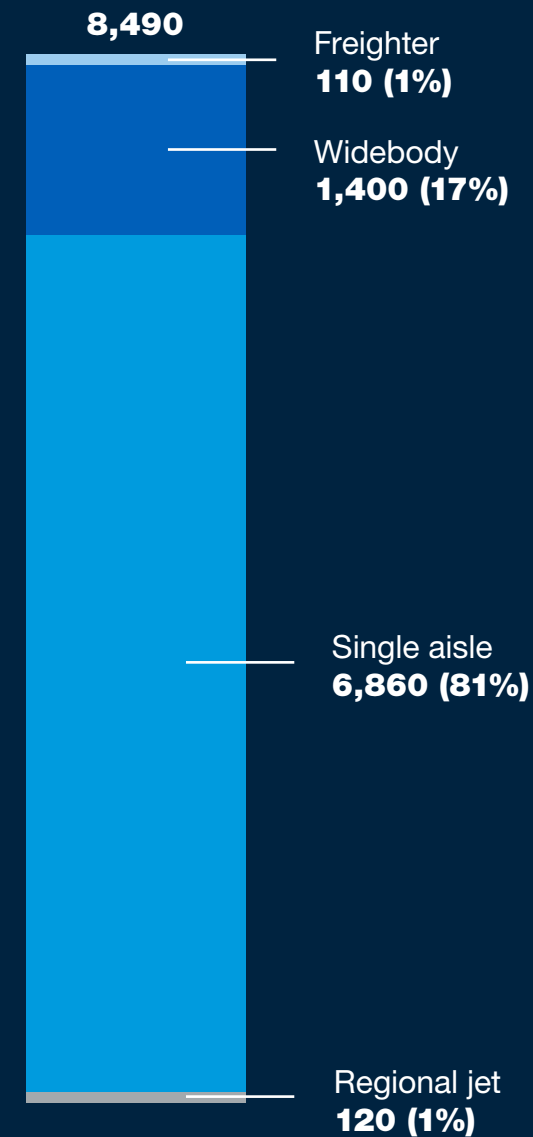
European air traffic continued its strong run in 2017, with network airlines carrying 5.3 percent more passenger traffic than in 2016 and the largest low-cost carriers (LCC) in Europe reporting an increase in short-haul passenger traffic of 13.2 percent. These strong traffic increases came in the face of GDP growth in Europe of only 2.8 percent, suggesting that European aviation is not entirely dependent on GDP to generate traffic growth.

European short-haul service has become a battleground, with large LCCs continuing to grow aggressively and the LCC subsidiaries of large network groups pushing back and defending their market share in intra-Europe point-to-point service. This cutthroat competition has resulted in lower fares and more service choices, benefiting the passenger.

The European aviation market continues to consolidate, with the airberlin and Monarch bankruptcies, latest Alitalia restructuring, IAG acquisition of Aer Lingus, and Travel Service acquisition of Czech Airlines. The capacity lost through consolidation has largely been taken over by LCCs such as Ryanair and the LCC subsidiaries of large network carriers such as Eurowings. This continuing trend toward consolidation has highlighted the urgency for smaller airlines to find a profitable operating niche or risk becoming the next consolidation casualty.

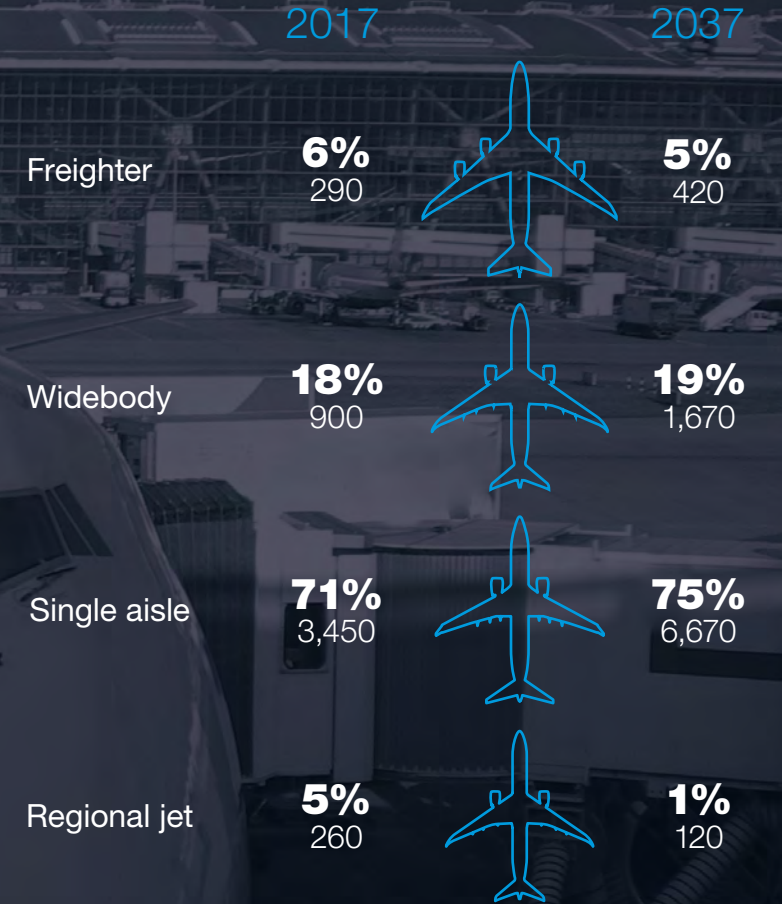
DELIVERIES 2018-2037

Europe's large installed base of airplanes drives substantial demand for replacement. Replacements represent 53 percent of total European deliveries.



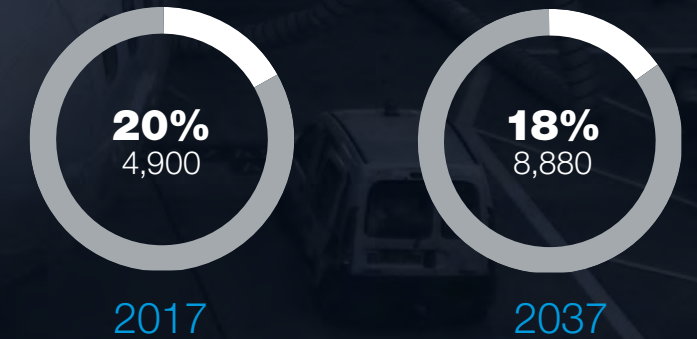
FLEET COMPOSITION

Single-aisle airplanes will represent 75 percent of the European fleet, driven largely by rapid growth of LCCs on short-haul routes.



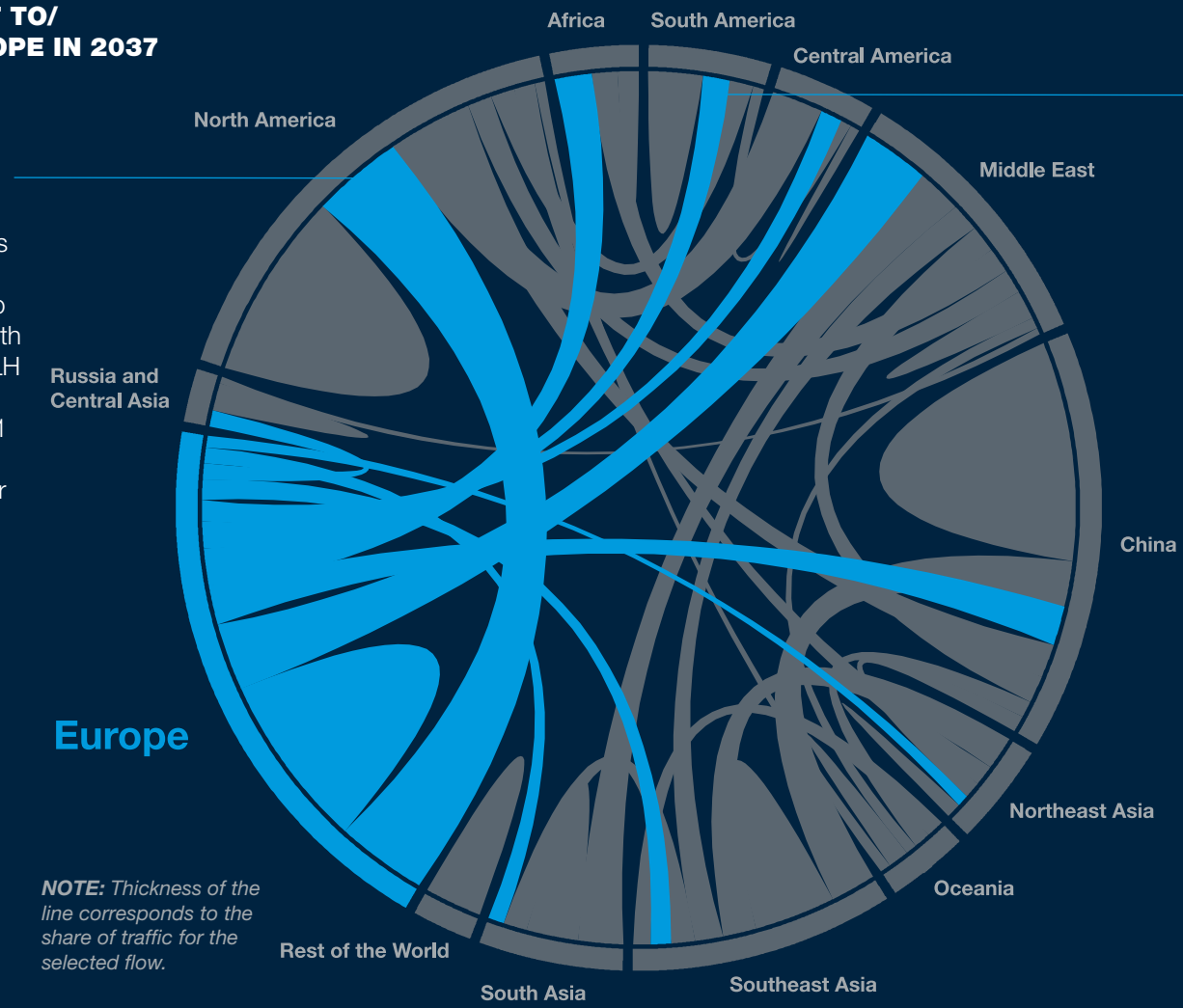
SHARE OF WORLD FLEET

LCCs will operate 42 percent of the single-aisle European fleet by 2037.

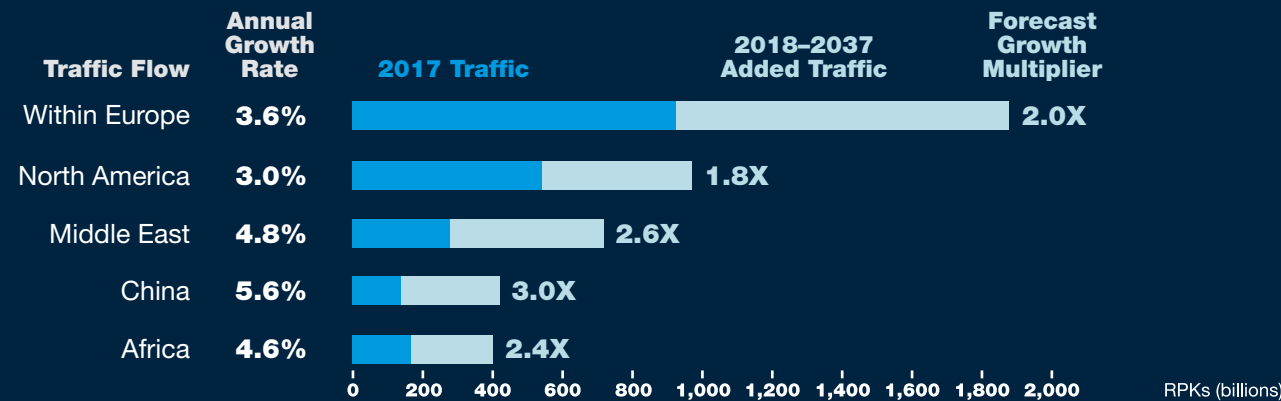


TRAFFIC FORECAST TO/ FROM/WITHIN EUROPE IN 2037

The emergence of the low-cost long-haul (LCLH) business model is driving traffic growth and fragmentation of nonstop city pairs on Europe-North America routes. The LCLH share of North Atlantic departures grew from 1.1 percent in summer 2012 to 6.3 percent in summer 2017. The number of unique city pairs served nonstop on this flow similarly grew from 10 in summer 2012 to 64 in summer 2017.



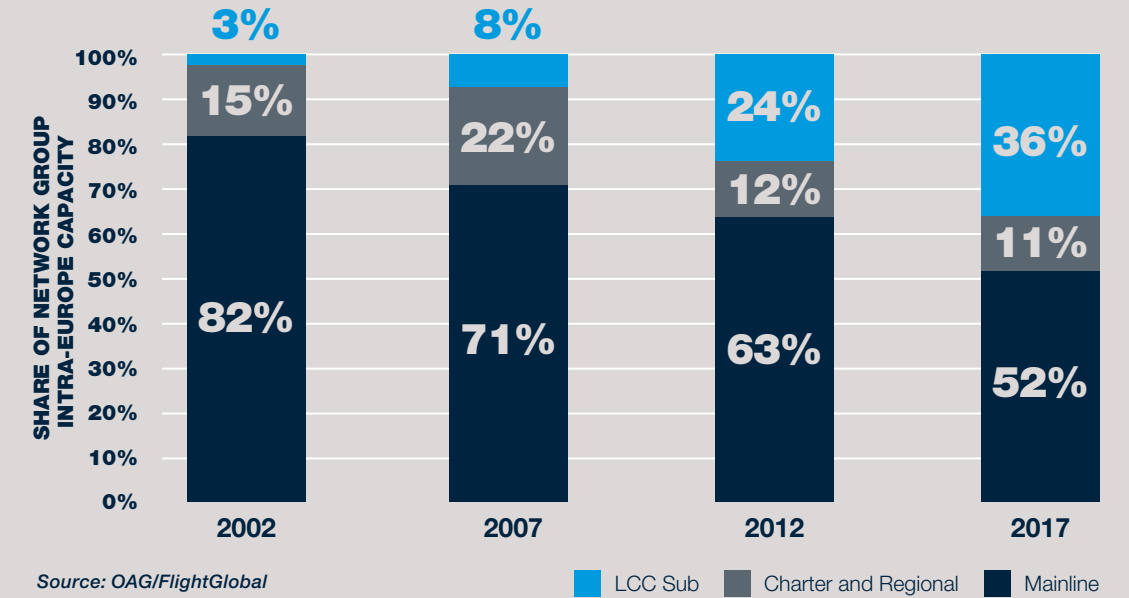
NOTE: Thickness of the line corresponds to the share of traffic for the selected flow.



The introduction of a European carrier serving the intra-South America market will occur in 2018. Norwegian is establishing a 737 base in Argentina, with 10 to 16 aircraft serving 10 to 20 cities in Argentina from Buenos Aires.

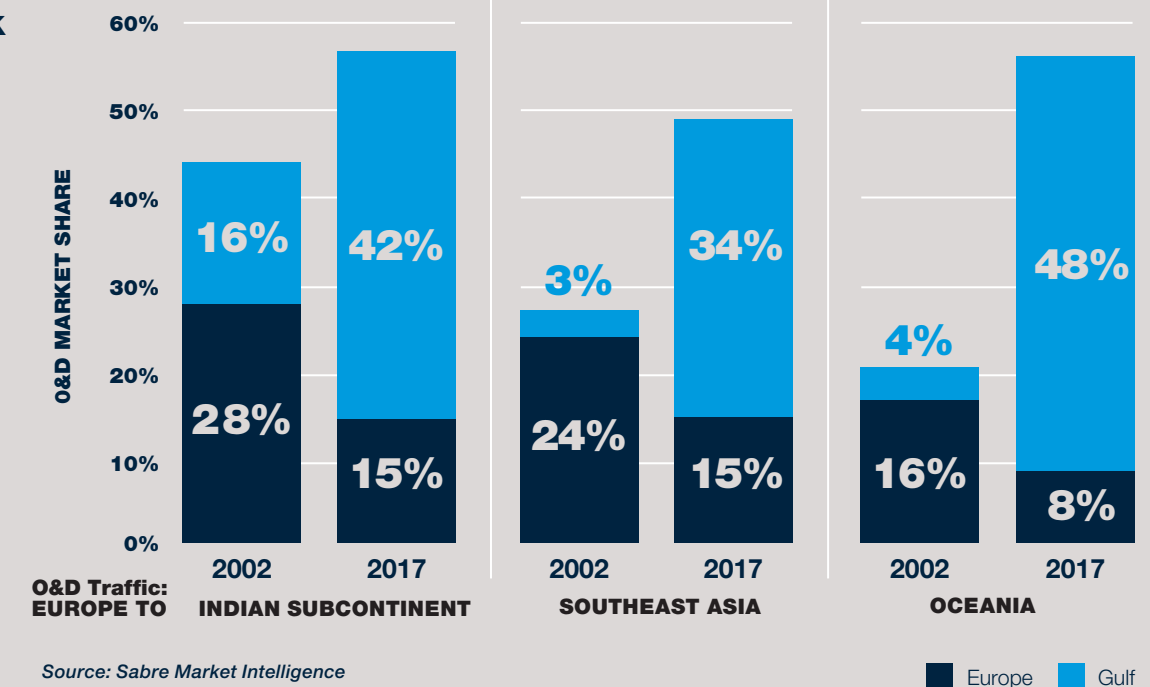
THE THREE LARGE NETWORK CARRIER GROUPS ARE SHIFTING INTRA-EUROPE FLYING TO THEIR LCC SUBSIDIARIES

Large European network carriers are moving increasing amounts of intra-Europe flights to their LCC subsidiaries. LCC subsidiary intra-Europe capacity for the three large European network carrier groups (IAG, Lufthansa Group, and Air France-KLM) has grown from 3 percent in 2002 to 36 percent in 2017. These subsidiaries help the network groups address cost disadvantages versus LCC competitors.



GULF CARRIERS HAVE CAPTURED O&D MARKET SHARE FROM EUROPEAN NETWORK CARRIERS ON KEY LONG-HAUL ROUTES

Gulf carriers Emirates, Etihad, and Qatar Airways have taken a large share of origin-and-destination (O&D) traffic from European network carriers on key long-haul routes to the Indian subcontinent, Oceania, and Southeast Asia. Combined O&D market share on these flows for the three large European network carrier groups has dropped from more than 23 percent in 2002 to under 12 percent in 2017. Gulf carrier gains are strongest on routes with favorable geography.



LATIN AMERICA

3,040 DELIVERIES



3.0%
GDP

5.9%
TRAFFIC

4.2%
FLEET

\$360B
MARKET VALUE

The economic outlook for the Latin America region continues to improve after an extended period of challenges. Among the top countries in the region, Brazil and Argentina continue their post-recession rebounds and Mexico is experiencing modest economic growth. The long-term growth prospects for Colombia, Chile, and Peru remain strong.

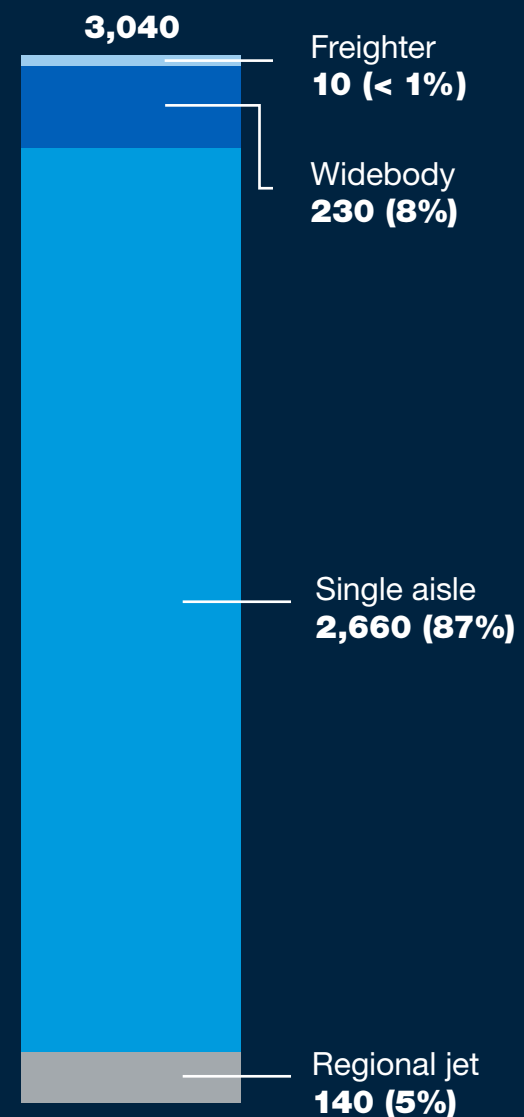
Aviation in Latin America is entering a dynamic period. The economic recovery and growth opportunities in air travel have generated renewed interest in low-cost carriers (LCC) in the region. The availability of competitive low-fare LCC flights, coupled with a larger middle-class population, fosters a shift from slower modes of transportation to air travel.

Further liberalization is on the horizon, and airlines are forming strategic relationships to take advantage of further growth. Mexico and the United States established an Open Skies agreement in 2017, and Brazil-US Open Skies approval is imminent. Numerous cross-airline joint ventures are being formed or planned. Aeroméxico and Delta Air Lines have already established a joint operating agreement under antitrust immunity, and the Brazil-US agreement is likely to pave the way for similar business arrangements. Partnerships and cross-airline equity arrangements are being formed or discussed between airlines in Latin America and other regions as well.

DELIVERIES 2018-2037

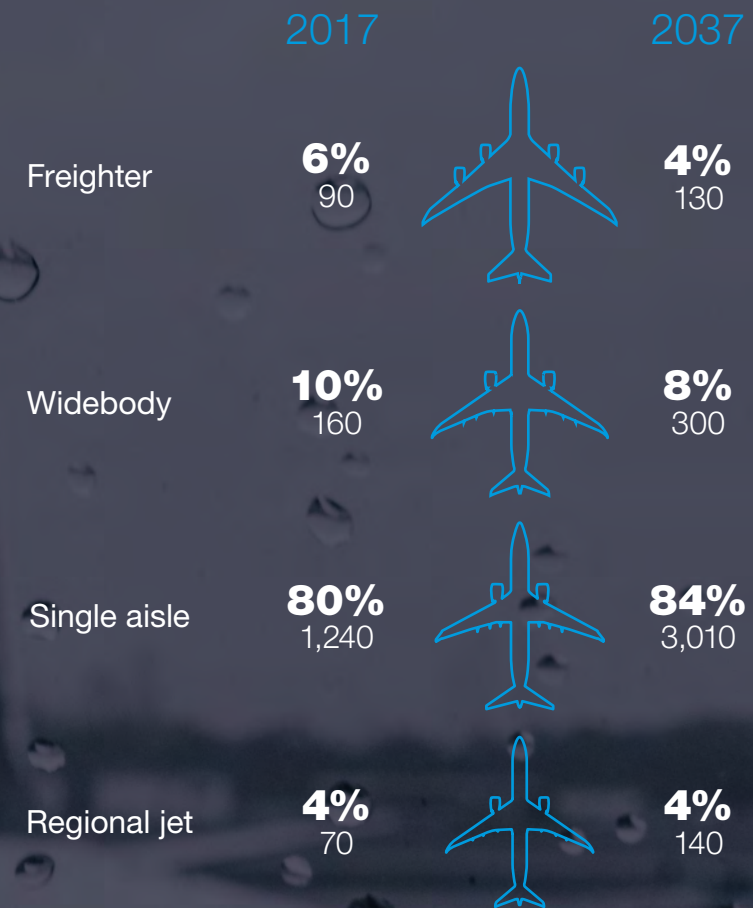
87%

Deliveries into Latin America forecast to be single-aisle airplanes, the highest percentage among all regions



FLEET COMPOSITION

The availability of single-aisle airplanes with increased capability and economics is forecast to shift the fleet mix toward the single-aisle category.

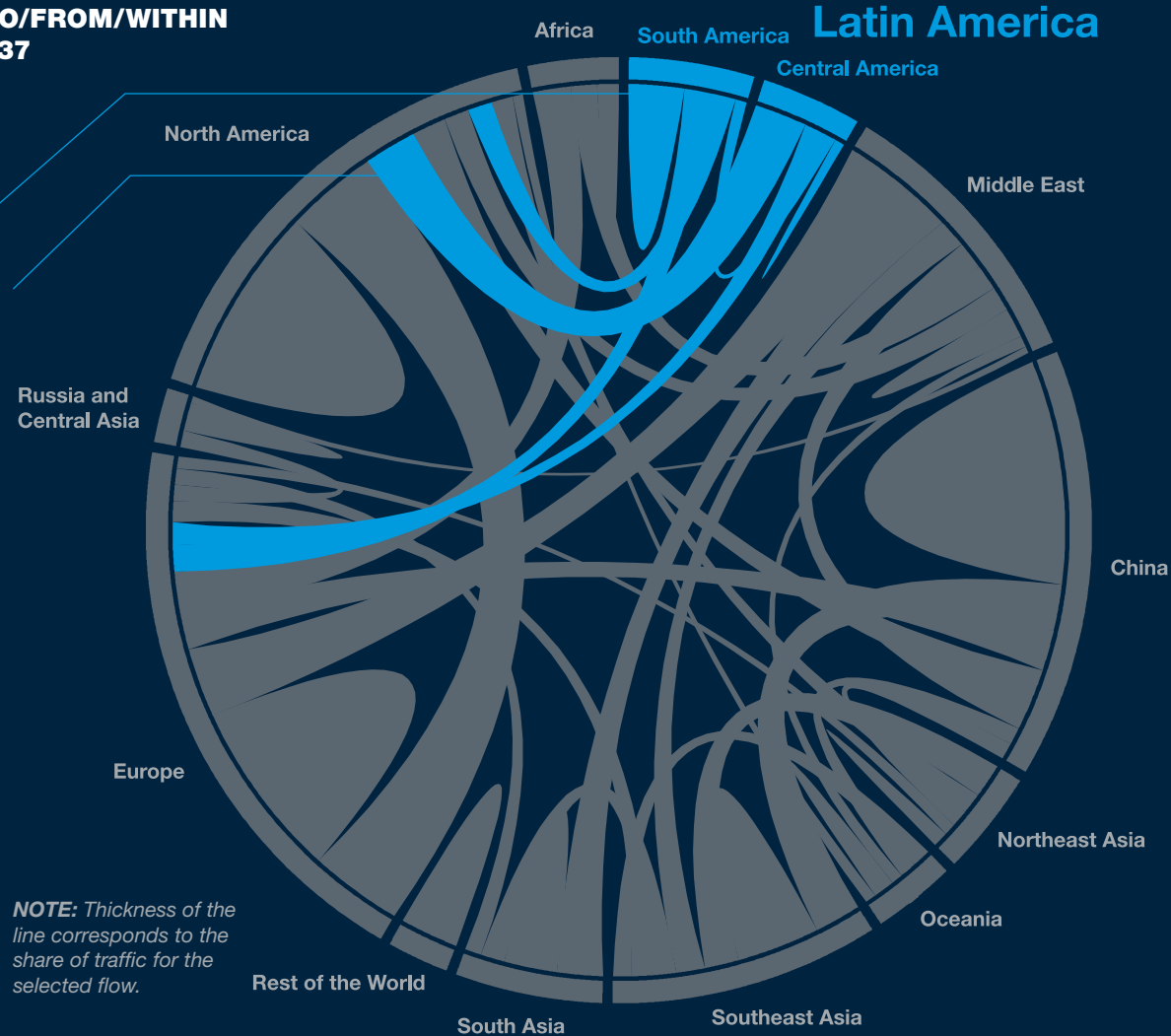


SHARE OF WORLD FLEET



TRAFFIC FORECAST TO/FROM/WITHIN LATIN AMERICA IN 2037

Traffic within South America is the largest flow and is also forecast to have the fastest growth rate. Traffic between Latin America and North America is also robust.

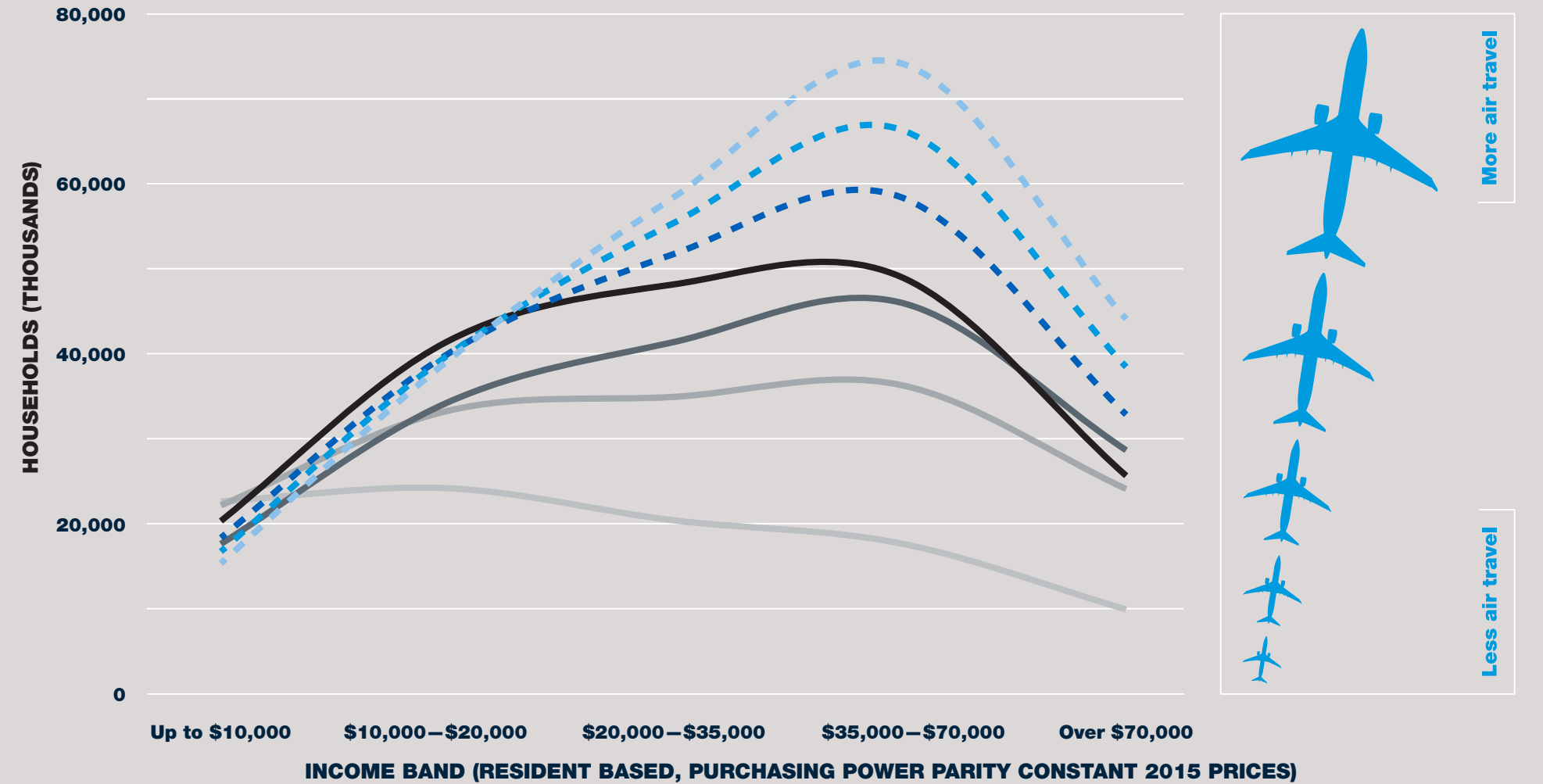


NOTE: Thickness of the line corresponds to the share of traffic for the selected flow.

Traffic Flow	Annual Growth Rate	2017 Traffic	2018–2037 Added Traffic	Forecast Growth Multiplier
Within South America	6.6%	~150	~450	3.6X
Central America–North America	5.4%	~180	~320	2.9X
Europe–South America	4.8%	~120	~130	2.5X
North America–South America	5.6%	~100	~200	3.0X
Central America–Europe	3.7%	~110	~100	2.1X

0 100 200 300 400 500 600 700 RPKs (billions)

LATIN AMERICAN HOUSEHOLDS BY INCOME BAND



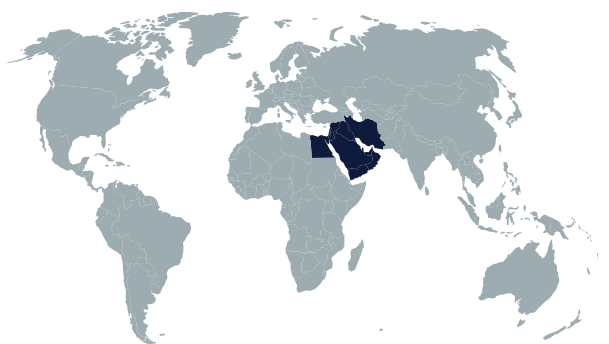
Source: Oxford Economics

Economic growth and rising income levels fuel the expansion of middle classes in many Latin American economies, which in turn leads to a rising share of the population who can afford to travel by air. Propensity for air travel increases as income levels rise.

2002 2007 2012 2017 2022 2027 2032

MIDDLE EAST

2,990
DELIVERIES



3.5%
GDP

5.2%
TRAFFIC

4.9%
FLEET

\$660B
MARKET VALUE

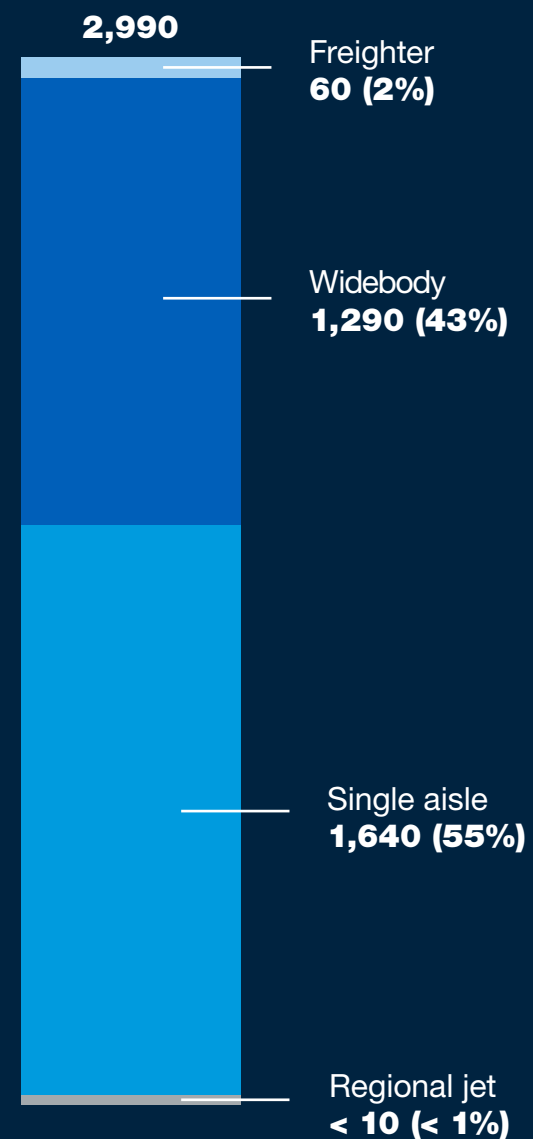
The Middle East has unique advantages and growth prospects, which position the region's airlines for resilient growth in the coming 20 years. Today, the Middle East accounts for only 3.7 percent of global GDP, while its airlines provide about 10 percent of global capacity, illustrating some of the region's advantages.

The Middle East has a centuries-old role connecting the land masses and populations of Asia, Europe, and Africa, but the region's success and growth prospects are also due to sound strategic and technological choices. Long-range airplanes enable an "anywhere to anywhere" business model founded on sixth freedom connections, which is so successful that one-third of all 777 flights now originate or depart from the Middle East. An eight-hour flight from the region's hub can reach 80 percent of the world's population, and the same boundary will also contain 70 percent of global economic growth for the next two decades.

Finally, the Middle East has many opportunities located within its own borders. A growing middle class, coupled with the buildout of low-fare airline networks, will do much to stimulate short-haul travel. Tourism is well-developed in some locations but an untapped source of potential growth in others. Pilgrimage traffic remains a strong draw, particularly as rising incomes elsewhere in the Muslim world support greater participation in the Hajj and Umrah. Opportunities both inside and outside the region support the Middle East's continued growth despite the challenges of the last year.

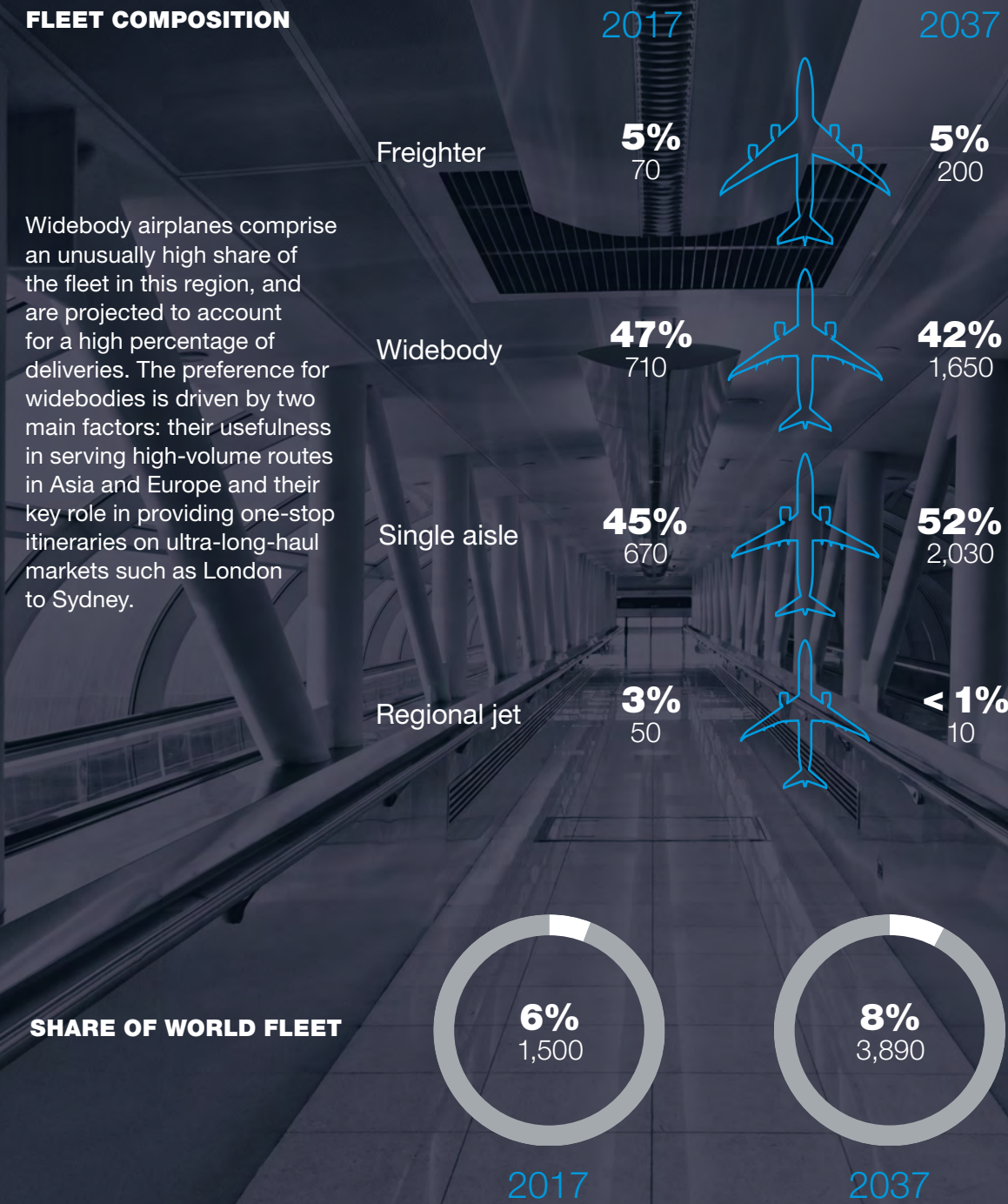
DELIVERIES 2017-2018

Of forecast deliveries, 43 percent are widebodies, the highest share of any region.

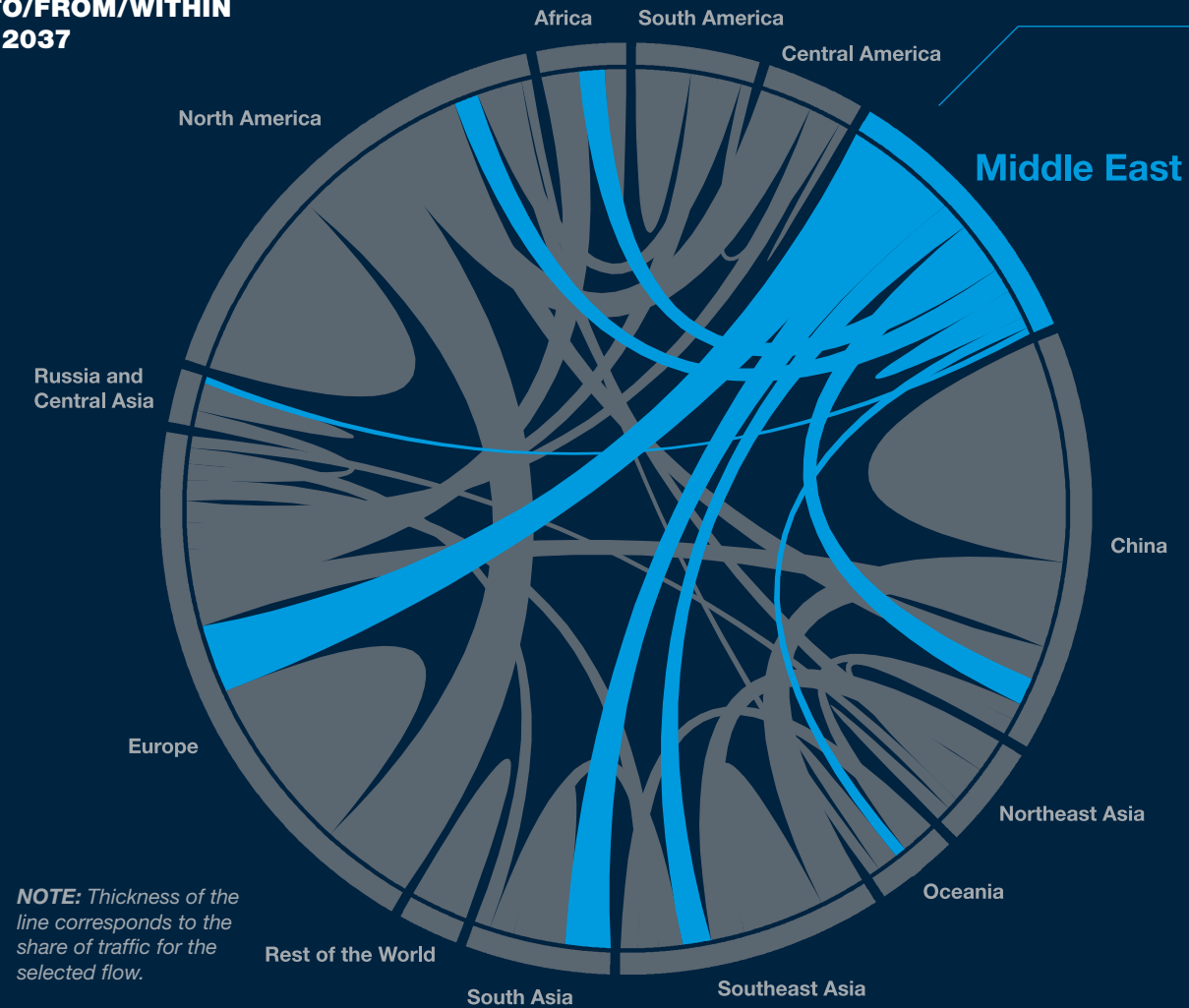


FLEET COMPOSITION

Widebody airplanes comprise an unusually high share of the fleet in this region, and are projected to account for a high percentage of deliveries. The preference for widebodies is driven by two main factors: their usefulness in serving high-volume routes in Asia and Europe and their key role in providing one-stop itineraries on ultra-long-haul markets such as London to Sydney.



TRAFFIC FORECAST TO/FROM/WITHIN THE MIDDLE EAST IN 2037



The largest interregional traffic flows for the Middle East are those to Europe, South Asia, and Southeast Asia. Middle East to China traffic is forecast to see very high growth rates, reaching six times its current size by 2037.

NOTE: Thickness of the line corresponds to the share of traffic for the selected flow.

Traffic Flow	Annual Growth Rate	2017 Traffic	2018-2037 Added Traffic	Forecast Growth Multiplier
Europe	4.8%	~150	~150	2.6X
South Asia	6.3%	~100	~200	3.4X
Within Middle East	4.9%	~100	~100	2.6X
Southeast Asia	4.8%	~100	~100	2.6X
China	9.4%	~50	~250	6.1X

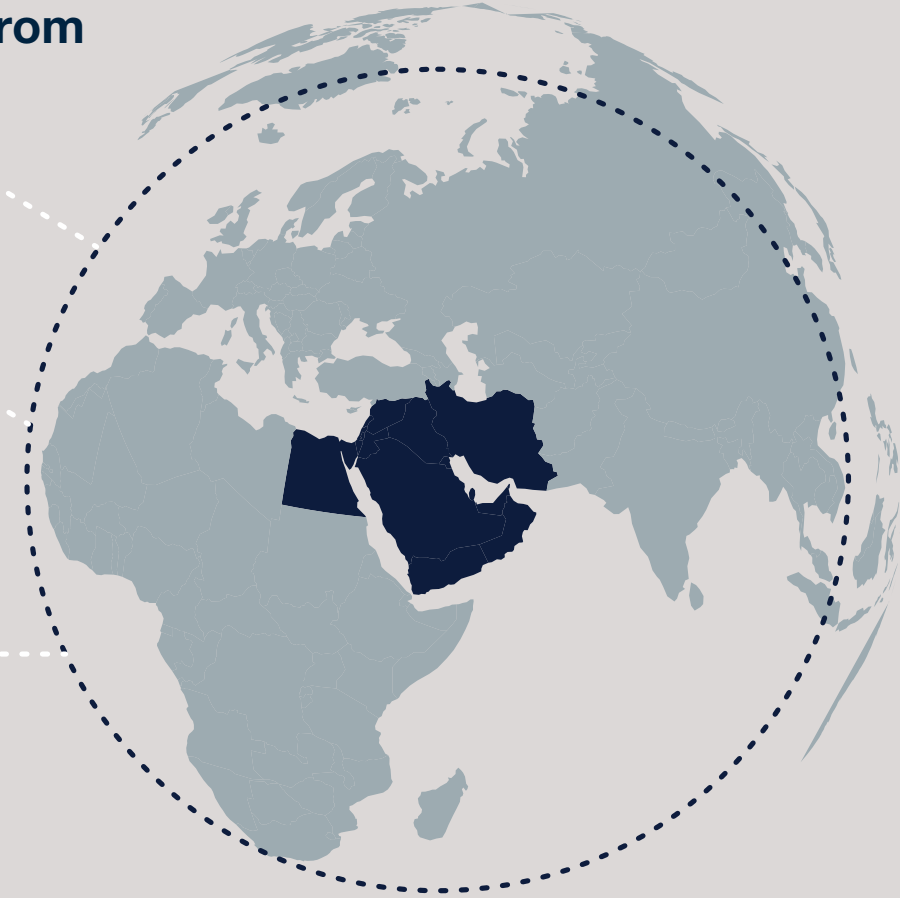
RPKs (billions)

The Middle East region is eight hours away from

65% of the global economy

70% of the 20-year economic growth

85% of the global population

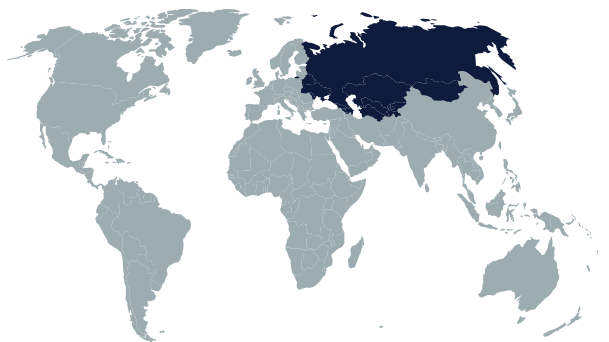


The Middle East is uniquely positioned near the center of the landmass defined by Europe, Asia, and Africa. This position offers the region's airlines the opportunity to build balanced connecting hubs, connecting north and south, east and west, in a way that is difficult to duplicate from locations on the periphery of the landmass. From any given point in the network, there will be many more on the far side of each hub, and this transfer traffic provides a solid foundation on which to build the region's aviation industry.

Exposure to fast-growing markets in Asia is also an advantage, as the Middle East is exceptionally well-positioned to connect these markets to destinations in Europe and Africa.

RUSSIA AND CENTRAL ASIA

1,290 DELIVERIES



2.0%
GDP

3.9%
TRAFFIC

2.6%
FLEET

\$150B
MARKET VALUE

The economies of Russia and the neighboring countries in Central Asia continue to gradually recover after a challenging two-year period. Russia's economy is dominant in the region, providing more than 70 percent of GDP, followed by Ukraine and Kazakhstan. Russia also represents the largest population base, with nearly one-half of the people in the region.

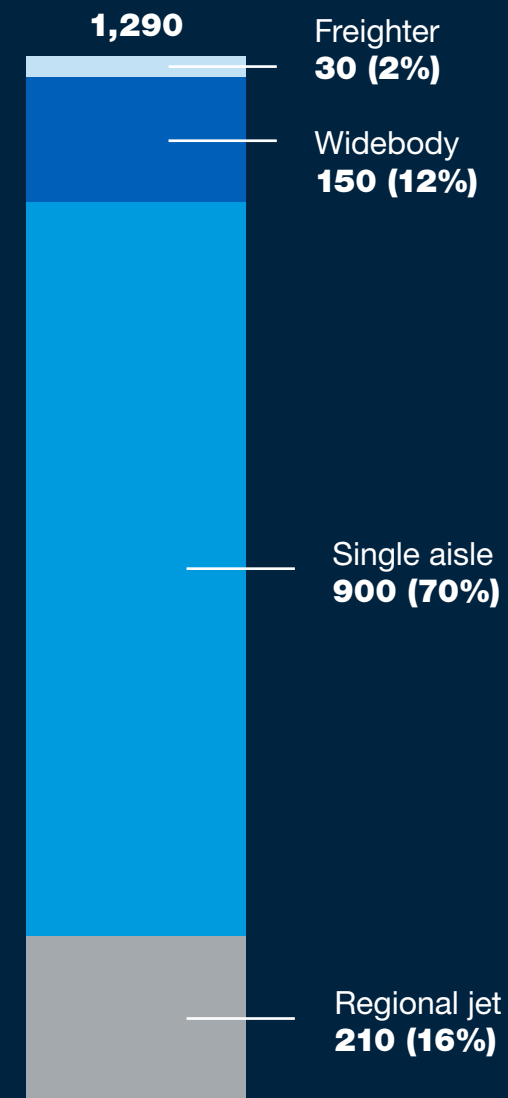
Russia covers a vast geographic area, stretching from Kaliningrad in the west to the Bering Strait in the east, and spanning 11 time zones. Population and air services are heavily concentrated around Moscow, eastern and southern Russia, and Central Asia, representing more than 75 percent of total capacity flown within the overall region. These demographic and regional characteristics have led to unique fleet requirements to serve a combination of shorter-haul, high-density markets as well as longer-haul routes with limited demand.

Air transport helps industries do business globally and supports tourism and investment. Most arrivals to Russia and Central Asia are from Europe, followed by Asia-Pacific and the Middle East. Air cargo is also vital for the region, and freighter operators in Russia and Central Asia are well-positioned geographically to meet the growing demand between Asia, Europe, the Middle East, and Africa.

DELIVERIES 2018-2037

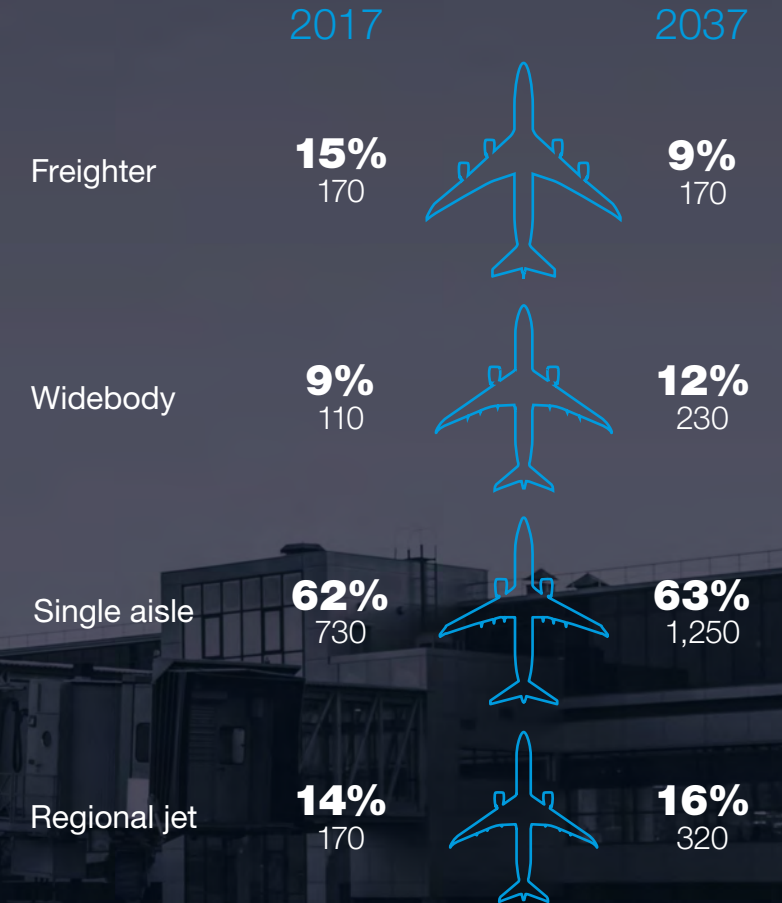
86%

Forecast to be single-aisle or regional jet deliveries

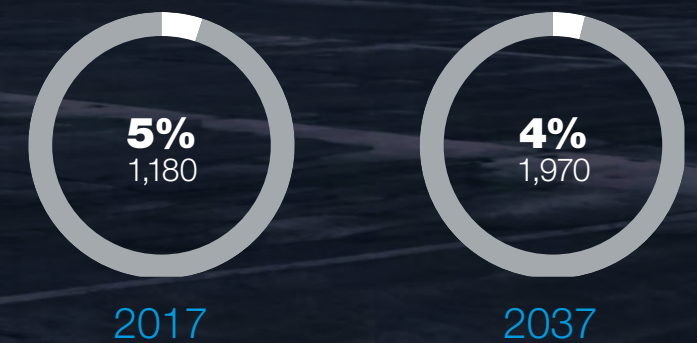


FLEET COMPOSITION

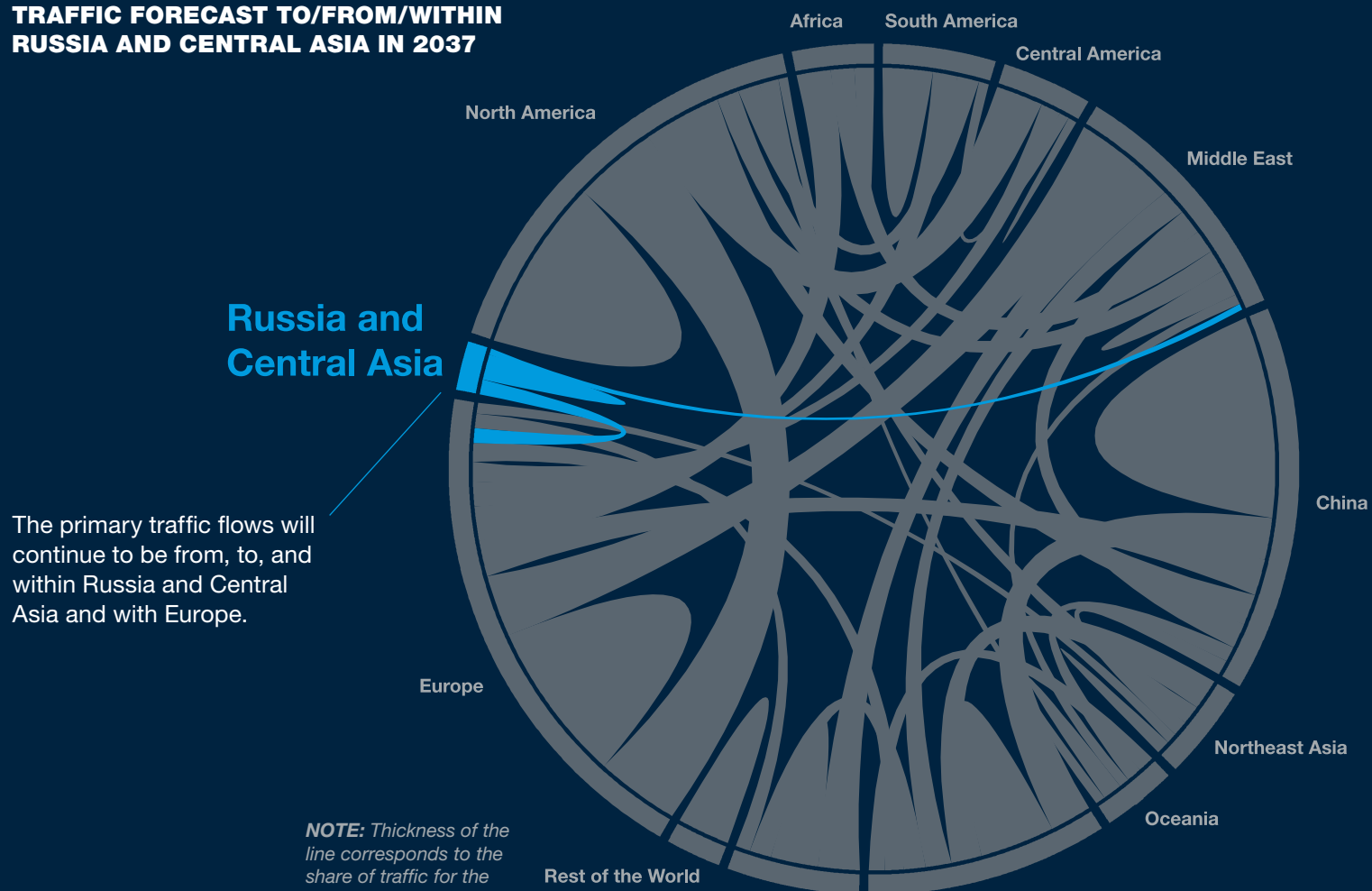
Deliveries of new airplanes contribute to shifts in the fleet mix, as more productive passenger and freighter airplanes are introduced to meet demand for growth as well as replacement.



SHARE OF WORLD FLEET

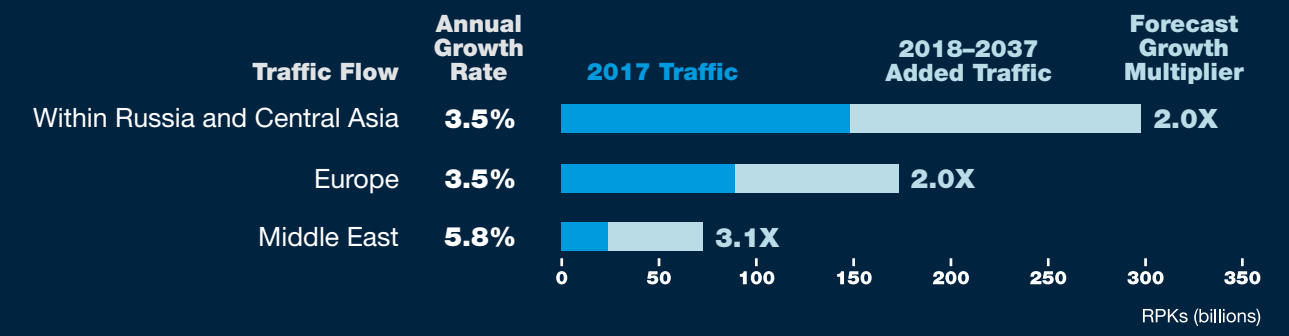


TRAFFIC FORECAST TO/FROM/WITHIN RUSSIA AND CENTRAL ASIA IN 2037



The primary traffic flows will continue to be from, to, and within Russia and Central Asia and with Europe.

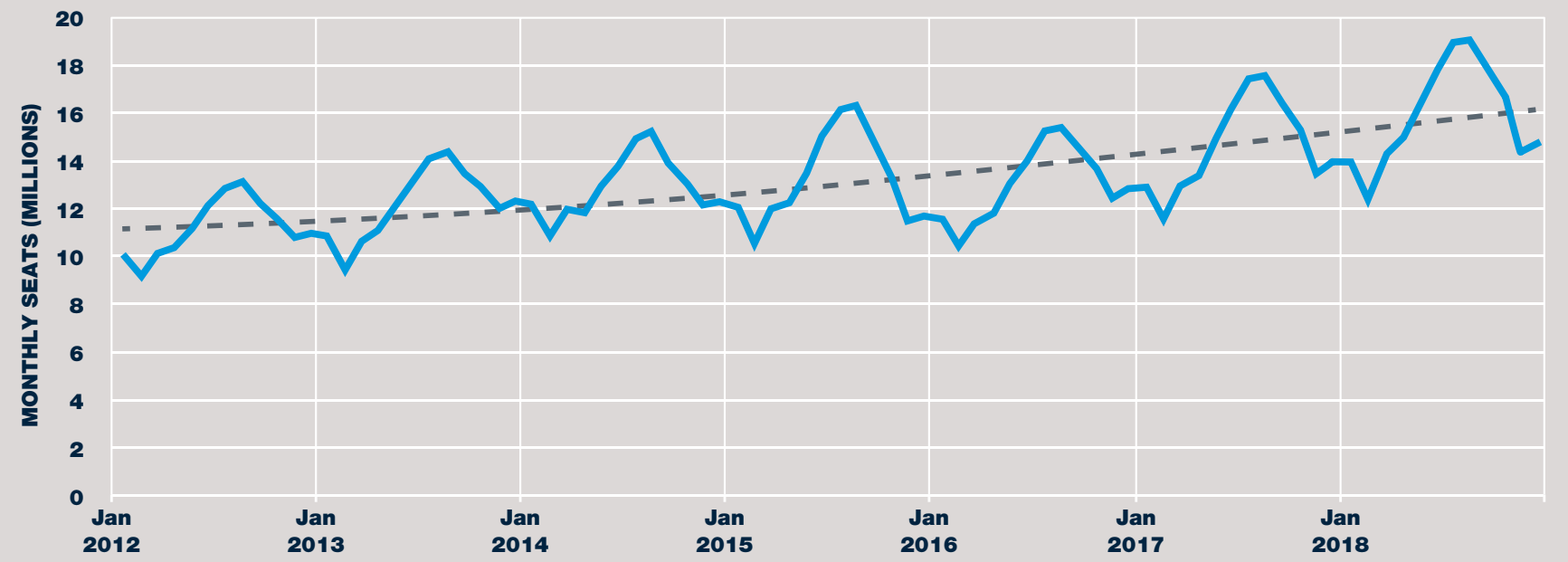
NOTE: Thickness of the line corresponds to the share of traffic for the selected flow.



COMMERCIAL MARKET OUTLOOK
2018-2037

SCHEDULE CAPACITY FROM/TO/WITHIN RUSSIA AND CENTRAL ASIA

Scheduled service fluctuates significantly to match demand between peak and non-peak periods.

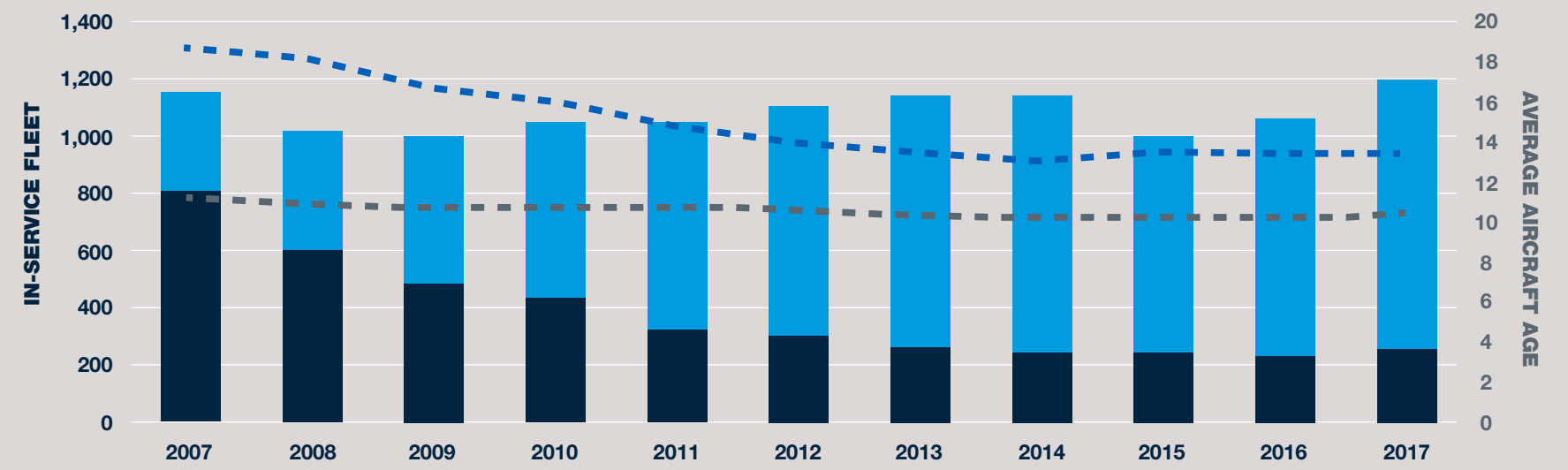


Source: Diio Mi

Monthly Seats Trend

RUSSIA AND CENTRAL ASIA FLEET MODERNIZATION

In-service fleet is now above pre-recession levels. Older airplanes have been phased out of service, and average fleet age has dropped toward world-average levels. Airlines have additional units on order to sustain this trend, including existing and new models coming forward from Russian manufacturers.

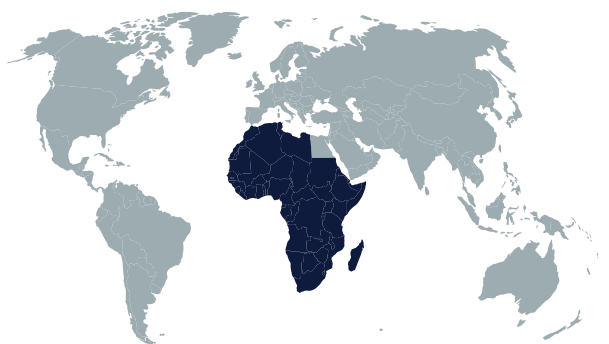


Source: FlightGlobal Flight Fleets Analyzer, Boeing Analysis

Eastern Built Western Built Average Age (Russia and Central Asia) Average Age (World)

AFRICA

1,190
DELIVERIES



3.3%
GDP

6.0%
TRAFFIC

4.4%
FLEET

\$170B
MARKET VALUE

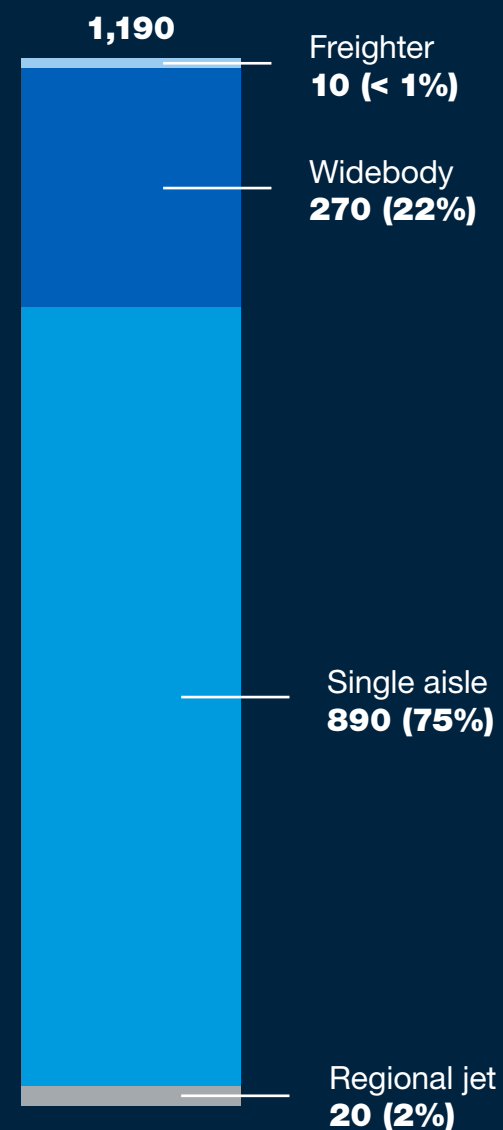
Long-term economic growth potential in Africa remains strong. Key drivers are a large and growing working-age population and continuing diversification away from historical reliance on natural resources for economic and income growth.

Above-average economic growth prospects are not the only factor driving Africa's above-world-average traffic growth forecast. Major countries on the continent recognize the value of aviation in boosting trade, expanding tourism, and growing commerce both within Africa and with the rest of the world. This understanding was reaffirmed early in 2018 as 23 nations, comprising nearly two-thirds of Africa's GDP, signed the Single African Air Transport Market initiative. The agreement paves the way for deregulation and increased harmonization of air space, which have boosted air travel growth in other regions of the world.

Africa's fleet is forecast to more than double in the next 20 years, as both new airplanes and rising productivity will accommodate above-average passenger traffic growth. Both single-aisle and widebody fleets are projected to double as the continent boosts both intracontinental and intercontinental connectivity.

DELIVERIES 2018-2037

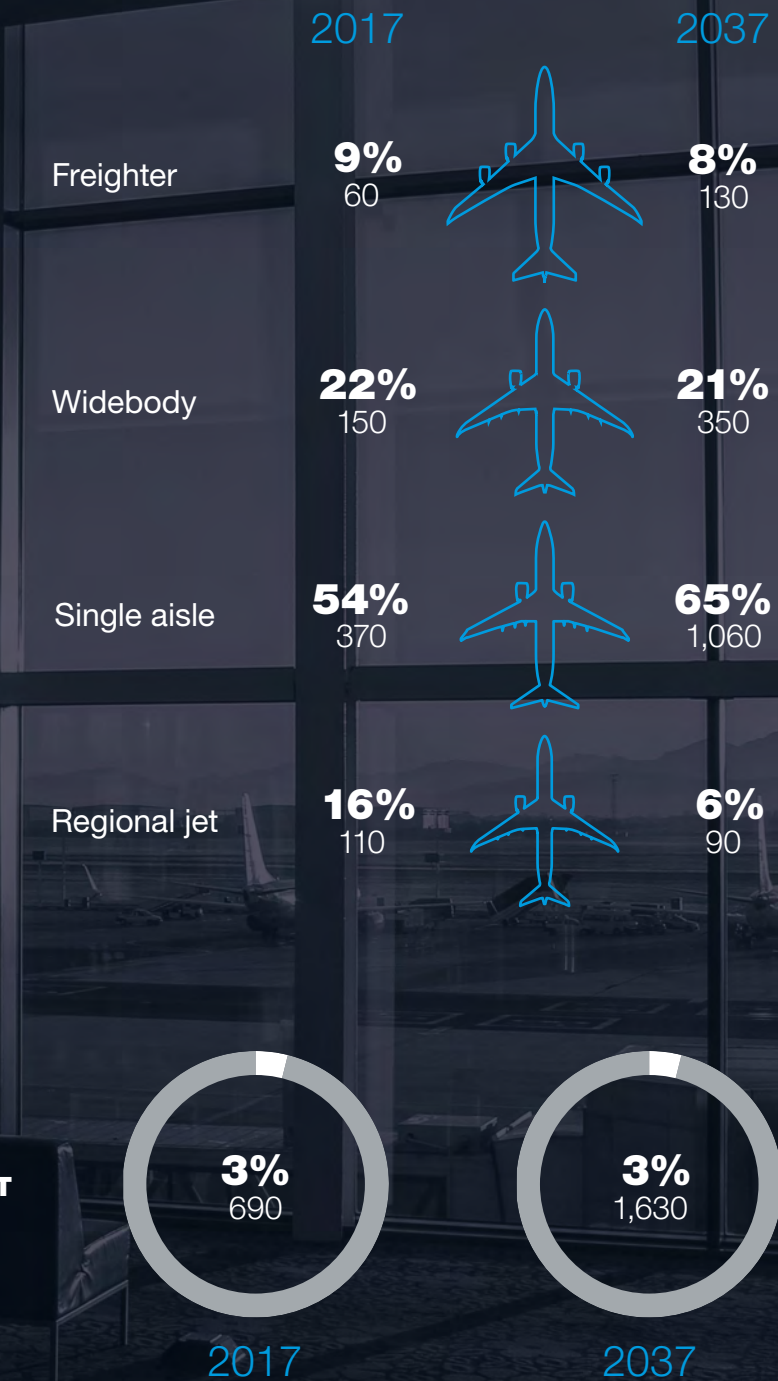
3/4 of new deliveries are forecast to be single aisle, providing growth options on many routes in the top three African flows: intra-Africa, to and from Europe, and to and from the Middle East.



FLEET COMPOSITION

Africa's small widebody fleet is forecast to triple in the next two decades, while larger widebody deliveries will mainly be for replacement of the existing fleet. The difference reflects broader market trends of fragmentation in widebody markets, with more capable and economical aircraft available today.

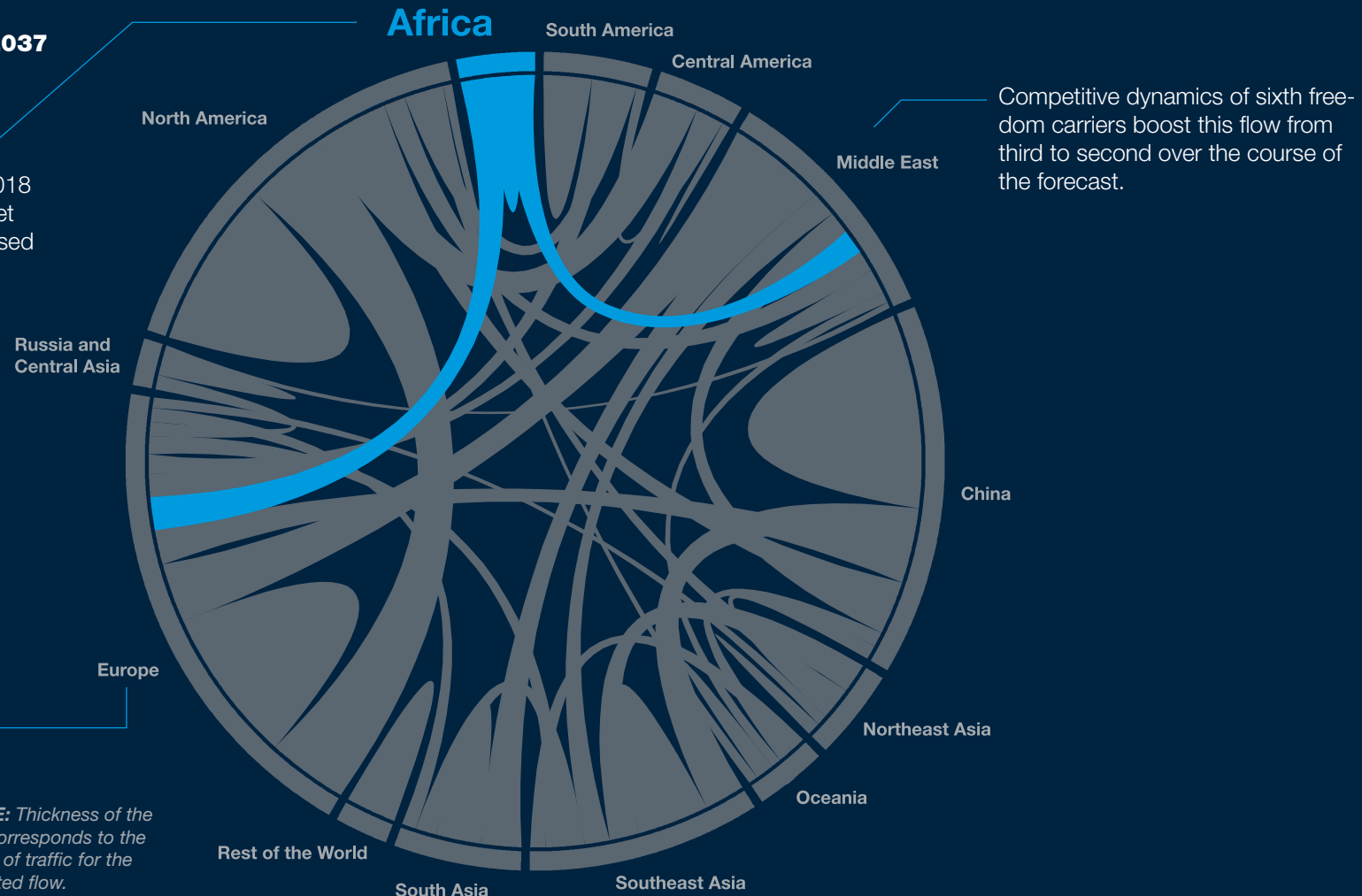
New or newer airplanes will replace almost 90 percent of Africa's fleet in the next 20 years. In the last decade, the average fleet age in Africa has declined by roughly four years. However, the fleet overall is still about four years older than the world average.



TRAFFIC FORECAST TO/FROM/WITHIN AFRICA IN 2037

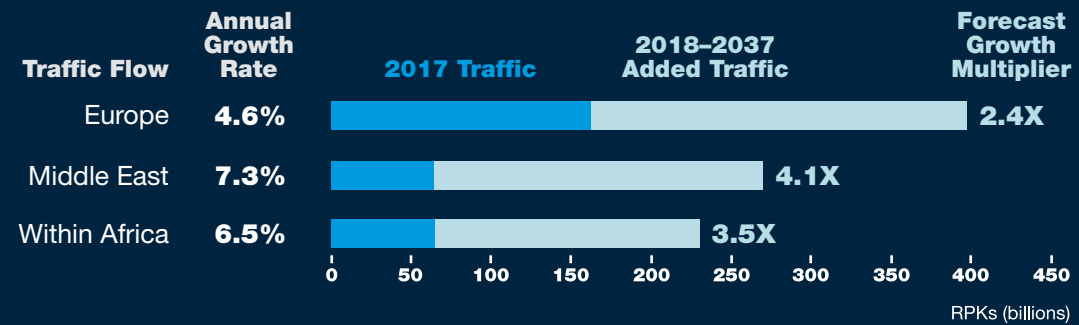
Liberalization benefits from the 2018 Single African Air Transport Market initiative promise to deliver increased competition and service in some intra-Africa routes.

This flow is forecast to remain the largest during the next 20 years because of strong cultural and commerce links as well as leisure demand. As European low-cost carriers have looked for new growth opportunities, African destinations have become more popular. The new service and lower fares have stimulated traffic.

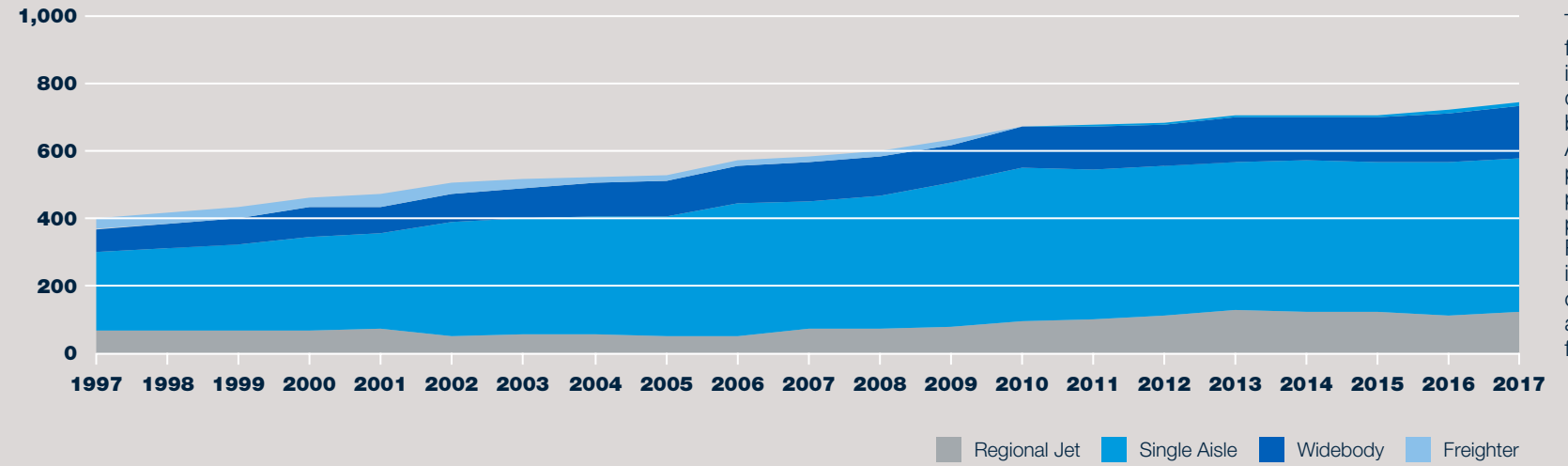


Competitive dynamics of sixth freedom carriers boost this flow from third to second over the course of the forecast.

NOTE: Thickness of the line corresponds to the share of traffic for the selected flow.



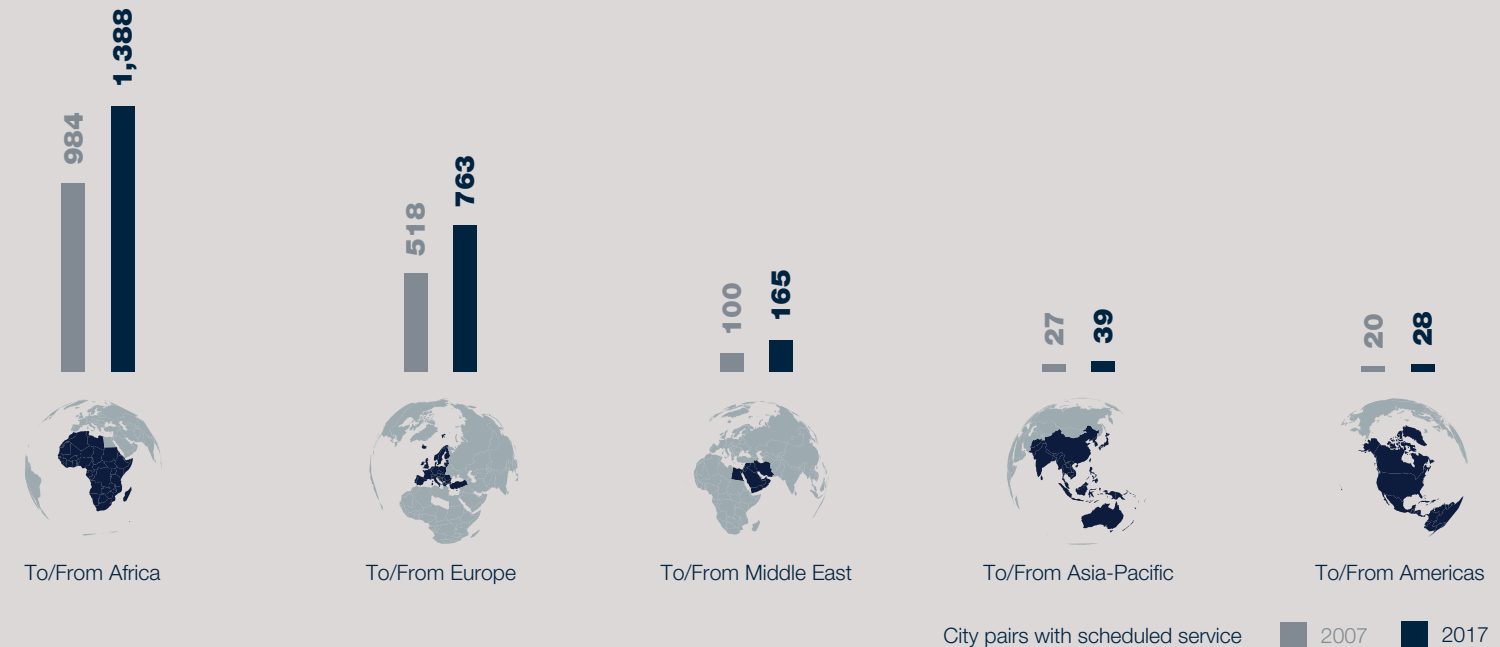
SINGLE AISLE COMPRISES 2/3 OF AFRICAN FLEET GROWTH DURING LAST TWO DECADES



The African domiciled fleet has almost doubled in size in the past two decades, primarily driven by single-aisle airplanes. Airlines have also increased productivity (traffic carried per airplane) by almost 20 percent in the last five years. Rising productivity levels indicate increasing competitiveness and are a long-term positive for fleet growth in the region.

Source: OAG, FlightGlobal

INCREASING AFRICA AIR CONNECTIVITY



Africa's network connectivity has increased by an average of 4 percent per year in the last decade. The number of airports with scheduled passenger service has grown by one-quarter, with many governments on the continent investing in aviation infrastructure.

FORECAST METHODOLOGY

Boeing publishes the Commercial Market Outlook (CMO) on an annual basis to measure the effect of new or significant trends developing in the aviation industry and their resulting impact on future aircraft demand. The CMO is a top-down, bottom-up forecast that matches passenger and cargo traffic demand with a corresponding level of capacity. The CMO produces a long-range fleet forecast of at least 180 global airlines that includes all passenger jet aircraft in commercial service that have more than 30 seats.

The forecasting process begins with the creation of a capacity forecast for the next 20 years. Global- and country-level economics are considered during the development process, but recently other forces, including the rapid global expansion of low-cost carriers and regional variations, contribute significantly to the capacity forecast.

AIR TRAVEL DEMAND FACTORS

The CMO is a long-term, noncyclical forecast that looks beyond short-term shocks to address underlying trends in the aviation industry.

Travel demand is forecast for 63 intraregional and interregional traffic flows. Different flows have different drivers and are therefore modeled differently. For example, some flows may emphasize development GDP per capita (economic activity) while others may be influenced by local market factors such as industry consolidation.

Many factors can influence air travel growth in a market. Generally, these factors can be grouped into one of three categories: economic activity, ease of travel, and local market factors. Some factors that drive demand, such as GDP, are easy to quantify. Other factors are more difficult to quantify but can have an even greater effect on market performance. When such factors are present, other information sources (e.g., expert opinion or analogies to other markets) must be harnessed to create a meaningful forecast.

ECONOMIC ACTIVITY

Economic activity is the most easily understood and quantified. Key factors include:

- > Country and regional GDP development.
- > Population and per capita income trends.
- > Labor-force composition.
- > International trade, economic, and investment links.

EASE OF TRAVEL

While economic indicators have strong explanatory power in some markets, there is a risk that regression of traffic on economic variables can overstate the importance of economic drivers, because in these markets another set of factors is

changing at the same time. In many cases, these influencers are related to ease of travel.

Ease of travel can improve in many ways. Some of the more common examples include

- > More open air services agreements between countries.
- > Liberalized domestic market regulation.
- > Emerging technology (e.g., new airplanes enable new routes).
- > Business-model innovation (e.g., low-cost airlines driving down fares).
- > Airline network improvements (e.g., new nonstop city pairs, greater frequencies).

LOCAL MARKET ATTRIBUTES

Finally, influencing factors may be present in local markets that are unrelated to macro-economic trends or ease of travel. The impact of these factors on a market can be considerable. One notable example: From 2009 to 2015, the US domestic market saw essentially no airline capacity growth. Given that load factors were already high, very little headroom was left for traffic growth. Therefore, traffic growth during that period was anemic, while the economy as a whole grew by 13 percent. Consolidation of the US airline industry during that time contributed to the disconnect, as did the reluctance of US airlines to increase capacity in a time of high fuel prices. Those factors were not replicated in a similar combination anywhere else in the world.

Demand changes as countries develop economically. Emerging markets throughout the world show that air travel is one of the first discretionary expenditures added as consumers join the global middle class. As emerging market demand starts to develop, it may take the form of nonscheduled services to leisure destinations. Later, the same demand may migrate to scheduled services of low-fare carriers or to network airlines.

In developed markets, demand for essential travel has largely been met, so growth comes mainly from discretionary travel. GDP per capita matters less in these market contexts. Factors such as the availability of vacation time and funds needed to travel, consumer confidence, service pricing, and service quality (e.g., the availability of nonstop flights) tend to have a greater impact.

Within a given region, propensity to travel, measured in trips or in revenue passenger-kilometers, generally increases with per capita income. This increase varies considerably. Generally, markets that are more open are more responsive to changes in per capita income because airlines are freer to add routes, frequencies, and seats to capture demand. In a more regulated environment, demand may increase with GDP per capita, but lower service quality and higher pricing may restrain travel growth. Geography may also influence travel within a region, with island geographies or poorly connected land masses necessitating more air travel than might otherwise be the case.



BOEING

AIRPLANE DEMAND

The product forecast phase is the final step of the process. With detailed knowledge of airlines' current fleets and short-term fleet plans, inclusive of seating configurations, aircraft utilization, fleet retirement schedules, and a sold-aircraft backlog, a base is established to assign current production or future aircraft products to an airline's long-term fleet. Again, several factors are considered during this phase, including an airline's strategy and brand as well as its current and future route network, and matching those with the appropriate aircraft product that maximizes profitability and capability. The capacity of the incoming and existing fleets must equal the total capacity targets for each participating regional flow and time period.

USING THE FORECAST

Boeing utilizes the outputs of the forecast process to make key business decisions, including the market demand changes for existing aircraft, market demand for future aircraft product scenarios, and future production capacity and personnel planning. Boeing also uses the forecast to encourage alignment in how industry stakeholders, including governments, regulatory bodies, suppliers, and airlines, view the aviation industry and its prospects.

APPENDIX

AIRPLANES FORECAST ON A PAGE

	Asia-Pacific	North America	Europe	Latin America	Middle East	Russia & Central Asia	Africa	World
World economy (GDP) %	3.9%	2.0%	1.7%	3.0%	3.5%	2.0%	3.3%	2.8%
Airline traffic (RPK) %	5.7%	3.1%	3.8%	5.9%	5.2%	3.9%	6.0%	4.7%
Airplane fleet %	4.6%	1.8%	3.0%	4.2%	4.9%	2.6%	4.4%	3.5%
MARKET SIZE								
Deliveries	16,930	8,800	8,490	3,040	2,990	1,290	1,190	42,730
Market value (\$B)	2,670	1,100	1,240	360	660	150	170	6,350
Average value (\$M)	160	130	150	120	220	120	140	150
Unit share	40%	21%	20%	7%	7%	3%	3%	100%
Value share	42%	17%	20%	6%	10%	2%	3%	100%
DELIVERIES								
Regional jet	240	1,590	120	140	< 10	210	20	2,320
Single aisle	12,570	5,840	6,860	2,660	1,640	900	890	31,360
Widebody	3,810	920	1,400	230	1,290	150	270	8,070
Freighter	310	450	110	10	60	30	10	980
TOTAL	16,930	8,800	8,490	3,040	2,990	1,290	1,190	42,730
MARKET VALUE (\$B)								
Regional jet	10	70	10	10	< 5	10	<5	110
Single aisle	1,410	650	770	290	180	90	100	3,480
Widebody	1,160	260	420	70	460	40	70	2,480
Freighter	90	120	40	<5	20	10	<5	280
TOTAL	2,670	1,100	1,240	360	660	150	170	6,350
2017 FLEET								
Regional jet	150	1,730	260	70	50	170	110	2,540
Single aisle	5,270	3,970	3,450	1,240	670	730	370	15,700
Widebody	1,600	660	900	160	710	110	150	4,290
Freighter	340	850	290	90	70	170	60	1,870
TOTAL	7,360	7,210	4,900	1,560	1,500	1,180	690	24,400
2037 FLEET								
Regional jet	280	1,590	120	140	10	320	90	2,550
Single aisle	12,880	6,650	6,670	3,010	2,030	1,250	1,060	33,550
Widebody	3,930	1,050	1,670	300	1,650	230	350	9,180
Freighter	1,110	1,100	420	130	200	170	130	3,260
TOTAL	18,200	10,390	8,880	3,580	3,890	1,970	1,630	48,540

NOTE: Market Value in 2017 catalog prices

SERVICES FORECAST ON A PAGE, 2018–2037

	Asia-Pacific	North America	Europe	Middle East	Latin America	Russia & Central Asia	Africa	World
Economic growth (GDP) %	3.9%	2.0%	1.7%	3.5%	3.0%	2.0%	3.3%	2.8%
Airline traffic (RPK) %	5.7%	3.1%	3.8%	5.2%	5.9%	3.9%	6.0%	4.7%
Airplane fleet (%)	4.6%	1.8%	3.0%	4.9%	4.2%	2.6%	4.4%	3.5%
MARKET SIZE (\$M)								
Corporate & External	\$46,500	\$41,400	\$36,400	\$6,850	\$7,250	\$2,600	\$2,350	\$143,350
Marketing, Planning & Customer Service	\$171,000	\$162,150	\$138,300	\$24,650	\$25,850	\$8,500	\$8,200	\$538,650
Flight Operations	\$419,300	\$242,350	\$258,400	\$77,800	\$65,850	\$27,350	\$23,550	\$1,114,600
Maintenance & Engineering	\$814,100	\$524,250	\$500,150	\$241,950	\$129,500	\$90,500	\$65,500	\$2,365,950
Ground, Station & Cargo Operations	\$1,915,450	\$879,000	\$940,150	\$391,350	\$287,750	\$135,600	\$116,950	\$4,666,250
TOTAL	\$3,366,350	\$1,849,150	\$1,873,400	\$742,600	\$516,200	\$264,550	\$216,550	\$8,828,800
GROWTH RATES								
Corporate & External	4.2%	2.1%	2.2%	4.0%	3.6%	3.2%	4.3%	3.0%
Marketing, Planning & Customer Service	6.3%	5.7%	5.4%	4.6%	5.6%	3.5%	5.5%	5.7%
Flight Operations	5.1%	2.8%	3.4%	4.6%	5.0%	3.4%	5.2%	4.1%
Maintenance & Engineering	5.1%	2.4%	3.2%	4.8%	5.1%	3.5%	5.3%	4.0%
Ground, Station & Cargo Operations	5.1%	2.7%	3.4%	4.5%	5.1%	3.0%	5.1%	4.2%
TOTAL	5.1%	2.9%	3.5%	4.6%	5.1%	3.2%	5.2%	4.2%
MARKET SIZE BY SERVICE TYPE (\$M)								
Maintenance & Engineering	\$799,950	\$499,450	\$481,500	\$241,300	\$127,300	\$90,200	\$65,100	\$2,304,800
Training & Pilot Services	\$55,550	\$22,600	\$32,950	\$13,650	\$9,050	\$5,800	\$4,350	\$143,950
Information Services	\$188,300	\$344,500	\$258,200	\$6,600	\$29,200	\$2,700	\$5,300	\$834,800
Air Traffic Management	\$31,050	\$13,100	\$15,100	\$6,250	\$4,850	\$2,400	\$1,900	\$74,650
Marketing & Planning	\$103,250	\$40,700	\$47,400	\$22,100	\$15,500	\$7,500	\$6,300	\$242,750
Cabin Services	\$307,450	\$112,600	\$145,150	\$62,650	\$47,950	\$20,850	\$17,750	\$714,400
Ground Handling	\$1,880,800	\$816,200	\$893,100	\$390,000	\$282,350	\$135,100	\$115,900	\$4,513,450
TOTAL	\$3,366,350	\$1,849,150	\$1,873,400	\$742,550	\$516,200	\$264,550	\$216,600	\$8,828,800

NOTE: Values rounded to nearest \$50M

PASSENGER TRAFFIC

REGIONAL FLOW RPKS in billions	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2027	2037	2017–2037 ANNUAL GROWTH
Africa–Africa	37.3	41.6	43.9	48.7	51.1	54.5	53.7	56.6	59.2	62.9	65.4	123.7	230.6	6.5%
Africa–Europe	125.3	125.6	128.2	135.5	134.1	140.4	140.4	146.5	153.2	153.8	163.9	264.0	399.4	4.6%
Africa–Middle East	23.1	24.9	32.9	36.4	39.4	48.6	50.8	53.7	59.5	62.5	66.2	159.3	272.0	7.3%
Central America–Central America	29.7	32.3	29.8	31.3	32.2	33.8	36.5	38.7	42.5	48.7	51.9	73.7	99.6	3.3%
Central America–Europe	80.7	83.3	77.1	73.8	73.7	78.3	82.1	87.4	95.3	104.8	112.3	166.6	230.4	3.7%
Central America–North America	106.8	115.8	104.7	112.7	114.5	132.0	138.3	153.0	170.1	180.5	190.7	364.6	550.2	5.4%
Central America–South America	11.0	13.1	14.0	18.3	19.2	23.2	28.5	30.8	34.2	35.5	37.1	65.4	118.9	6.0%
China–China	223.1	236.5	287.4	335.4	380.1	411.3	460.8	509.2	564.7	629.8	715.1	1,645.1	2,357.2	6.1%
China–Europe	91.0	82.5	77.3	82.1	94.2	96.7	96.9	105.2	121.1	132.9	141.7	288.0	421.1	5.6%
China–Middle East	8.8	11.5	14.8	19.2	21.8	26.4	30.0	34.5	37.7	43.9	47.7	143.6	290.0	9.4%
China–North America	54.5	62.7	60.9	71.4	85.4	87.1	89.5	98.1	107.5	119.1	132.0	240.4	360.7	5.2%
China–Northeast Asia	49.3	48.4	43.2	51.8	51.5	60.9	60.7	66.2	73.0	81.0	78.6	135.9	173.7	4.0%
China–Oceania	19.4	21.4	22.8	27.4	31.4	34.1	35.0	37.7	44.3	55.4	66.8	120.5	178.1	5.0%
China–Southeast Asia	49.3	50.6	45.3	54.7	63.0	73.8	82.5	89.4	109.9	127.0	144.4	258.3	488.1	6.3%
Europe–Europe	634.2	660.5	624.9	640.2	659.5	676.6	714.0	760.3	796.8	859.4	930.6	1,408.4	1,879.2	3.6%
Europe–Middle East	106.6	115.2	131.2	143.8	153.3	178.0	196.8	210.9	242.5	260.1	280.2	480.5	721.3	4.8%
Europe–North America	420.6	432.4	405.4	418.6	430.2	432.9	441.8	462.7	475.0	499.7	537.9	756.4	970.2	3.0%
Europe–Northeast Asia	67.9	69.0	59.4	64.3	63.8	75.9	74.3	77.8	81.3	78.4	81.3	104.6	123.9	2.1%
Europe–Russia & Central Asia	45.4	42.9	45.8	55.3	67.3	75.2	84.0	86.7	78.9	74.2	87.7	133.6	173.1	3.5%
Europe–South America	70.7	75.2	79.3	82.9	89.8	99.6	102.4	102.1	104.4	107.4	112.1	180.1	285.8	4.8%
Europe–South Asia	58.5	55.5	51.3	53.8	54.1	53.9	56.4	57.2	57.5	58.3	60.9	100.7	168.9	5.2%
Europe–Southeast Asia	96.8	101.5	95.9	97.1	100.4	106.6	105.3	108.0	111.3	111.8	115.3	164.8	218.5	3.2%
Middle East–Middle East	60.3	63.4	68.6	77.9	82.4	76.5	86.3	91.7	102.2	116.1	120.4	209.7	313.3	4.9%
Middle East–North America	23.4	29.5	41.6	45.7	50.3	57.1	63.2	73.7	88.3	98.8	100.9	179.0	259.9	4.8%
Middle East–Oceania	13.2	16.1	19.7	24.5	26.7	31.4	33.3	36.1	37.4	41.5	47.8	79.8	116.5	4.5%
Middle East–Russia & Central Asia	8.4	8.3	9.1	11.3	14.1	16.1	19.0	20.6	19.6	19.2	23.4	49.1	72.3	5.8%
Middle East–South Asia	46.5	49.5	64.8	75.1	83.0	87.3	95.1	100.5	114.4	129.8	140.8	294.1	481.4	6.3%
Middle East–Southeast Asia	41.1	45.4	46.7	56.3	61.3	66.4	79.0	89.4	97.6	109.0	118.0	205.6	301.8	4.8%
North America–North America	1,022.4	974.1	915.1	946.3	976.3	984.7	998.4	1,029.9	1,077.7	1,120.1	1,164.7	1,528.1	2,016.2	2.8%
North America–Northeast Asia	143.7	139.4	120.2	128.4	135.4	149.0	150.4	154.0	160.5	168.2	178.4	204.5	225.1	1.2%
North America–Oceania	32.1	32.3	34.8	34.9	38.3	40.3	43.1	43.3	48.3	53.4	55.1	88.4	112.3	3.6%
North America–South America	52.1	52.7	56.9	60.9	66.7	72.0	79.2	82.7	86.9	83.2	85.6	161.6	254.2	5.6%
Northeast Asia–Northeast Asia	88.8	84.9	81.9	84.6	81.9	92.6	103.9	107.6	112.5	116.8	123.3	152.1	159.4	1.3%
Northeast Asia–Southeast Asia	86.3	87.7	74.3	79.6	92.3	104.9	113.3	124.2	134.6	143.9	159.7	236.7	355.9	4.1%
Oceania–Oceania	74.4	72.0	73.3	78.4	83.8	92.0	99.0	100.0	102.8	105.3	106.0	159.9	225.6	3.8%
Oceania–Southeast Asia	52.4	57.4	54.7	61.1	66.9	71.5	77.8	83.2	80.0	83.5	86.1	135.0	192.7	4.1%
Russia & Central Asia–Russia & Central Asia	80.8	88.9	76.9	87.6	103.1	107.1	118.3	125.3	138.1	134.9	148.3	215.5	296.3	3.5%
South America–South America	83.1	81.6	86.9	115.8	134.4	141.9	147.4	155.7	159.1	156.8	161.6	317.6	585.2	6.6%
South Asia–South Asia	36.3	40.1	43.8	49.5	58.6	63.8	68.1	71.4	79.2	97.0	114.4	284.2	557.4	8.2%
Southeast Asia–South Asia	20.6	24.3	21.9	28.5	29.2	34.0	36.2	38.4	40.4	44.6	50.7	127.4	252.9	8.4%
Southeast Asia–Southeast Asia	93.4	93.2	96.0	113.1	130.7	145.1	166.6	176.9	194.0	212.3	228.2	487.3	870.9	6.9%
Rest of World	92.4	96.3	101.7	124.4	136.9	151.4	159.9	168.9	170.9	183.0	202.3	385.3	612.2	5.7%
GRAND TOTAL	4,561.9	4,639.2	4,564.2	4,938.7	5,262.2	5,585.0	5,898.0	6,246.0	6,664.5	7,104.3	7,635.3	12,879.0	18,972.3	4.7%

AIRPLANE MARKET SECTORS

PASSENGER AIRPLANES

REGIONAL JETS	SINGLE-AISLE AIRPLANES		WIDEBODY AIRPLANES
Antonov An-148, -158	Boeing 707	BAe 146-300, Avro RJ100	Boeing 747
AVIC ARJ-700	Boeing 717	Bombardier CRJ1000	Boeing 767
Avro RJ70, RJ85	Boeing 727	Embraer 190, 190-E2, 195, 195-E2	Boeing 777, 777X
BAe 146-100, -200	Boeing 737-100 through -600	COMAC C919	Boeing 787
Bombardier CRJ	Boeing 737-700, -800, -900ER	Fokker 100	Boeing/MDC DC-10
Dornier 328JET	Boeing 737 MAX 7, MAX 8, MAX 9, MAX 10	UAC MS 21-200/300	Boeing/MDC MD-11
Embraer ERJ-135/140/145	Boeing 757	Ilyushin Il-62	Airbus A300, A310
Embraer 170, 175, 175-E2	Boeing/MDC DC-9	Tupolev TU-154, -204, -214	Airbus A330
Fokker 70, F28	Boeing/MDC MD-80, -90	Yakovlev Yak-42	Airbus A340
Mitsubishi MRJ	Airbus A220, A318, A319, A320, A321		Airbus A350
Sukhoi Superjet 100	Airbus A319neo, A320neo, A321neo		Airbus A380
Yakovlev Yak-40			Lockheed L-1011
			Ilyushin Il

NOTE: Airplanes in bold are in production or launched

FREIGHTER AIRPLANES

STANDARD BODY	MEDIUM WIDEBODY	LARGE WIDEBODY
Boeing 707	Boeing 767	Boeing 747-100 through -400
Boeing 727	Boeing/MDC DC-10	Boeing 747-8F
Boeing 737	Airbus A300	Boeing 777
Boeing 757-200	Airbus A310	Boeing/MDC MD-11
Boeing/MDC MD-80	Airbus A330	Airbus A350
Boeing/MDC DC-8/9	Lockheed L-1011SF	Ilyushin Il-96T
Bombardier CRJ	Ilyushin Il-76TD	Antonov An-124
Airbus A320, A321		
BAe 146		
Tupolev Tu-204		

*NOTE: Standard-body < 45 tonnes, medium widebody 40–80 tonnes, large freighter > 80 tonnes
Production and conversion (SF) models assumed for each type unless otherwise specified*



777X

COMMERCIAL MARKET OUTLOOK 2018-2037

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