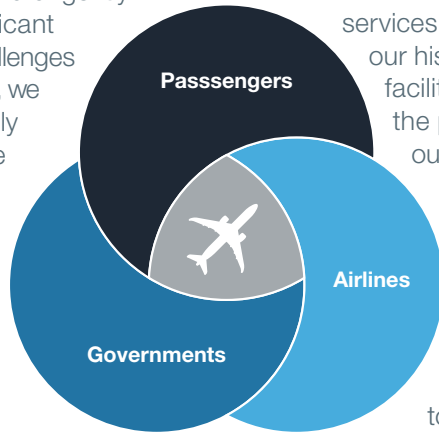




**COMMERCIAL MARKET
OUTLOOK** 2020–2039

Commercial aviation has always been a long-cycle business, and stakeholders in our industry know that it's imperative to plan for the future. This is even more true today. Our industry – a global community – is working tirelessly and diligently to manage the significant COVID-19 related challenges in front of us. At Boeing, we also are thinking deeply about the shape of the aviation market over the medium and long term, as we do annually through the Commercial Market Outlook (CMO).



Every year for nearly 60 years, through upturns, downturns and market shocks, Boeing has published the CMO to share our analysis and perspective on industry dynamics. The 2020 CMO, released months later than usual due to the pandemic, faces more near-term uncertainty than any forecast in recent memory, including CMOs released after 9/11 (2002 CMO)

and the Global Financial Crisis (2009 CMO). Providing these insights now may be even more important than during normal times.

Our decision to publish this forecast of commercial airplanes and services demand is guided by our history and our desire to facilitate dialogue around the path forward. While our industry will continue to evolve and innovate in ways we can only imagine, our Market Analysis team's deep understanding about our market, industry and customers can help to shed light on likely pathways toward recovery.

By sharing this CMO, and in conversations with our customers, suppliers and other industry stakeholders in 2020 and in the years to come, we look forward to building on this knowledge base and enabling a return to growth.



Darren Hulst

Vice President
Commercial Marketing
The Boeing Company

20-Year Market Demand

 **2,430 Deliveries**
Regional Jet

 **32,270 Deliveries**
Single Aisle

 **7,480 Deliveries**
Widebody

 **930 Deliveries**
Freighter

43,110
Global Deliveries

3.2%
Fleet
Growth

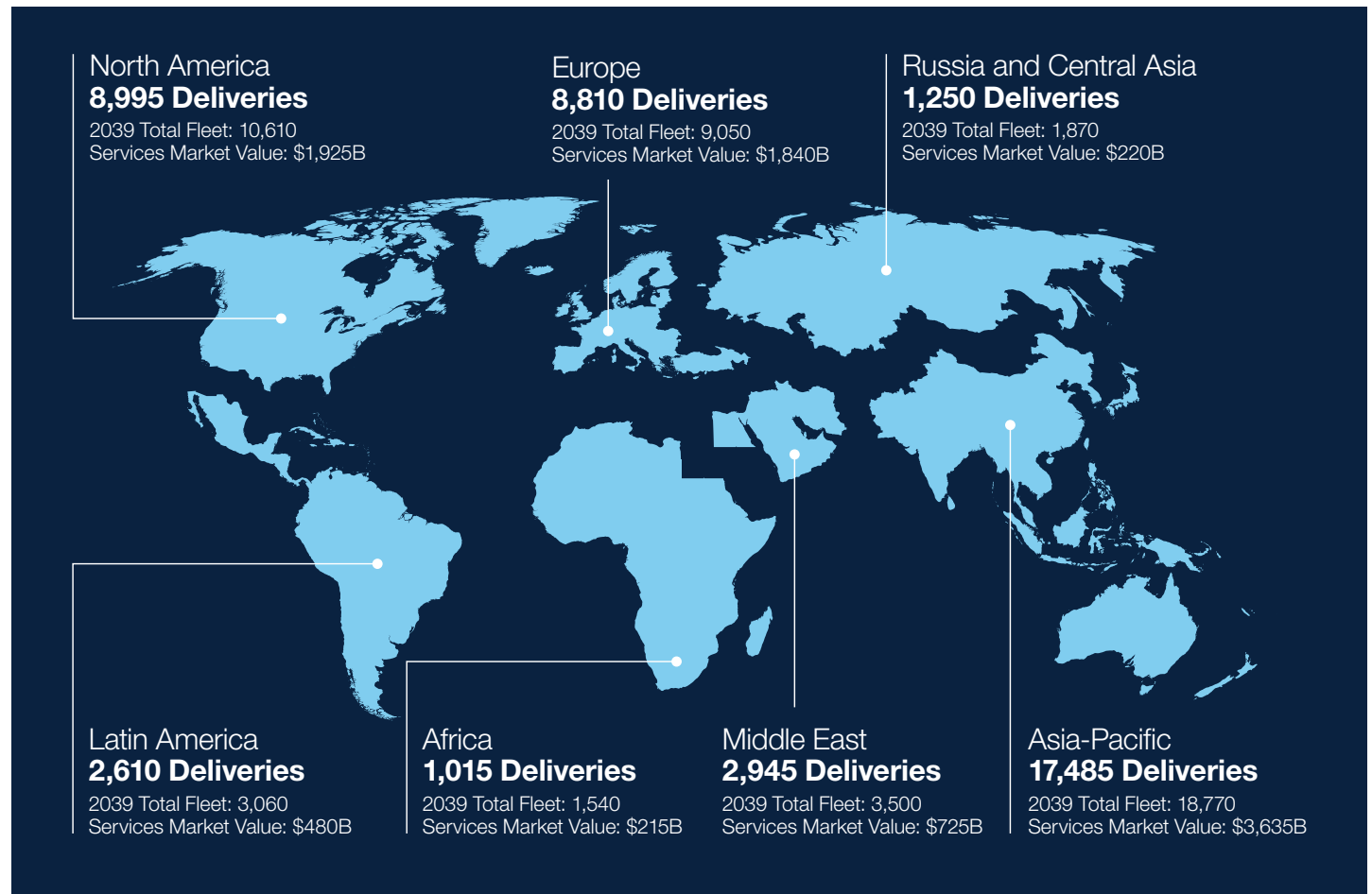
2.5%
GDP
Growth

4.0%
Traffic
Growth

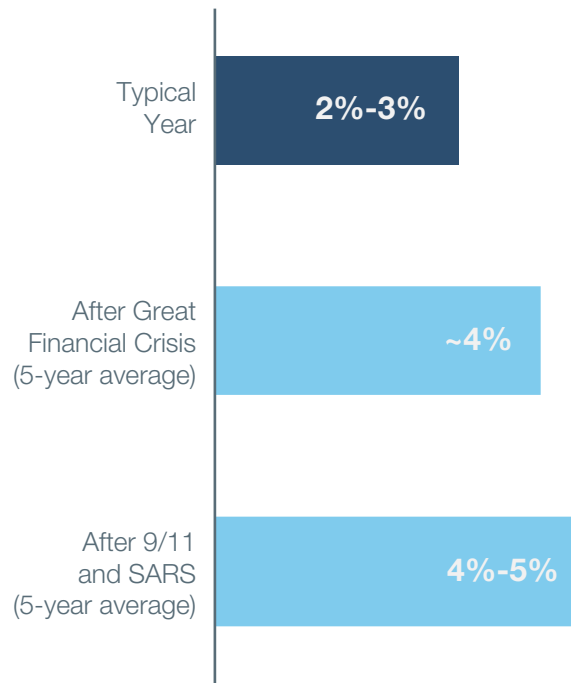
48,400
2039
Fleet

2.1M
New
Personnel

\$9,040B
Services
Market
Value



Average annual fleet retirement rates



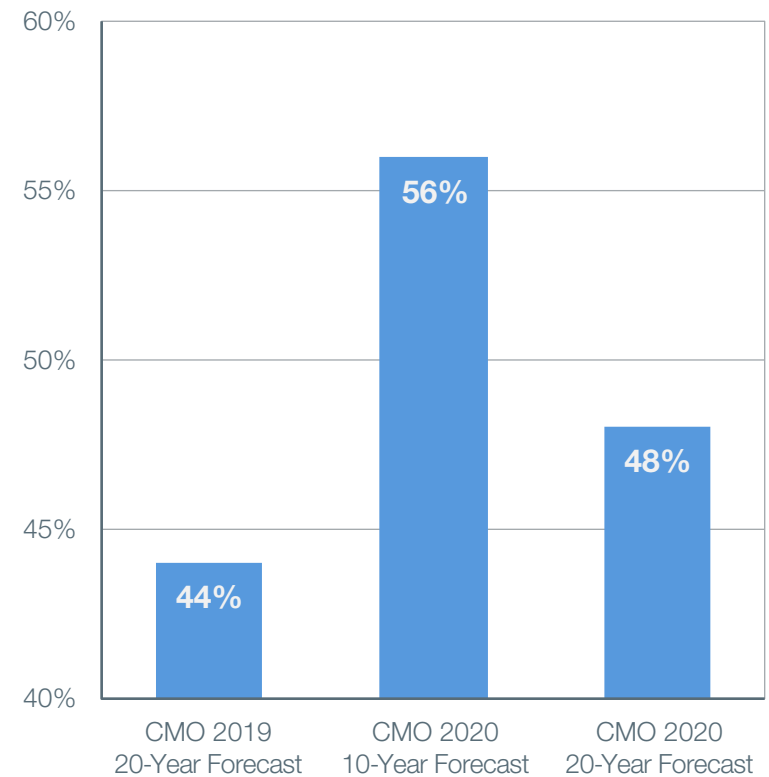
In the near term, the COVID-19 shock has shifted the focus to replacement after a decade of growth bias.

Over the last decade, growth in passenger air travel averaged 6.5% per year, well above the long-term average of 5%. In this business environment, many of the world's airlines grew their fleets through deliveries of new airplanes and often delayed airplane retirements to accommodate passenger demand.

Roughly 4,000 airplanes in today's commercial fleet are at least 20 years old. The current downturn is expected to lead to the replacement of many older airplanes. Airlines have announced phase-out plans for many of these airplanes already. This accelerated replacement cycle will position airlines for the future by improving the efficiency and sustainability of today's fleet.

In average years, 2%-3% of the airplane fleet retires annually. This rate has risen to 4%-5% in past industry downturns. The 2020 CMO reflects this dynamic with a significant increase in replacement share of new deliveries particularly in the first decade of the forecast.

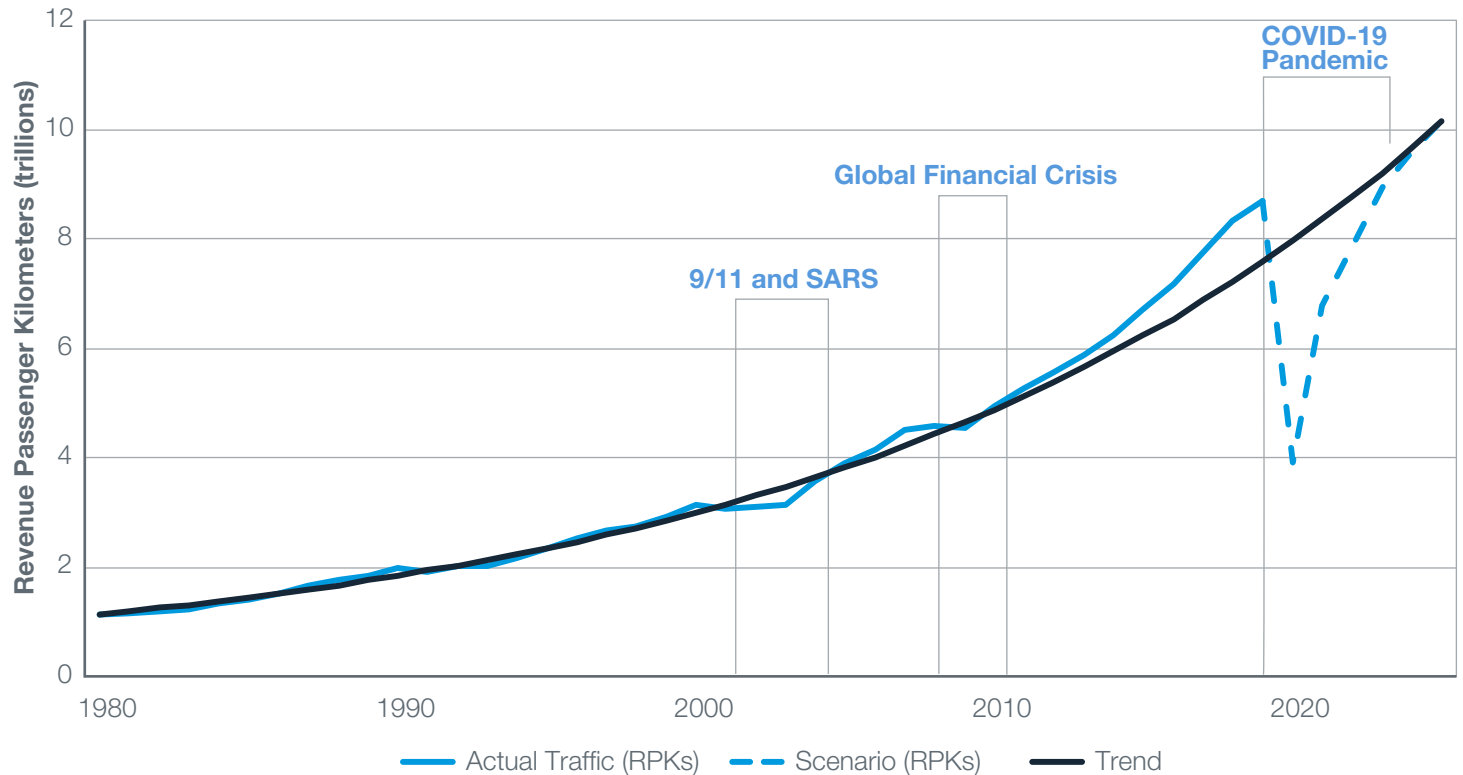
Replacement as share of new deliveries



The fundamentals that have driven air travel the past five decades and doubled air traffic over the past 20 years remain intact. While aviation has seen periodic demand shocks since the beginning of the Jet Age, our industry has recovered from these downturns every time throughout its history. After 9/11 in 2001, followed by the SARS epidemic in 2003, air travel returned to its long-term growth trend by 2004. More recently, after the Global Financial Crisis from 2008 to 2009, passenger demand returned to long-term trend in 2011.

We remain confident in the resilience of commercial aviation. Consumer spending is driving economic growth in many parts of the world. The maturation of many emerging market economies will further increase consumer spending's share of economic activity, bolstering demand for air travel. In addition, coming out of every crisis, the industry has innovated to improve service and value for the traveling public.

Aviation proven resilient over and over again



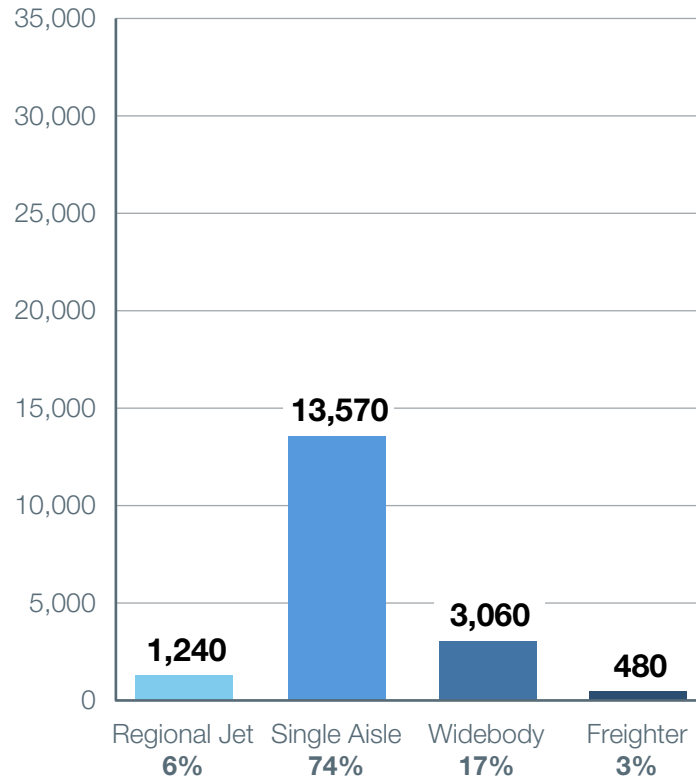
ICAO scheduled traffic through 1999 / 2000-2019E IATA stats / 2020F IATA December 2019

LONG TERM: FUNDAMENTALS DRIVE RESILIENCE, SINGLE AISLE LEADS THE WAY

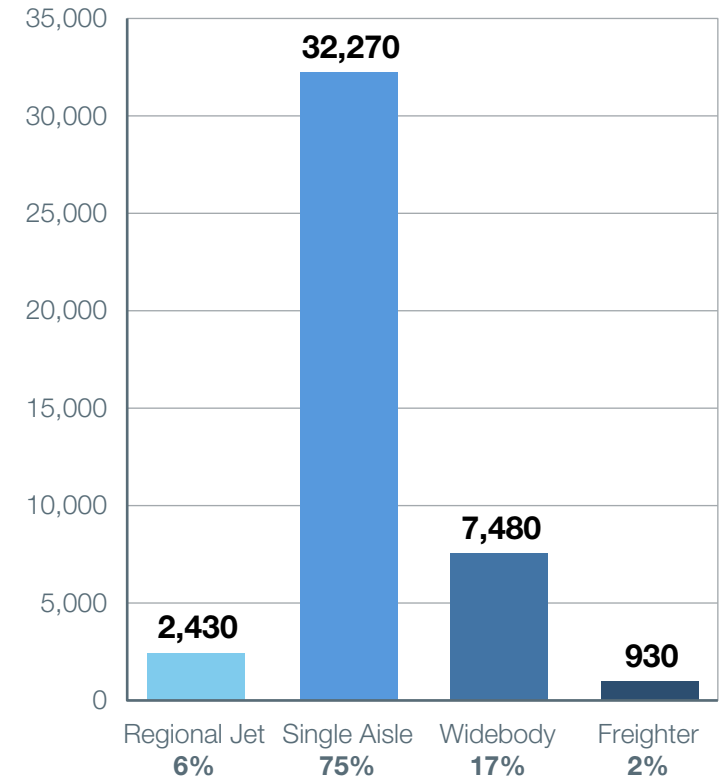
The current market disruption will shape airline fleet strategies into the future as airlines make decisions to renew their fleets into the medium term and grow again into the longer term. The 2020 CMO reflects a combination of the unprecedented near-term industry disruption and the long-term resilience we have seen for decades.

Airlines will focus on building versatile fleets that provide future network flexibility, maximizing capability while minimizing risk, and improving efficiency and sustainability. Narrowbody airplanes will lead the way to recovery as domestic and short-haul markets are forecast to recover earlier, followed by widebody fleets as airlines progressively bring their networks back online.

10-year forecast (2020-2029) 18,350 new airplane deliveries



20-year forecast (2020-2039) 43,110 new airplane deliveries



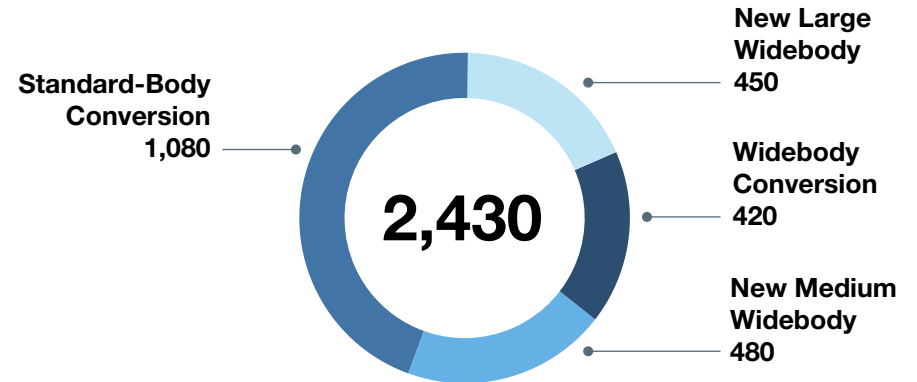
Air cargo's importance to world trade is illustrated by the fact that, although freighters carry just 1% of all commodities by weight, the value of those commodities comprises 35% of total trade.

In the coming years, the value of freighters will be increasingly apparent as above-trend growth from e-commerce and pharmaceuticals is expected. This will drive new opportunities for air cargo, as only freighters can provide the security, speed and safety needed to transport high-value

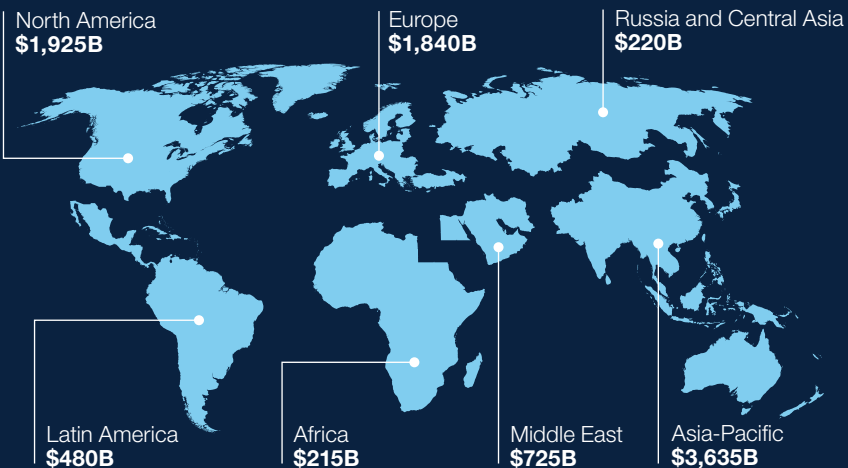
and time-sensitive commodities to serve those market segments.

Over the next 20 years, the air cargo market is forecast to grow at an average annual rate of 4%, led by the robust markets in Asia. As a result, the fleet is forecast to expand from 2,010 freighters to 3,260 over the next two decades. This growth will drive the need for 2,430 new and converted freighters. Of these, 930 airplanes will be new widebody freighters and 1,500 will be passenger airplane conversions.

Freighter fleet to grow nearly 60% by 2039



Commercial aviation services market demand by region



As the commercial aviation industry navigates the challenging near-term environment, the underlying long-term fundamentals for services growth remain strong. The current downturn has already led to near-term declines in demand for some services, whereas others will increase as airlines adjust to their new operating environment.

Discretionary spending including modifications and upgrades will be most affected as these services give way to fleet replacements for airlines seeking to replace older aircraft with more-efficient platforms. Additionally, services dependent on aircraft utilization such as maintenance and part supply will also be heavily affected.

However, there will be bright spots such as freighter conversions and digital solutions and analytics. Other areas, such as training, will see a near-term increase in demand as personnel transition to new aircraft types, maintain certifications and are recalled from furlough.

Our 20-year global forecast for commercial aviation services is \$9 trillion. This is a reduction of nearly 10% from last year's forecast and largely observed over the first five years.

Commercial airplanes

Region	Asia-Pacific Detail												
	Asia-Pacific	China	Southeast Asia	South Asia	Northeast Asia	Oceania	North America	Europe	Middle East	Latin America	Russia and Central Asia	Africa	World
Economic Growth (GDP)	3.6%	4.3%	4.0%	5.0%	1.0%	2.1%	1.9%	1.2%	2.3%	2.2%	1.5%	2.6%	2.5%
Airline Traffic Growth (RPK)	5.1%	5.5%	5.7%	7.0%	1.5%	3.3%	2.7%	3.1%	4.3%	5.1%	2.4%	5.5%	4.0%
Airline Fleet Growth	4.3%	4.4%	5.3%	6.6%	1.2%	2.3%	1.7%	2.8%	4.3%	3.5%	2.0%	3.7%	3.2%
DELIVERIES													
Regional Jet	500	380	30	10	70	10	1,640	50	30	10	170	30	2,430
Single Aisle	13,320	6,450	3,580	2,040	690	560	6,140	7,210	1,540	2,360	940	760	32,270
Widebody	3,400	1,590	760	300	550	200	770	1,460	1,280	220	130	220	7,480
Freighter	265	180	30	<5	55	<5	445	90	95	20	10	5	930
Total	17,485	8,600	4,400	2,350	1,365	770	8,995	8,810	2,945	2,610	1,250	1,015	43,110
2019 FLEET													
Regional Jet	150	60	<5	10	50	30	1,890	240	30	80	190	130	2,710
Single Aisle	5,720	3,050	1,140	590	560	380	4,080	3,690	660	1,200	770	400	16,520
Widebody	1,800	620	430	90	540	120	700	980	740	150	140	150	4,660
Freighter	350	200	30	10	80	30	940	310	80	110	160	60	2,010
Total	8,020	3,930	1,600	700	1,230	560	7,610	5,220	1,510	1,540	1,260	740	25,900
2039 FLEET													
Regional Jet	440	300	40	10	70	20	1,640	60	40	40	320	110	2,650
Single Aisle	13,640	6,630	3,480	2,180	770	580	6,860	6,840	1,730	2,600	1,190	990	33,850
Widebody	3,600	1,680	780	330	580	230	950	1,680	1,580	310	200	320	8,640
Freighter	1,090	750	100	50	140	50	1,160	470	150	110	160	120	3,260
Total	18,770	9,360	4,400	2,570	1,560	880	10,610	9,050	3,500	3,060	1,870	1,540	48,400

Commercial services

Region	Asia-Pacific Detail												
	Asia-Pacific	China	Southeast Asia	South Asia	Northeast Asia	Oceania	North America	Europe	Middle East	Latin America	Russia and Central Asia	Africa	World
PERSONNEL DEMAND													
Pilots	226,000	118,000	45,000	34,000	19,000	10,000	129,000	115,000	58,000	36,000	22,000	19,000	605,000
Technicians	237,000	121,000	55,000	30,000	21,000	10,000	123,000	113,000	59,000	34,000	21,000	20,000	607,000
Cabin Crew Members	333,000	156,000	83,000	39,000	37,000	18,000	156,000	181,000	106,000	47,000	26,000	25,000	874,000
Total	796,000	395,000	183,000	103,000	77,000	38,000	408,000	409,000	223,000	117,000	69,000	64,000	2,086,000
SERVICES													
Services Market Size (\$B)	\$3,635	\$1,730	\$790	\$415	\$530	\$170	\$1,925	\$1,840	\$725	\$480	\$220	\$215	\$9,040

Passenger traffic flows between regions

Traffic Flow (RPKs in billions)	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2029	2039	2019-2039 Annual Growth
Africa—Africa	43.9	48.7	51.1	54.5	53.7	56.6	59.2	62.9	65.4	67.2	71.1	121.4	251.3	6.5%
Africa—Europe	128.2	135.5	134.1	140.4	140.4	146.5	153.2	153.8	163.9	175.1	184.4	251.1	377.4	3.6%
Africa—Middle East	32.9	36.4	39.4	48.6	50.8	53.7	59.5	62.5	66.2	69.0	69.5	111.9	218.6	5.9%
Central America—Central America	29.8	31.3	32.2	33.8	36.5	38.7	42.5	48.7	51.9	55.2	59.6	69.6	96.0	2.4%
Central America—Europe	77.1	73.8	73.7	78.3	82.1	87.4	95.3	104.8	112.3	114.3	115.5	158.5	224.0	3.4%
Central America—North America	104.7	112.7	114.5	132.0	138.3	153.0	170.1	180.5	190.7	197.5	201.2	287.4	462.7	4.3%
Central America—South America	14.0	18.3	19.2	23.2	28.5	30.8	34.2	35.5	37.1	39.9	39.5	57.5	112.5	5.4%
China—China	287.4	335.4	380.1	411.3	460.8	509.2	564.7	629.8	715.1	800.7	838.5	1,544.2	2,533.0	5.7%
China—Europe	77.3	82.1	94.2	96.7	96.9	105.2	121.1	132.9	141.7	153.7	169.0	256.2	390.2	4.3%
China—Middle East	14.8	19.2	21.8	26.4	30.0	34.5	37.7	43.9	47.7	50.7	53.2	108.3	226.2	7.5%
China—North America	60.9	71.4	85.4	87.1	89.5	98.1	107.5	119.1	132.0	140.9	140.6	195.2	294.2	3.8%
China—Northeast Asia	43.2	51.8	51.5	60.9	60.7	66.2	73.0	81.0	78.6	80.3	87.6	114.3	162.2	3.1%
China—Oceania	22.8	27.4	31.4	34.1	35.0	37.7	44.3	55.4	66.8	72.6	69.3	106.5	169.2	4.6%
China—Southeast Asia	45.3	54.7	63.0	73.8	82.5	89.4	109.9	127.0	144.4	166.0	173.4	319.8	531.6	5.8%
Europe—Europe	624.9	640.2	659.5	676.6	714.0	760.3	796.8	859.4	930.6	982.5	1,044.9	1,462.9	2,003.0	3.3%
Europe—Middle East	131.2	143.8	153.3	178.0	196.8	210.9	242.5	260.1	280.2	300.3	314.0	409.3	595.3	3.2%
Europe—North America	405.4	418.6	430.2	432.9	441.8	462.7	475.0	499.7	537.9	579.2	620.5	778.1	1,012.1	2.5%
Europe—Northeast Asia	59.4	64.3	63.8	75.9	74.3	77.8	81.3	78.4	81.3	89.6	96.1	98.9	117.1	1.0%
Europe—Russia and Central Asia	45.8	55.3	67.3	75.2	84.0	86.7	78.9	74.2	87.7	104.3	117.1	100.1	129.3	0.5%
Europe—South America	79.3	82.9	89.8	99.6	102.4	102.1	104.4	107.4	112.1	122.4	133.6	163.1	269.6	3.6%
Europe—South Asia	51.3	53.8	54.1	53.9	56.4	57.2	57.5	58.3	60.9	67.2	58.6	89.8	154.8	5.0%
Europe—Southeast Asia	95.9	97.1	100.4	106.6	105.3	108.0	111.3	111.8	115.3	123.9	128.2	149.7	201.3	2.3%
Middle East—Middle East	68.6	77.9	82.4	76.5	86.3	91.7	102.2	116.1	120.4	122.1	121.5	190.5	290.1	4.4%
Middle East—North America	41.6	45.7	50.3	57.1	63.2	73.7	88.3	98.8	100.9	96.2	96.7	134.5	204.8	3.8%
Middle East—Oceania	19.7	24.5	26.7	31.4	33.3	36.1	37.4	41.5	47.8	49.4	46.6	59.4	88.7	3.3%
Middle East—Russia and Central Asia	9.1	11.3	14.1	16.1	19.0	20.6	19.6	19.2	23.4	29.9	29.4	40.3	62.5	3.8%
Middle East—South Asia	64.8	75.1	83.0	87.3	95.1	100.5	114.4	129.8	140.8	144.0	140.5	256.0	429.5	5.7%
Middle East—Southeast Asia	46.7	56.3	61.3	66.4	79.0	89.4	97.6	109.0	118.0	119.6	118.6	191.5	293.5	4.6%
North America—North America	915.1	946.3	976.3	984.7	998.4	1,029.9	1,077.7	1,120.1	1,164.7	1,229.2	1,286.0	1,624.2	2,142.2	2.6%
North America—Northeast Asia	120.2	128.4	135.4	149.0	150.4	154.0	160.5	168.2	178.4	178.3	180.0	191.7	215.6	0.9%
North America—Oceania	34.8	34.9	38.3	40.3	43.1	43.3	48.3	53.4	55.1	58.5	58.8	77.5	103.8	2.9%
North America—South America	56.9	60.9	66.7	72.0	79.2	82.7	86.9	83.2	85.6	90.0	84.9	128.7	218.2	4.8%
Northeast Asia—Northeast Asia	81.9	84.6	81.9	92.6	103.9	107.6	112.5	116.8	123.3	126.9	122.5	136.5	150.0	1.0%
Northeast Asia—Southeast Asia	74.3	79.6	92.3	104.9	113.3	124.2	134.6	143.9	159.7	179.6	203.3	257.6	397.8	3.4%
Oceania—Oceania	73.3	78.4	83.8	92.0	99.0	100.0	102.8	105.3	106.0	105.5	105.9	141.6	196.1	3.1%
Oceania—Southeast Asia	54.7	61.1	66.9	71.5	77.8	83.2	80.0	83.5	86.1	89.2	90.5	126.0	179.9	3.5%
Russia and Central Asia—Russia and Central Asia	76.9	87.6	103.1	107.1	118.3	125.3	138.1	134.9	148.3	158.3	170.9	214.6	305.7	2.9%
South America—South America	86.9	115.8	134.4	141.9	147.4	155.7	159.1	156.8	161.6	172.8	176.4	279.3	562.9	6.0%
South Asia—South Asia	43.8	49.5	58.6	63.8	68.1	71.4	79.2	97.0	114.4	130.5	135.5	280.3	565.8	7.4%
Southeast Asia—South Asia	21.9	28.5	29.2	34.0	36.2	38.4	40.4	44.6	50.7	53.5	54.5	120.3	247.8	7.9%
Southeast Asia—Southeast Asia	96.0	113.1	130.7	145.1	166.6	176.9	194.0	212.3	228.2	238.3	241.2	485.6	934.5	7.0%
Rest of World	101.7	124.4	136.9	151.4	159.9	168.9	170.9	183.0	202.3	232.7	256.5	346.2	558.8	4.0%
Grand Total	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	8,157.4	8,506.2	12,236.1	18,679.9	4.0%



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