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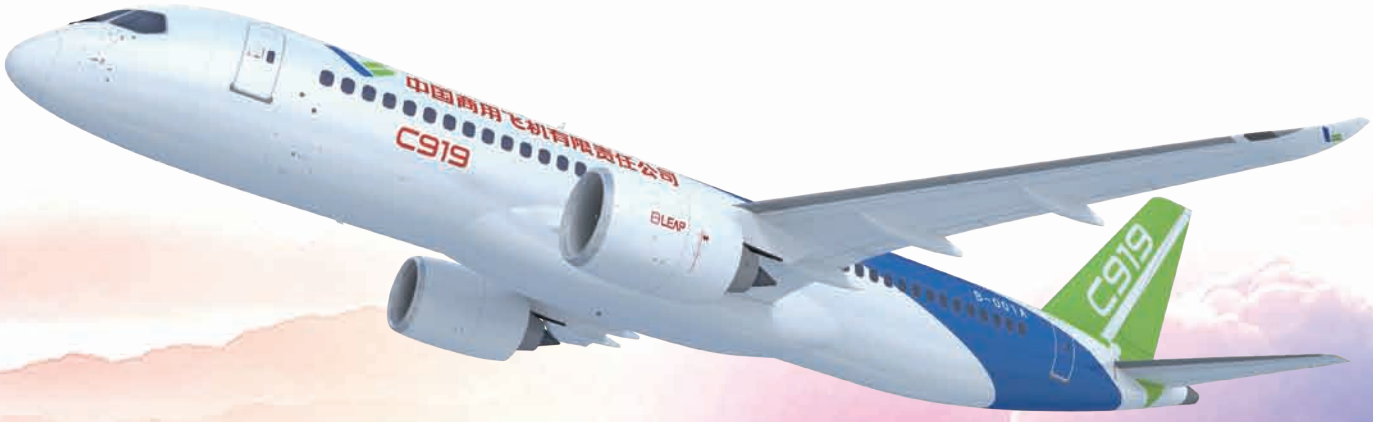
COMAC

COMAC MARKET FORECAST

2022-2041



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1.Preface

Nowadays,as the world is caught between a centennial pandemic and geopolitical changes we have not seen in a century, a period of tumultuous transformation has already arrived. Climate change, Omicron, high oil price and regional conflict altogether severely challenge the global economy and aviation industry.While confronting these challenges, the aviation industry reveals its resilience, bouncing back from the most catastrophic event in the history of the industry. As we have entered 2022, the recovery has been widening instead of narrowing.

Looking back at 2021, IATA's official data indicates that, throughout the year, air travel demand(in terms of revenue passenger kilometers or RPKs) continued to rebound, as a result of increased vaccination coverage, ease of travel restrictions, and resumption of more passenger routes. Compared to the year of 2019, the RPKs of 2021 decreased by 58.4%, while that number of 2020 is 65.8%. It is expected that air travel demand will return to the pre-pandemic level by the end of 2023. In the mean time, the growth of air freight is promising. Between 2016 to 2021, the freight revenue accounted for a much larger portion of the revenue of the entire aviation industry, rising from 11.4% to 40.3%.

In recent years, the pandemic and regional conflicts have disrupted the balance of supply and demand of crude oil, causing fluctuations in global oil prices. Travel restrictions in various countries have added uncertainty, as well as increasing the economic and time cost of travel. The emergence of new VR/AR technologies has brought new challenges and opportunities to the traditional business model of the aviation industry. Climate change has forced the aviation industry to rethink its sustainable development and social responsibility. Meanwhile, structural adjustments of the global air transport industry continue to unveil, and low-cost airline has proved its superior economic resilience during the pandemic. Economic development and growth of the aviation industry have always been symbiotic and mutually reinforcing. Global economic development will still be the main driving force for the aviation industry, and air transport will substantially contribute to economic growth.. Because between countries, and between cities,, the exchange of people and technology and the flow of good and capital, to a large extent, depend on air transport.

Over the past ten years, COMAC has been deeply engaged in the aviation market, and its market research and forecast have kept evolving as well. "Commercial Aircraft Corporation of China Market Forecast Annual Report (CMF) (2022-2041)" mainly demonstrates our understanding of the development and changes of the Chinese and the global aviation market from the perspective of supply and demand. We forecast global air passenger turnover to grow at an average annual rate of 3.9% over the next 20 years. 42,428 jetliners of all categories, with a market value of 6.4 trillion dollars, will be delivered, In addition, new freighters and passenger-to-freighter aircraft delivery will be 2,991. Taking account of the pandemic, the forecast for demand adopts reasonable scenario assumptions. The report conducts a detailed analysis of the Chinese market, which will be the most dynamic market in the future, to provide reference and help for the planning of the aviation industry.

2022-2041 Overview of Forecast Data

	China*	Asia Pacific**	Europe	Latin America	Middle East	North America	Russia $ CIS	Africa	Global
Average GDP Growth Rate	4.21%	3.10%	1.37%	2.78%	2.41%	2.06%	1.97%	3.24%	2.61%
Average RPK Growth Rate	5.61%	4.77%	2.64%	4.47%	4.52%	2.20%	3.27%	4.78%	3.90%
2041RPKs (trillion)	4.39	4.28	3.51	1.17	2.23	3.16	0.64	0.56	19.93
Deliveries									
Regional Jet(RJ)	958	506	408	388	53	1,496	256	302	4,367
Single-Aisle(SA)	6,288	6,398	6,431	2,173	1,651	5,835	745	846	30,367
Twin-Aisle(TA)	2,038	1,509	1,471	380	1,077	836	151	232	7,694
Total	9,284	8,413	8,310	2,941	2,781	8,167	1,152	1,380	42,428
Market Value B$									
Regional Jet	49	26	21	19	3	73	14	16	221
Single-Aisle	749	780	765	258	204	708	83	96	3,643
Twin-Aisle	673	483	482	118	401	260	49	72	2,538
Total	1,471	1,289	1,268	395	608	1,041	146	184	6,402
2021 Fleet***									
Regional Jet	94	140	167	47	41	1,691	199	137	2,516
Single-Aisle	3,040	1,902	3,131	1,063	503	3931	704	386	14,660
Twin-Aisle	561	710	719	107	537	502	128	123	3,387
Total	3,695	2,752	4,017	1,217	1,081	6,124	1,031	646	20,563
2041 Fleet									
Regional Jet	960	515	423	428	88	1,904	292	312	4,922
Single-Aisle	6,896	6,943	7,255	2,581	1,735	6,657	983	933	33,983
Twin-Aisle	2,151	1,753	1,644	403	1,225	906	263	281	8,626
Total	10,007	9,211	9,322	3,412	3,048	9,467	1,538	1,526	47,531

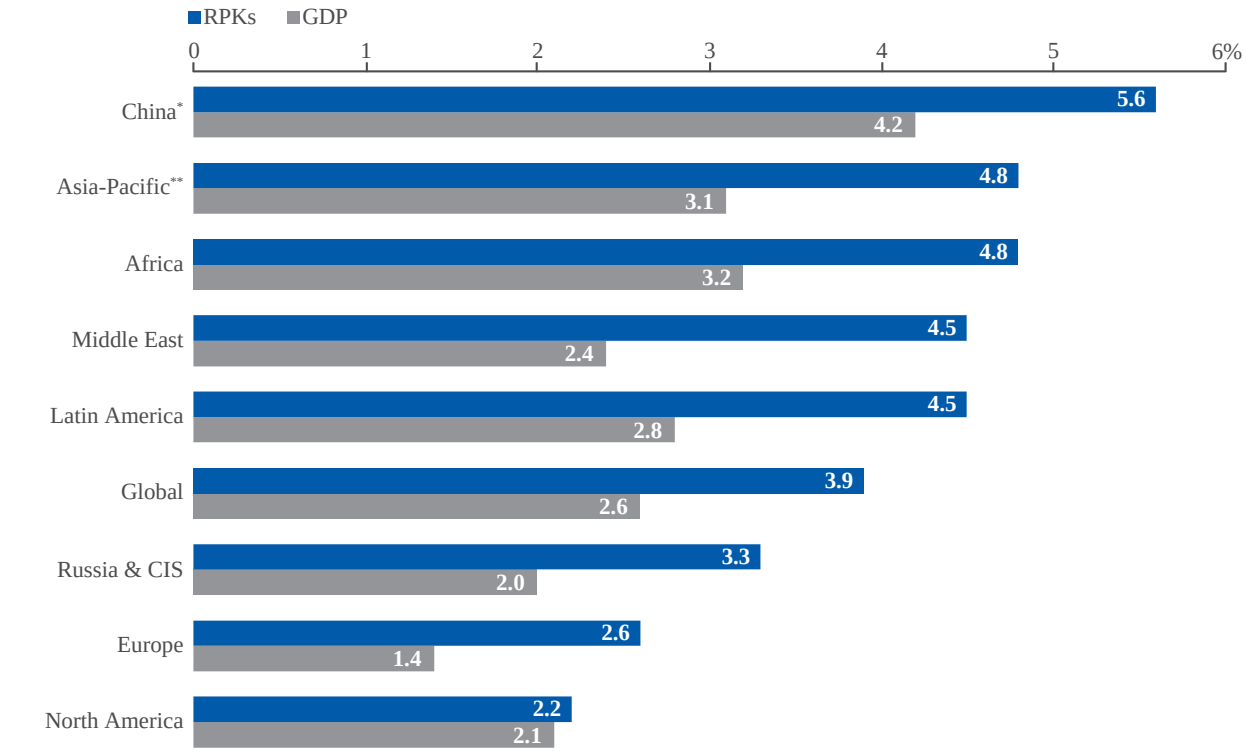
* China includes Hong Kong, Macau and Taiwan

** Asia-Pacific excludes China

*** Excluding "In Storage"

Source: COMAC, Cirium, IHS

Global Forecast Outlook (2022-2041)

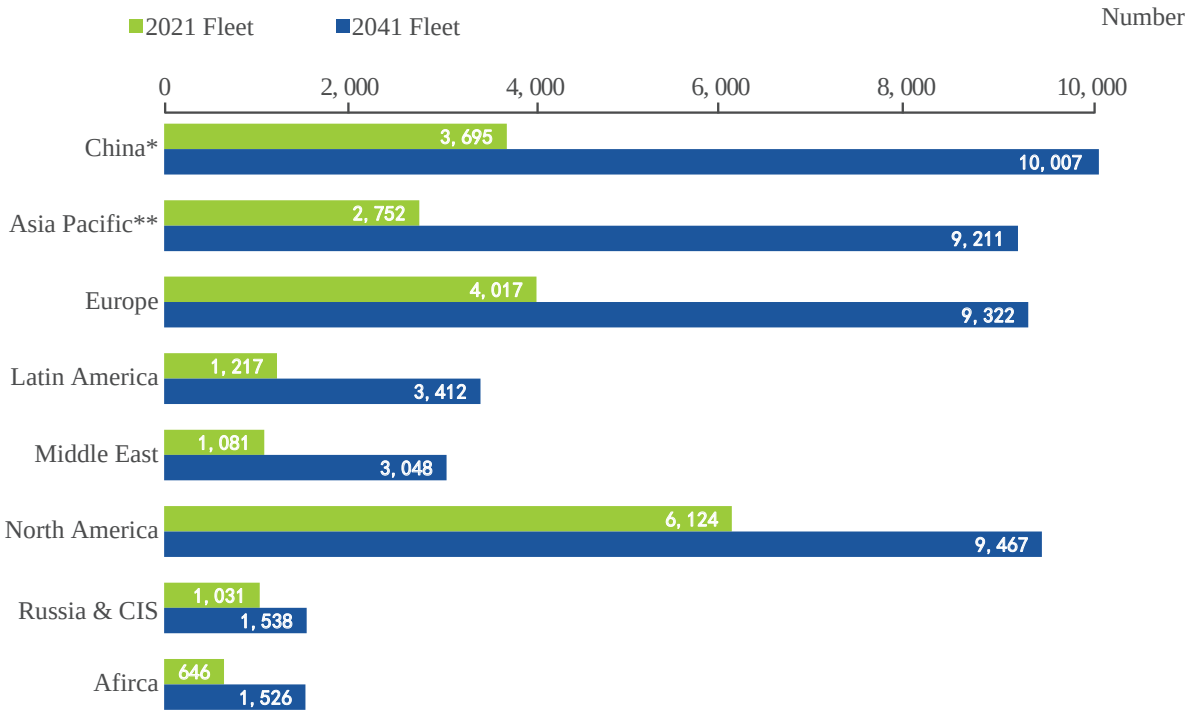


Source: COMAC, IHS

2. Executive Summary

Total passenger demand, as measured in RPKs, is forecast to increase over the next 2 decades at an average annual rate of 3.9%. We expect that RPKs in China related markets will grow at 5.6% per annum on average over the next two decades. This demand forecast is based on the projection of long-term growth in the global economy of 2.6% per year for the period to 2041.

Global Fleet Forecast by Region



*China includes Hong Kong, Macau and Taiwan

** Asia-Pacific excludes China

Source: COMAC, Cirium

Passenger Jet Fleet and Traffic Forecast Summary

	Global Total		China		
	Fleet	RPKs (trillion)	Fleet	% of global total	RPKs (trillion)
2021	20,563	4.5	3,695	18.0	0.8
2026F	26,578	10.8	5,296	19.9	2.0
2031F	32,637	13.5	6,995	21.4	2.7
2036F	39,035	16.5	8,376	21.5	3.5
2041F	47,531	19.9	10,007	21.1	4.4
2022–2041 CAGR	4.30%	3.90%	5.10%	--	5.61%

Source: COMAC, Cirium

It is expect that the total air passenger demand in 2041 to be 4.4 times that of 2021 and 2.3 times that of 2019. It is forecast that the fleet size will reach to 47,531 aircraft by 2041, which is more than 2.3 times of the current operating fleet of 20,563 aircraft.

It is expected that out of the current operating fleet 15,460 aircraft (around 75.2%) will be retired from commercial passenger services in the next twenty years. They will be converted to business aircraft, freighters and other roles, or permanently scrapped and subsequently be replaced. Additionally, there is a need of 25,824 new aircraft in the global fleet market. Therefore, we expect that there will be a need for the delivery of over 42,428 new aircraft worth $6.4 trillion (based on 2021 dollar term and at list prices) over the next 2 decades for both replacement and growth, about 71.6% are single-aisle jets. It is estimated that China-based airlines will take 9,284 of the total delivery, worthing around $1.5 trillion at 2021 list prices.

2022-2041 Passenger Jet Delivery Forecast Summary

		Global Total		China
		Deliveries	Market value (hundred million $)	New deliveries
Regional Jets	Small	160	50	0
	Medium	484	231	0
	Large	3,723	1,924	958
Single-Aisle	Small	2,092	1,890	260
	Medium	20,587	24,161	4,987
	Large	7,688	10,377	1,041
Twin-Aisle	Small	5,689	17,068	1,509
	Medium	1,466	5,692	477
	Large	539	2,612	52

Source: COMAC

3

Driving factors of Air Industry

3.1 Economics

In 2021, the world came to the normalization stage of prevention and control of the pandemic of COVID-19. With the expansion of vaccination coverage, the relaxation of control measures, and the implementation of large-scale fiscal stimulus and monetary easing policies, international trade and investment gradually recovered. The global economy showed a recovery trend, with GDP fell by 3.4% in 2020 and rebounded to 5.8% in 2021. In 2022, affected by unexpected events such as the sudden rise of the more transmissible Omicron and the Russian-Ukrainian crisis, the world's largest economies such as Western Europe, North America, Japan, and Russia are facing a protracted period of weak growth, and the global economic growth rate is expected to slow from 4.1% to 3.2% in 2022.

The Russia and Ukraine conflict has changed the geopolitical landscape, strained the global supply chain, exacerbated the global commodity shortage, brought about inflation, decline in consumer confidence and other related issues, which will drag down global economic growth in the near future. Affected by factors such as Russia and Ukraine conflict, Western sanctions and outflows of enterprises, Russia is facing the worst recession since 1990. It is forecast that GDP will plummet by 11.1% in 2022, and return to the level of 2021 until 2030 to 2035. Ukrainian GDP is expected to decline by 43.1% in 2022, emerging economies in Europe will also enter recession, with GDP expected to contract by 2.4% in 2022.

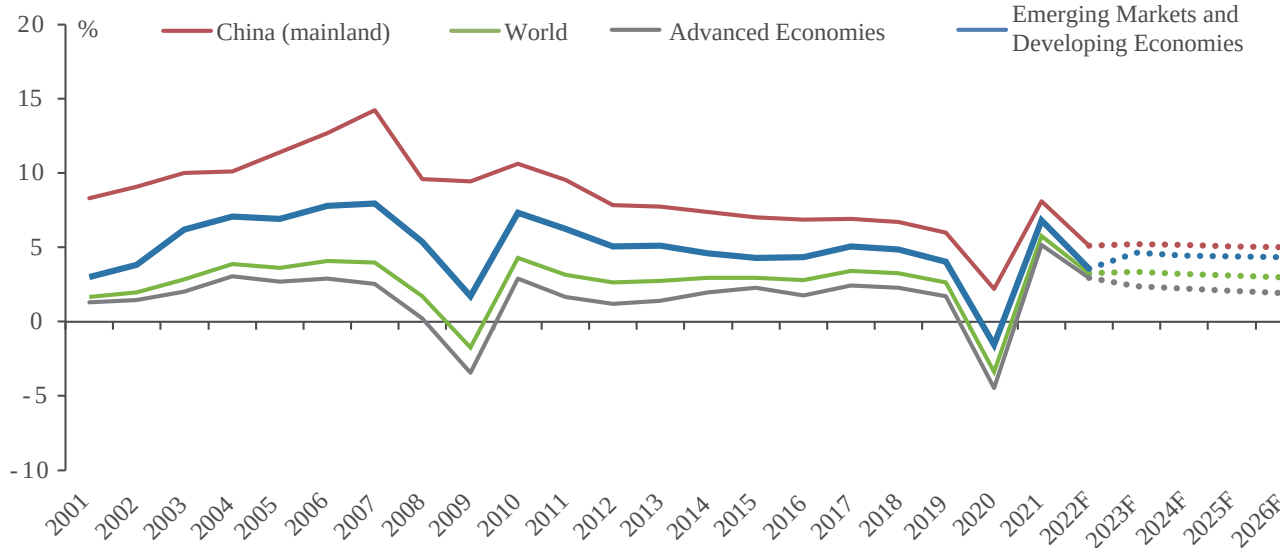
Among the major economies, affected by soaring energy prices, tightening supply chains, high inflation and rising interest rates, the Eurozone GDP growth rate will slow from 5.4% in 2021 to 2.4% and 1.8% in 2022 and 2023. The U.S. economy is facing inflation and the withdrawal of fiscal and monetary stimulus policies, with GDP slowing from 5.7% in 2021 to 1.4% in 2022.

As energy export regions, rising oil prices and increased oil exports may drive economic recovery in the Middle East and North Africa. With the entry into force of RCEP in 2022, Asia-Pacific will further accelerate its trade liberalization process, which will improve the stability of the local manufacturing supply chain and attract foreign investment. In the future, Asia-Pacific (excluding China) is expected to lead the global economic growth, with GDP grow by 3.9% and 3.8% in 2022 and 2023 respectively.

China's GDP grew by 4.8% in the first quarter of 2022. In the second quarter, due to the impact of the Omicron pandemic, some major financial cities were locked down. However, as the pandemic was brought under control, the economy in mainland China rebounded from June, with major economic indicators stabilized and rebounded. The overall GDP still achieved positive growth of 2.5% in the first half of the year, demonstrating significant resilience. For the next stage, as the risk of stagflation in the global economy is increasing, uncertainties still existed in China's economic recovery. However, the strong resilience, great potential, and long-term positive fundamentals of China's economy have not changed. IMF predicts that in 2022 China's economic growth rate will reach 4.4%, and the total GDP is expected to exceed 20 trillion US dollars.

According to IHS forecast, in the next 20 years, the global economy will maintain a growth rate of 2.6% (2019 as the benchmark), of which the growth rate in mainland China will be 4.3%, the growth rate in the Advanced economies will be 1.6%, and the the growth rate in the emerging and developing economies will be 3.7%.

Real GDP Growth (%YoY) & Projections for Major Country Groups



Source: COMAC, IHS

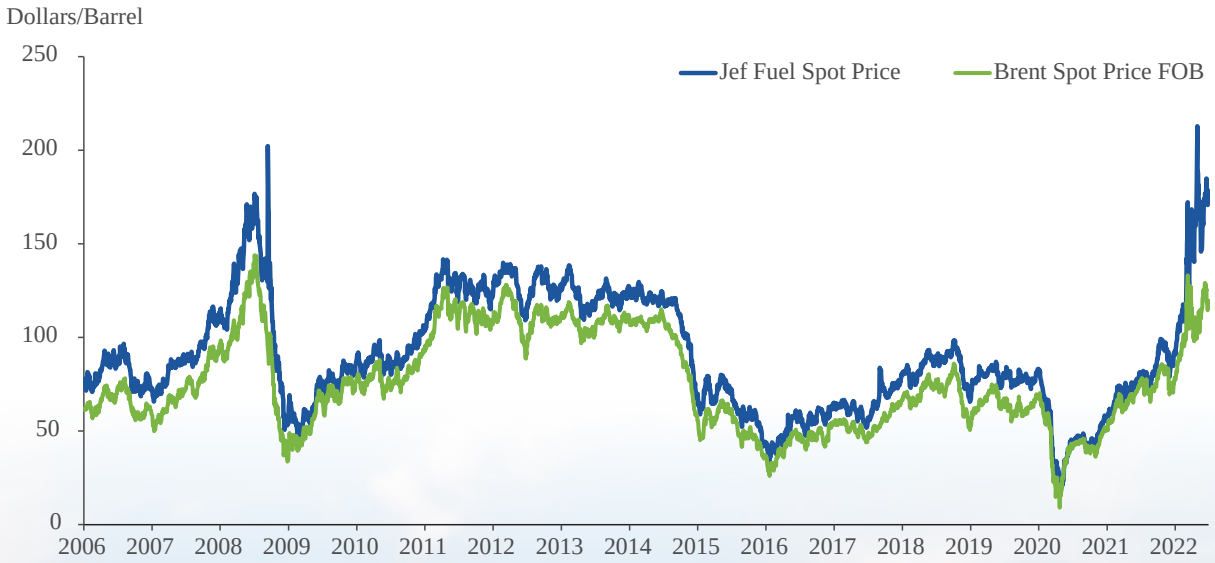
3.2 Oil Price

The long-term trend of crude oil prices is closely related to pricing power, technological progress, and the evolution of the international political landscape. From 2001 to 2007, oil prices continued to rise. The rapid economic growth of emerging countries represented by China has effectively boosted oil demand. From 2008 to 2010, oil prices rebounded in a "deep V-shaped" after the slump. The financial crisis triggered a panic in demand, and oil prices fell off a cliff. However, with the stimulation of various positive factors such as strong market rescues by various countries and OPEC production restrictions, oil prices gradually recovered. Since 2010, due to the revolutionary technological progress of shale oil in the United States, the influencing factors of global crude oil prices have tended to be diversified. After the establishment of the OPEC+ alliance in 2016, the competition between Saudi Arabia, the United States and Russia for crude oil pricing rights has become more intense.

Since 2020, Covid-19 pandemic has disrupted the normal supply and demand balance of crude oil, and the volatility of oil prices has increased, from negative oil prices to highs again. The most prominent feature of the international market in 2021 is the sharp rebound in crude oil prices, with the rebound growth rate hitting the highest level in 30 years. At the same time, the prosperity of the world oil refining industry has rebounded significantly, and the average operating rate of refineries has come out of the trough. The world's major oil demand rebounded sharply. Among them, gasoline and diesel recovered significantly, while the demand for jet fuel recovered slowly. Oil prices are significantly higher than in 2020. Entering 2022, the Russian-Ukrainian conflict has exacerbated the problem of crude oil supply bottlenecks, and Brent crude oil has exceeded 120 US dollars per barrel.

Looking ahead, both the tight spot market and concerns about future demand will affect oil prices at the same time, and the geopolitical premium will be difficult to eliminate in the short term, which will lead to increased volatility in oil prices.

Oil Spot price FOB (2006-2022)



Source: COMAC, U.S.EIA

3.3 Travel Restriction

The COVID-19 pandemic, breaking out at the end of 2019, is the biggest crisis the global aviation industry has encountered so far. The IATA report shows that the lost revenue passenger kilometre (RPK) between 2020 and 2022 due to the pandemic is 1.8 times the RPK in 2019. During this period, travel restrictions have become the most important factor affecting the aviation industry. In order to control the spread of the virus, countries have implemented policies to restrict entry and reduce the movement of people between regions. Specific measures include: passengers must wear masks throughout the flight, tourist visa are no longer issued to foreign nationals, the number of people who can enter the country in a single day is restricted, and a negative nucleic acid test report or an antigen negative certificate must be presented within 48 hours or 72 hours before boarding, those who have visited places that were hard hit by the pandemic are not allowed to enter the country, those who enter the country must undergo centralized isolation or other health testing and tracking, a certain number of confirmed cases may trigger the “circuit breaker” policy, meaning the route will be suspended for several weeks. In addition, most trips are bidirectional, that is, passengers must return to the place of origin after the trip, so not only must they pay attention to the entry policy of the destination country, but also take into consideration the entry policy of the home country when returning. These measures have greatly increased the financial expenses, time cost and uncertainty of travel. Coupled with concerns about the risk of contracting an infection during the journey, people's willingness to move across regions has been greatly dampened.

Here comes 2022, the third year into the pandemic. With the widespread promotion of vaccination worldwide and the introduction of therapeutic drugs, the overall immunity level of the population has gradually improved. Among new confirmed cases, the ratio of critically ill patients and mortality rate drop significcantly.Based on facts mentioned above, many countries ease their travel restrictions. The U.S. lifted a 20-month travel ban in November 2021, now fully vaccinated international travelers can enter the country with relevant proof. Some countries, such as Singapore and New Zealand, have cancelled the pre-departure nucleic acid test requirements. China adjusted the quarantine time after entrance from "14+7" to "7+3", that is, "7 days of centralized isolation and medical observation + 3 days of health self-monitoring at home".

After the relaxation of the travel restriction policy, the number of countries that are open to air traffic has increased, more and more international routes have been approved to resume service, and the weekly frequency of flights has increased, boosting the confidence of passengers and the market. The gradual relaxation of restriction measures in industries such as tourism and catering has also brought in a large number of people, which has further stimulated the recovery of aviation demand. It is reasonable to speculate that the travel restrictions of the past two years have not wiped out the desire to travel, and once the restrictions are removed, demand can quickly return to pre-pandemic levels.

3.4 Metaverse

Thirty years ago, in a science fiction novel, it was mentioned that in the world of the "metaverse", you can have your own virtual duplicate. Some people refer to 2021 as the "Year of the Metaverse". This year, the first share of Metaverse Concept was listed in New York Stock Exchange, and Center for New Media Communication Studies of Tsinghua University released the "2020-2021 Metaverse Development Report Plan". Metaverse applies VR/AR technology, which is considered to be the next-generation Internet. Users now engage with the information more fully and have an immersive experience rather than just browsing it.

Impact on Aviation Industry

In the future, the mature technology of Metaverse can provide a more natural online real-time interactive experience, as a result of which people's demand for cross-physical space and face-to-face interaction with real people may dwindle down. Overcoming the sense of isolation of screens, there is no need to travel thousands of miles for business trips anymore. With metaverse at home, you can still collaborate with customers in a virtual space full of realism to ensure communication efficiency. With the stereo sound and the liveliness of concerts well restored in the metaverse, and with every detail of exhibition vividly reserved, being physically present by means of air travel seems unnecessary.

How to adjust the business model and explore the potential of the Metaverse has become a major challenge that the aviation industry must face. In the future, airlines strive to overcome the constraints of single business model, leverage the Metaverse to provide better services, enhance high-tech immersive experience and entertainment, and offer new market appeal. For example, some airlines have already launched the Metaverse website by developing the "Travel Metaverse", where users can upload selfies to generate avatars that resemble their own appearance, purchase souvenirs, and go sightseeing in virtual attractions generated from local photos; visit the website to get virtual flights Travel, and experience a unique digital interactive experience; by creating a daily experience of "tourism", airlines are able to closely connect with customers under the pandemic

The past few decades have been the era of rapid development of the Internet, and there have always been voices suggesting that Internet would eventually replace air travel, but it is undeniable that virtual experiences will in turn stimulate real travel demand.

Outlook of Application in Aviation Industry

1

As an educational tool for the aviation industry.

On the one hand, the metaverse can be used to train professionals. Firstly, the metaverse replaces traditional simulators as a new place for pilots to conduct flight training; secondly, high simulated space can provide a better learning and practice platform for aircraft design. On the other hand, the metaverse can be used to educate the masses about aviation. The presentation form of knowledge has changed from static to more realistic and interactive dynamic, which is conducive to arousing the public's curiosity about the aviation industry, making the popularization process more concise and easy to understand and full of interest.

2

Metaverse can make aircraft design more efficient and economical.

It provides designers and engineers with a more compatible real-time collaboration platform and a highly interactive R&D ecosystem, integrates design materials such as dynamic models, data and calculates production planning. Before the stage in the physical world, the construction is simulated in the virtual space, which is conducive to optimizing a series of processes, reducing waste and cost, and speeding up the product development.

3

Metaverse can optimize route planning.

By transferring the big data obtained in real time from the physical space to the virtual space of the Metaverse for complex calculations, it is possible to predict the development trend quickly and at a low cost, provide directions of how to optimize, and then feed the results back to the physical space to guide practice.

3.5 Sustainable Development (ESG)

Environmental, social and corporate governance (Environment, Social, Governance, ESG as the abbreviation name) are important issues that the aviation industry needs to carefully consider in the context of global climate change. While meeting regulatory and investor requirements, the global aviation industry should also assume social and corporate governance responsibilities.

According to a report from the Air Transport Action Group, the total amount of carbon dioxide emitted by the global aviation industry accounts for 12% of the entire transportation industry and 2% of human historical carbon dioxide emissions. Constrained by the limited available alternative technologies and cross-border nature, the aviation industry has long been considered as having trouble reducing carbon emission. The aviation industry is committed to overcoming the obstacles in spite of how great they are. In October 2021, the International Air Transport Association (IATA) approved a resolution requiring the global air transport industry to achieve net zero carbon emission by 2050. To achieve the goal not only requires the maturity of technical “hardware”, but also demands that countries make collective efforts in the “software” aspect, that is, to build a supportive policy framework for technical upgrading, and to create an environment that can incubate a positive cycle of emission reduction.

At present, the possible technical paths for the aviation industry to improve the level of sustainable development and reduce carbon emissions mainly include:

1

By using sustainable aviation fuel (SAF).

For example: vegetable oil, organic waste, alcohol, etc. Compared with traditional fuel, SAF can reduce carbon emissions by more than 75%, and has the advantage of strong applicability. Given the fact that the technical level of batteries and hydrogen energy cannot meet the aviation requirements in the short term, SAF is a ready-made feasible solution to realize green aviation.

2

By improving engine fuel efficiency.

The carbon emissions of aircraft are closely related to fuel efficiency, and fuel efficiency is largely determined by engine technology. The earlier the aircraft is put into the market, the lower the fuel efficiency, and more carbon dioxide is emitted during flight. In the future, with further maturity and improved fuel efficiency, aircraft carbon emissions will gradually decrease.

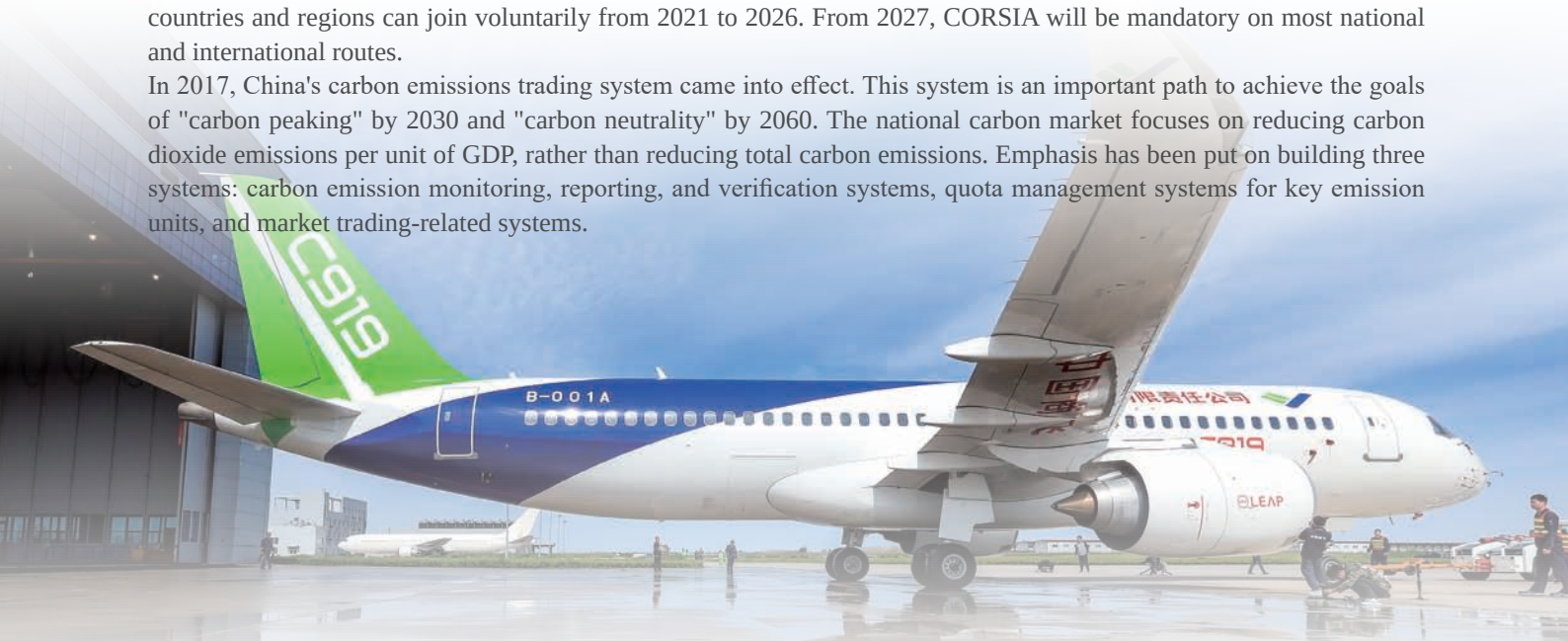
3

By optimizing the fleet and routes.

To meet emissions reduction targets, airlines can choose to phase out older aircraft and introduce newer, more fuel-efficient models. In terms of route optimization, shortening the route is an important solution to save fuel. In actual flight, the shortest path is the "great circle distance", specific measures to shorten routes are: building new take-off and landing airports, flying over polar regions, etc. Route optimization could also take advantage of the optimal flight level and the thrust of the wind, etc.

In addition to the improvement of technical conditions, countries around the world work together to establish and improve relevant policies and regulations. After the EU Emission Trading Scheme (ETS) was launched in 2005, in 2016, the 39th Assembly of International Civil Aviation Organization officially adopted the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA for short), marks the aviation industry as the first industry in the world to implement global carbon-neutral growth measures by agreement of governments. Unlike the EU emissions trading system, CORSIA does not require restrictions on carbon emissions from international flights, but requires airlines to use eligible emission units (referred to as EEU) to offset the increase in carbon emissions after 2020. CORSIA is implemented in three phases: the pilot phase in 2021-2023, the first phase in 2024-2026, and the second phase in 2027-2035. Among them, various countries and regions can join voluntarily from 2021 to 2026. From 2027, CORSIA will be mandatory on most national and international routes.

In 2017, China's carbon emissions trading system came into effect. This system is an important path to achieve the goals of "carbon peaking" by 2030 and "carbon neutrality" by 2060. The national carbon market focuses on reducing carbon dioxide emissions per unit of GDP, rather than reducing total carbon emissions. Emphasis has been put on building three systems: carbon emission monitoring, reporting, and verification systems, quota management systems for key emission units, and market trading-related systems.



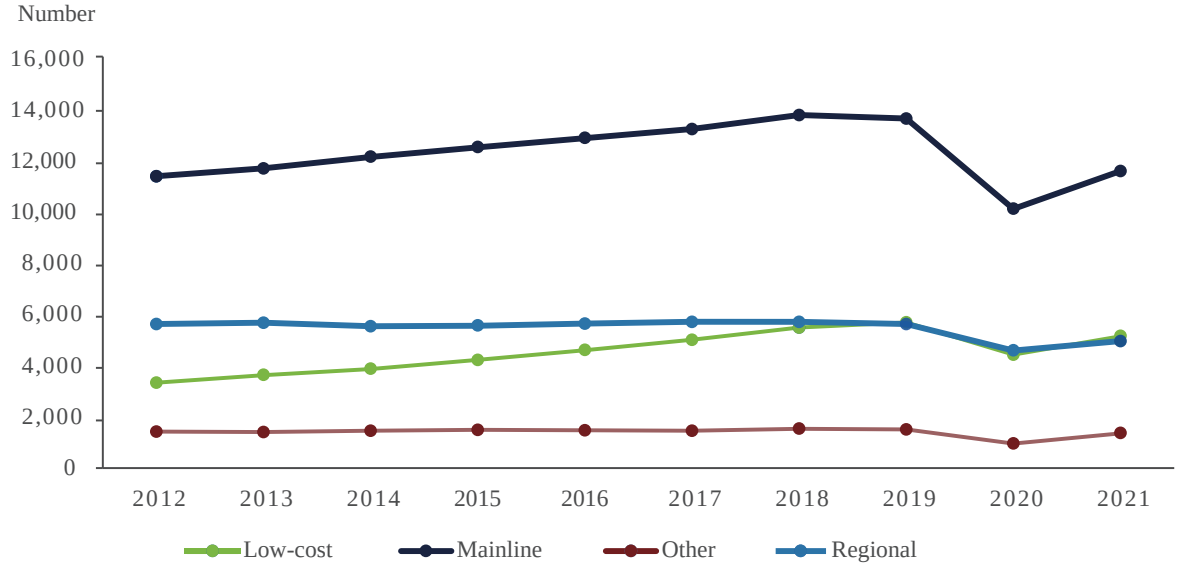
As a civil aircraft R&D and manufacturing enterprise, committing to social responsibility, COMAC has set an example for the industry by selecting the most advanced new-generation engines from the very beginning of the design of C919 aircraft. The fuel efficiency rate is 15% higher than that of the previous generation aircraft, saving energy for the air transportation industry. COMAC promote the green and sustainable development of the aviation industry by developing green aircraft, building green homes, building green industrial chains, and establishing green development centers.

3.6 The Structure of Aviation Industry

After decades of ups and downs in the global air transport industry, mainline airlines have maintained their leading position in the market. In the past decade, low-cost airlines have continued to develop well and their fleet size surpassed that of regional airlines before the outbreak of COVID-19 pandemic. The largest airlines that have been hit the hardest during the pandemic have shown impressive resilience, and their fleets have recovered rapidly in the past year.

In the shadow of the pandemic, low-cost airlines outperformed the mainline airlines. From the perspective of fleet size, mainline airlines have suffered more from this public health crisis. There are two main reasons behind: First, in the global aviation market, the international long-haul market is affected by entry restrictions most, given a large number of cross-border and transcontinental routes have been temporarily closed, so the reduction in capacity is more severe than that of the short- and medium-haul market. Mainline airlines have historically benefit from international business, whereas low-cost carriers primarily target the domestic or intra-regional medium- and short haul sector, which experienced less turbulence than mainline carriers. Second, corporate travelers provide for a sizable portion of mainline carrier's earnings. The pandemic has led to the rise of online telecommuting, and the demand for business travel has declined. In contrast, there has always been a desire for leisure travel. Once travel restrictions are lifted, the number of leisure passengers rebounds rapidly, and low-cost airlines can meet such market changes with their own characteristics.

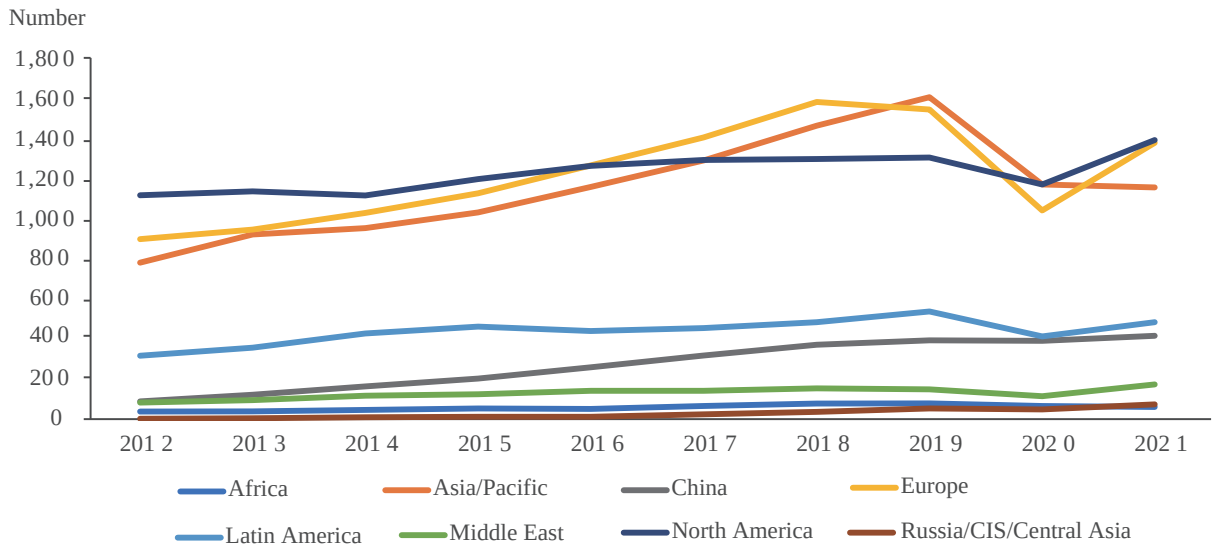
Fleet Size Changes of Different Types of Carriers over 2012-2021 (Including TP)



Source: COMAC, Cirium

During the previous ten years, the number of low-cost airlines in the world has maintained steady growth as a whole, from 112 in 2012 to 133 in 2019. Affected by the pandemic, the number of global low-cost airlines fluctuates, reducing to 119 in 2020 and recovering to 133 in 2021. Single-aisle aircraft are the preferred category of aircraft for low-cost airlines, accounting for 94% of the fleet. Regionally, low-cost airlines in North America once had the largest fleet, but were surpassed by Europe and Asia in 2016 and 2017, respectively. Prior to the COVID-19 pandemic, the fleet size of Asia low-cost airlines surpassed that of Europe, ranking first in the world. After the public health crisis swept the world, low-cost airlines in Europe were the most affected, with a sharp decline in the number of fleets, but there was a strong rebound in 2021; North America was less affected, and the fleet size returned to the world's largest in 2021.

Fleet Size Changes of Low cost carrier (LCC) by Region over 2012-2021 (Including TP)



Source: COMAC, Cirium

4

China Air Travel Industry Overview

4.1 China air travel industry overview

4.1.1 Market Overview (Mainland China)

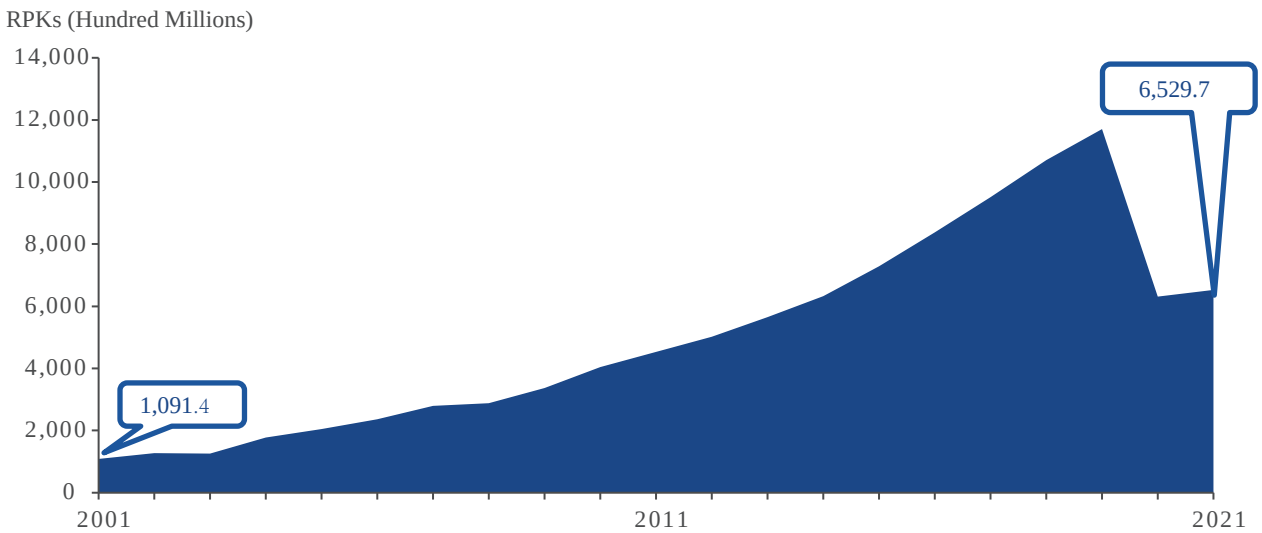
In 2021, despite the continued impact of the covid-19 pandemic on the global market, China's economic operation was generally stable, with a GDP of 114.4 trillion yuan, an increase of 8.1% over the previous year. If converted at an averaged exchanged rate, China’s GDP amounts to 17.7 trillion dollars last year, taking a proportion of more than 18% of the world’s GDP. The per capita GDP exceeds 12,000 US dollars, making it the largest middle-income group in the world, which is providing a solid foundation for the increase in the number of flights per capita in China and the further development of the aviation market in the future.

In the past two years, the overall demand in the global aviation market has been weak due to the impact of the pandemic. In 2021 China Civil Aviation has made great efforts to overcome the impact of pandemic prevention and control, operating losses, stricter safety measures and other difficulties, and achieved a 7.3% increase in overall transportation turnover, a 3.5% increase in passenger turnover, and a recovery to about 70% of the total passenger traffic in 2019 according to the statistics of CAAC, a hard-won achievement.

From March 2022, due to the impact of the Omicron virus, the pandemic in China has recurred few times, resulting in a severe decline in the domestic aviation industry demand, coupled with the rapid rise in oil prices in the short term, and the cautiousness of airlines on the introduction of aircraft, theses factors collectively contributed to an overall slowdown in supply. The slowdown indirectly affected the recovery of market demand.

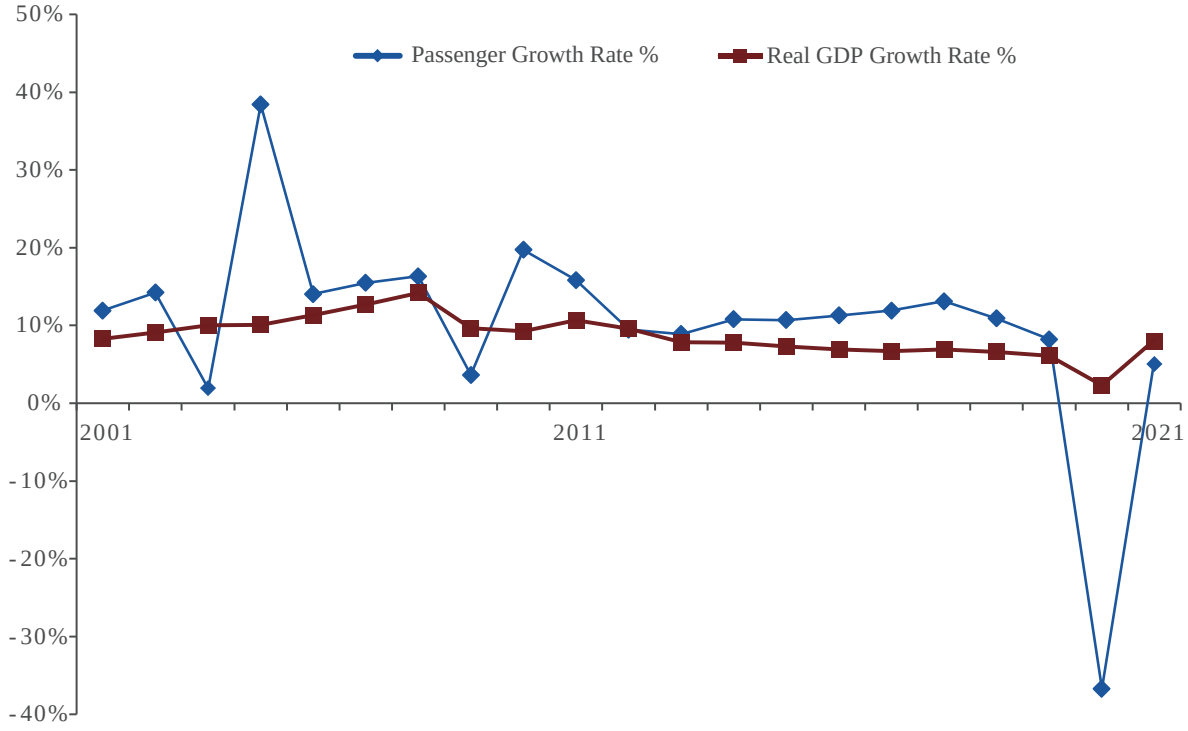
Looking back on the pandemic, the resilience of China's aviation market demand needs to be highlighted. After deeply falling down , it finally found its way to climb up again. In the future, if the impact of the pandemic gradually subsides from the end of 2022 or the beginning of 2023 and the international travel policy is further relaxed in China, the aviation market demand is expected to recover quickly. In addition, China's aviation market has developed rapidly in the past 20 years, and in 2019, it has become the world's second largest aviation market (by ASK statistics of the national carriers). Paying more attention to the enhancement of efficiency, the supply and demand structure of the aviation industry is expected to be improved, and the general trend of the long-term development of China's civil aviation have not changed.

China RPKs Trends (2001-2021)



Source: COMAC, CAAC

China Real GDP and Passenger Traffic Trends (2001-2021)

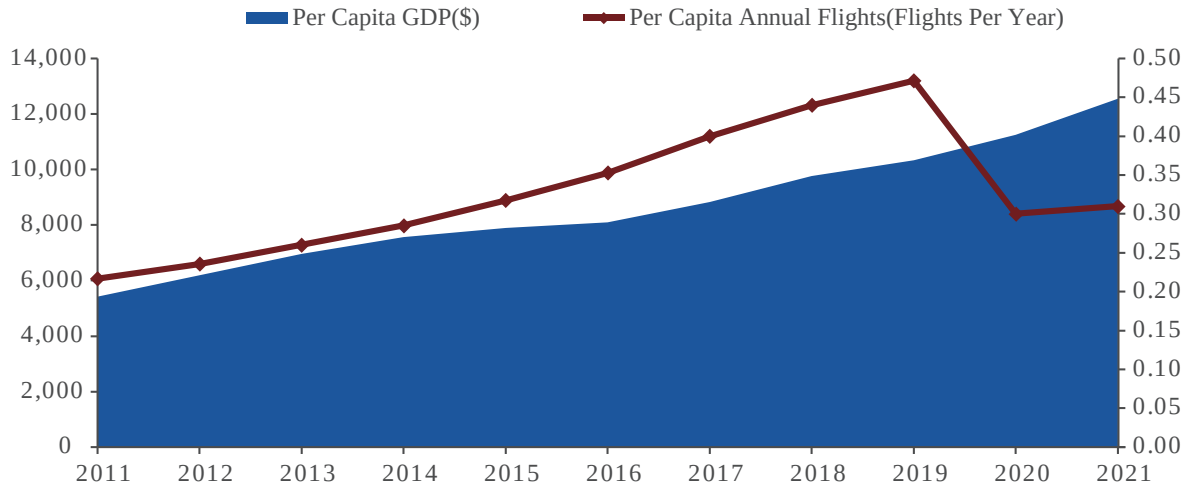


Source: COMAC, CAAC

4.1.2 China Per Capita GDP and Per Capita Annual Flight

The number of flights per capita reflects the frequency of residents' air travel. In the past 10 years, domestic per capita GDP has been growing constantly. In 2021, China's per capita GDP was 80,976 yuan, an increase of 11.8% compared to the previous year, and the number of flights per capita increased from 0.22 in 2011 to 0.47 in 2019. In 2020, China's economy was affected by COVID-19, with the number of flights per capita dropped to 0.3 for the first time in a decade, and then back to 0.31 in 2021. The number of flights per capita in the United States also dropped from 2.54 in 2019 to 1.1 in 2020, and back to 2.02 in 2021.

China Per Capita GDP and Per Capita Annual Flight (2011-2021)

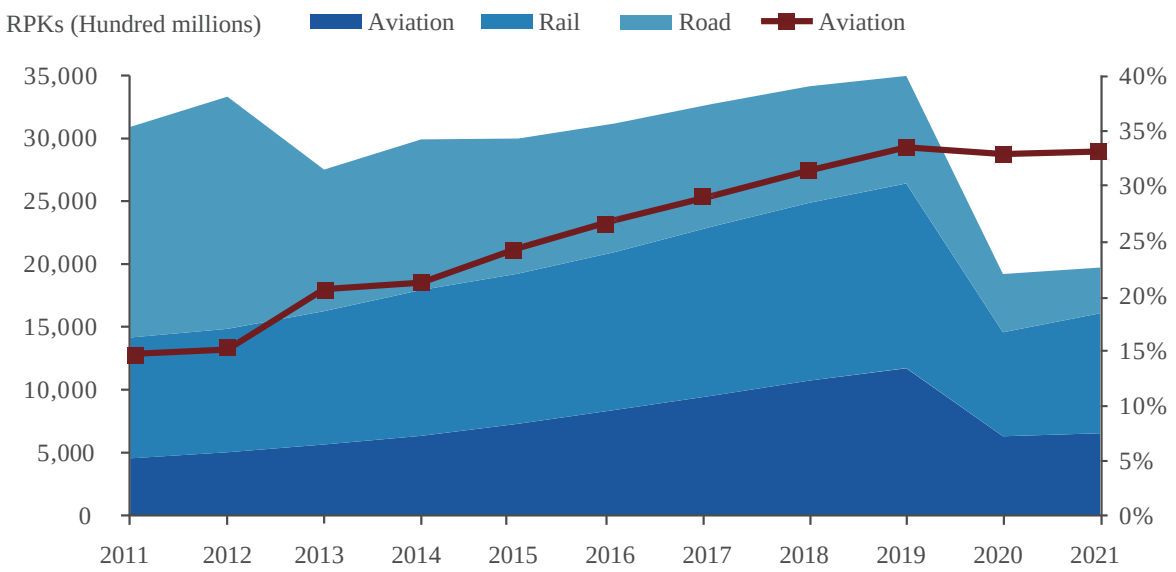


Source: COMAC, CAAC, NBSC

4.1.3 Major Transport Modes

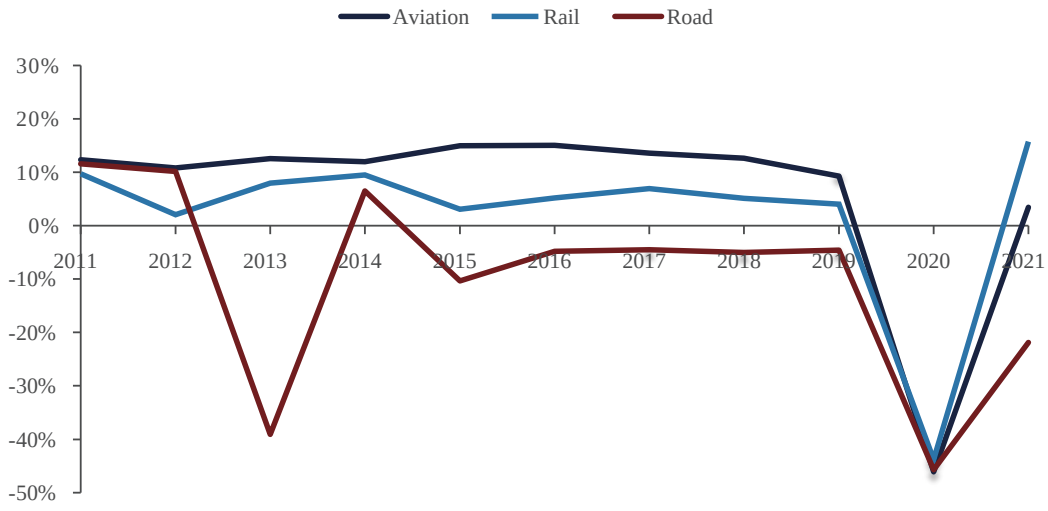
From 2011 to 2019, the transportation industry in China kept growing at a high speed with the number of passenger kilometers transported by various modes of transportation in China steadily increasing. In 2020, the passenger volume of the three modes of transportation--air, railway and road, decreased by 46.1%, 43.8% and 45.7% respectively compared with 2019. The proportion of aviation increased year by year, accounting for 33% of all means of transport in 2021.

Major Transport Modes RPKs Trends in Mainland China (2011-2021)



Source: COMAC, MOT

Comparison of Major Transport Modes in China (2011-2021)



Source: COMAC, MOT

Different Transport Modes' Freight Volume and Growth in 2021

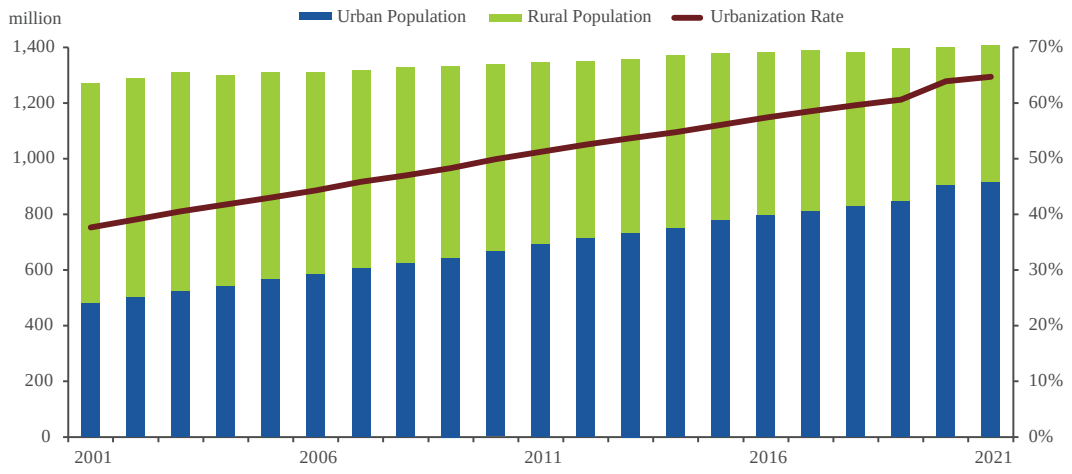
Index	Freight Volume (Billion Ton)	Rail (Billion Ton)	Road (Billion Ton)	Aviation (Million Ton)	Freight Turnover (Billion Ton-Km)	Rail (Billion Ton-Km)	Road (Billion Ton-Km)	Aviation (Billion Ton-Km)
2020	463.4	44.6	343.6	676.6	196,618.30	30,371.80	60,171.8	240.2
2021	521.6	47.74	391.39	731.84	218,181.32	33,238.00	69,087.65	278.16
Growth Rate (%)	12.6	7.0	13.9	8.2	11.0	9.4	14.8	15.8

Source: COMAC, NBSC

4.1.3 Urbanization

By the end of 2021, the total population of mainland China was 1.41 billion, with an increase of 63.44 million from the end of 2011. The population of urban permanent residents was 914.25 million, and the urbanization rate of the permanent residents population was 64.72% and is anticipated to reach 65% by the end of the 14th Five Year Plan The continuous increase in the rate of urbanization has led major cities to flourish, boosting airport construction and the growth of air passengers, which will stimulate the growth of aviation demand.

Urbanization (2001-2021)

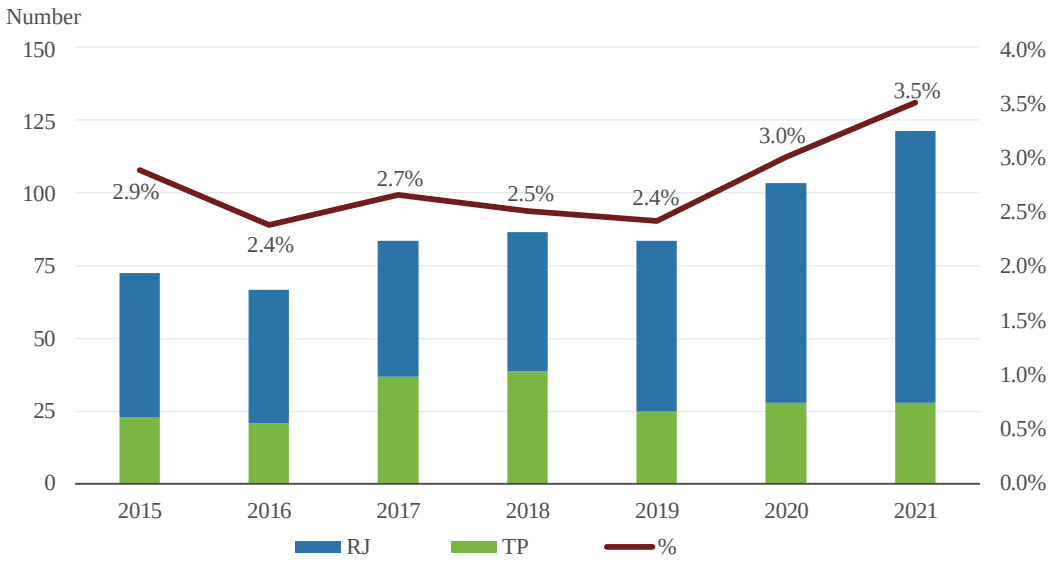


Source: COMAC, NBSC

4.2 China Regional Air Transport Market

By the end of 2021, China operated a total of 122 regional jets, whose proportion of the fleet reaches its highest level since 2014, thanks to the delivery of domestic regional aircraft in the past year.

Trend of China Regional Jet Fleet (2015-2021)

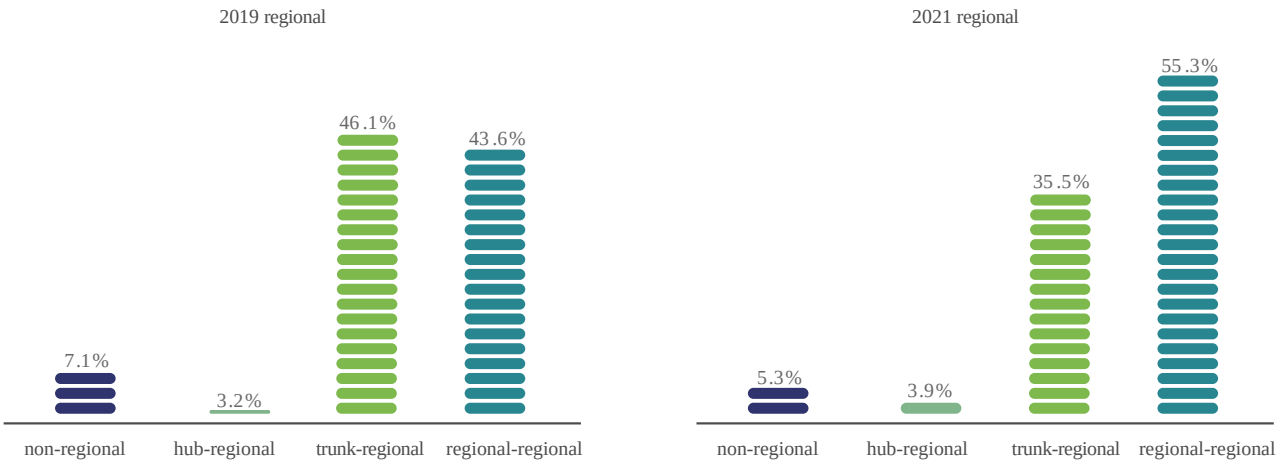


Source: COMAC, Cirium

In 2021, there are 7 newly opened airport in China, which locate in following cities: Chengdu Tianfu in Sichuan Province, Jinzhou Sashi in Hubei Province, Heze Mudan in Shandong Province, Wuhu Xuanzhou in Anhui Province, Chenzhou Beihu in Hunan Province, Jiujiang Lushan in Jiangxi Province, Shaoguan in Guangdong ProvinceDanxia Airport, the number of certified airports has amounted to 248. There were 187 airports with an annual passengers throughput less than 2 million, accounting for 10.6% of all domestic airports' passenger volume , basically at the same level with the previous year. 119 airports, which accounted for 60% of the whole number of airports, dealt with less than 500,000 passengers.

Regional route is defined as route connected to airports with annual throughput less than 2 million. Hub airports are the 43 airports in 39 cities announced by the Civil Aviation Administration. Other airports are defined as trunk airports. According to this, the regional routes are divided into hub-regional routes and trunk-regional routes and regional-regional routes, the rest are non-regional routes. In 2021, according to OAG data, excluding routes with less than 20 annual flights throughout the year, there were a total of 7,245 routes in China (excluding Hong Kong, Macao and Taiwan) based on one-way flights, 4,673 branch routes, accounting for 64.5% of total, 10% higher than that in 2019. Under the pandemic, the number of domestic high-traffic routes has decreased, and the regional routes have increased, which provided the development opportunities for the Chinese regional market in the near future.

Proportion of domestic direct flight in 2019 and 2021



Source: COMAC, OAG

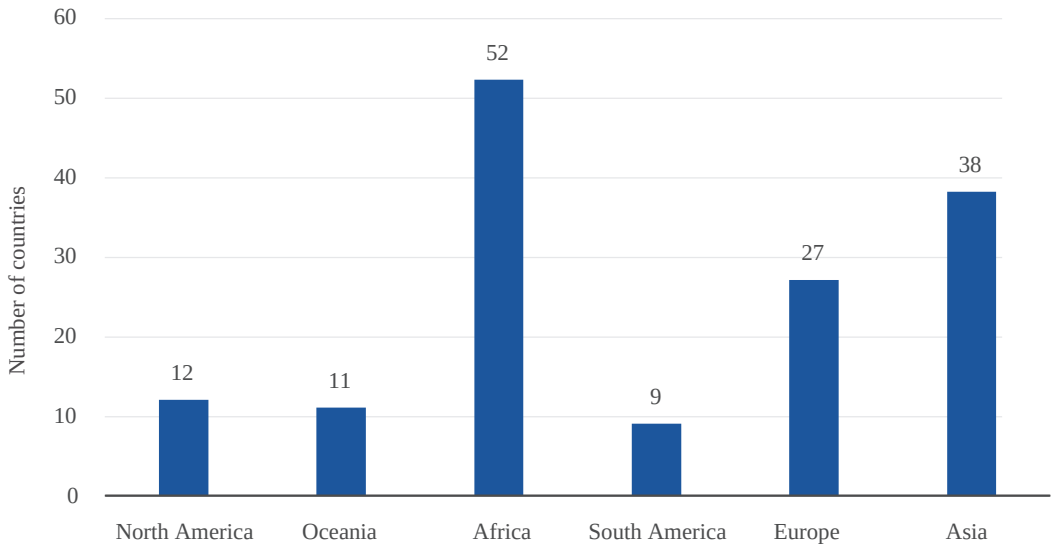
In December 2021, CAAC issued the "Implementation Opinions on Innovating the Service Model of "All-Network Connections via Trunk-Regional- general aviation ", officially including general aviation short-distance transport into the main body of civil aviation transit, and building three route networks for trunk, regional and general aviation (short-distance) transport, which will improve the accessibility of the regional air network. Combined with the siphon effect of general aviation and the improvement of domestic passenger transit facilitation services in the future, the potential of passenger demand in the feeder market will be fully released , and China's regional market will reach a wholly new level.

4.3 The Belt and Road Related Countries and China Aviation Market Development

"The Belt and Road" (B&R) initiative, which is based on the principle of mutual negotiation, construction and sharing, has been transformed from concept to action, vision to reality. In the past decade, "the Belt and Road" has always made interconnection a priority in its construction, focusing on promoting cooperation in highways, railroads, ports, aviation, aerospace, oil, gas pipelines, electricity, network communications and other fields. Besides, it jointly promotes the interconnection of land, sea, sky and network with other countries. In the field of aviation transport, China (excluding Hong Kong, Macao and Taiwan) has signed more than 200 cooperation documents with 149 countries and 32 international organizations along "the Belt and Road" until March 23, 2022. “The Belt and Road” expands into Asia, Europe, Africa, Oceania, South America and North America, of which 98 countries have signed air transport agreements with mainland China.

In 2021, "The Belt and Road" coverage have been enlarged from the countries along the original Eurasian continent previously to present-day Africa, South America and North America at present. Among the 149 countries participating in “The Belt and Road” program, Africa has the largest number of countries with more than 50, followed by Asia with 38.

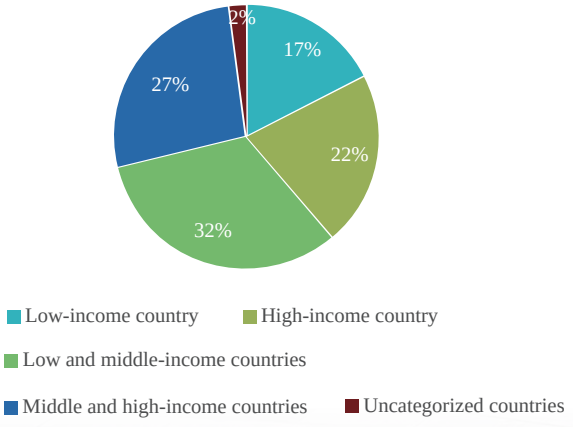
Global regional distribution of B&R countries in 2021

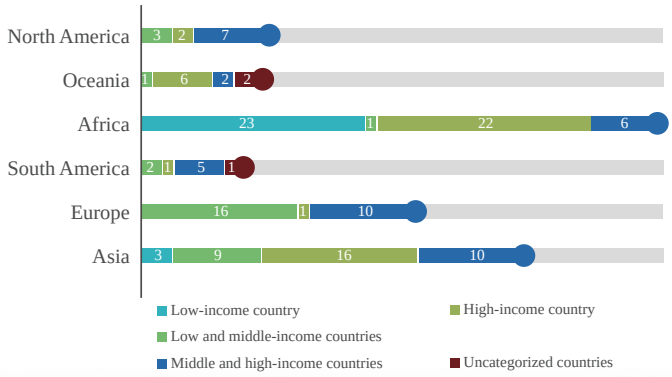


Source: COMAC, Belt and Road Portal

From the aspect of " the Belt and Road" countries' income level, the public data of the World Bank shows that among the B&R countries in 2021, the number of low- and middle-income countries is 48 which is the largest and accounts for 32%, including 22 African countries and 16 Asian countries. There are also 26 low-income countries, including 23 African countries; 32 high-income countries, accounting for 22%, and half of them come from Europe.

2021 B&R Countries Regional Distribution/By Income Level

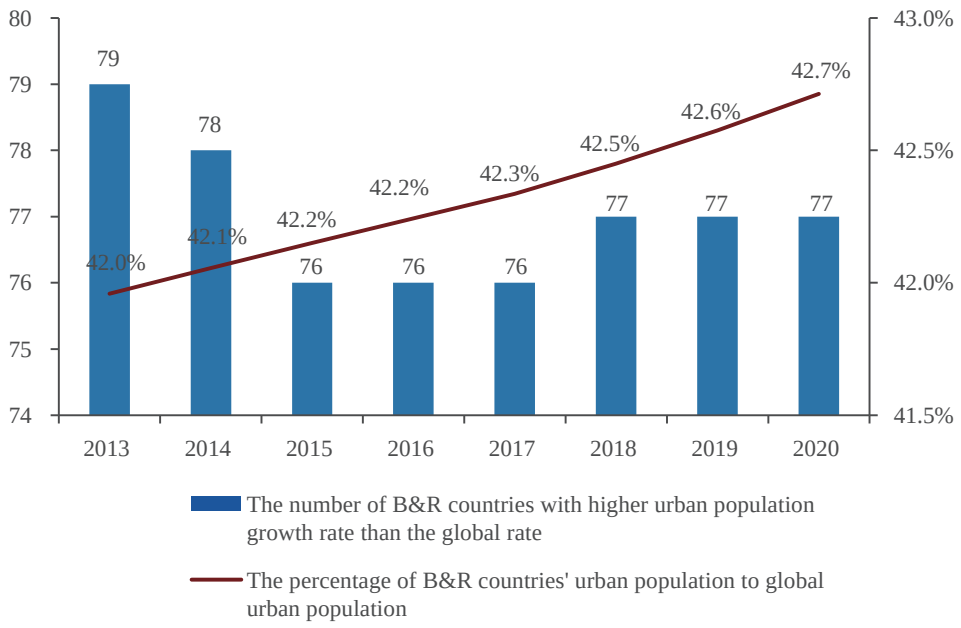




Source: COMAC, World Bank

From the perspective of the urban population in B&R countries, Indonesia, Russia and Nigeria have more than 100 million urban populations. From 2013 to 2020, B&R countries' urban population as a percentage of global urban population is gradually increasing. In 2020, the urban population of B&R countries accounted for 42.7% of the global urban population, and the growth rate of urban population in 77 countries was higher than the global average.

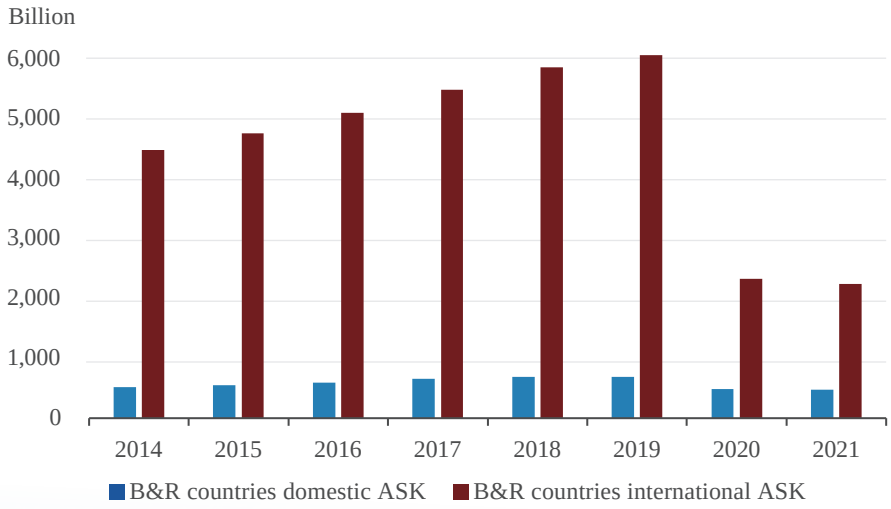
2013-2020 Urban Population and Growth Rate of B&R Countries



Source: COMAC, World Bank

Using ASK to observe the changing trend of domestic and international transport capacity in B&R countries: from 2014 to 2021, the domestic market ASK of B&R countries has increased steadily since 2014, reaching a peak in 2019, with a compound growth rate of 6.21% in the first six years. In 2020 and 2021, due to the global impact of the COVID-19 pandemic, the domestic ASK of B&R countries has fallen sharply. Furthermore, in 2021, it has decreased by 63% compared with 2019.

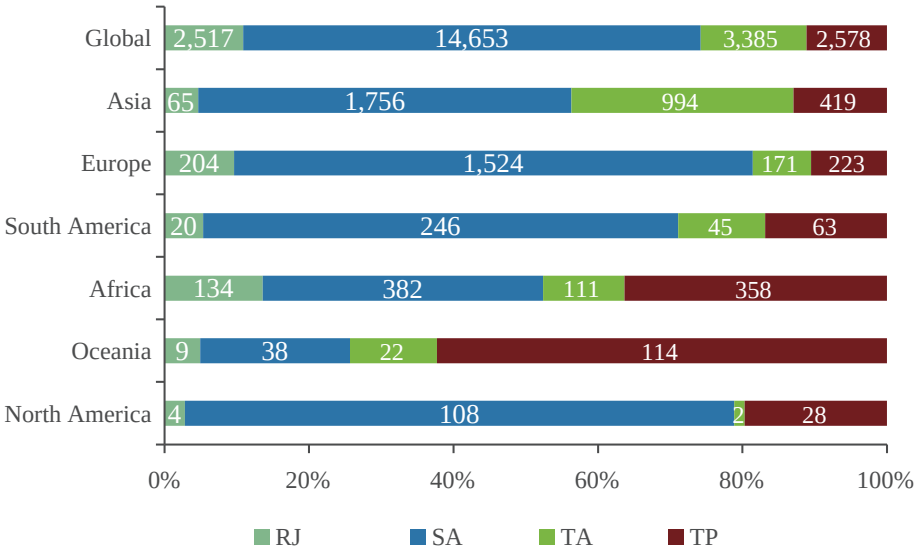
Domestic and International Transport Capacity Changes in B&R Countries (2014-2021)



Source: COMAC, OAG

From the regional structure characteristics of the in-service fleet, except for Oceania, which accounted for the highest proportion of turboprop regional aircraft, single aisle fleet comprised the highest proportion in the rest regions. Furthermore, the North American fleet accounted for 76% of single-aisle aircraft.

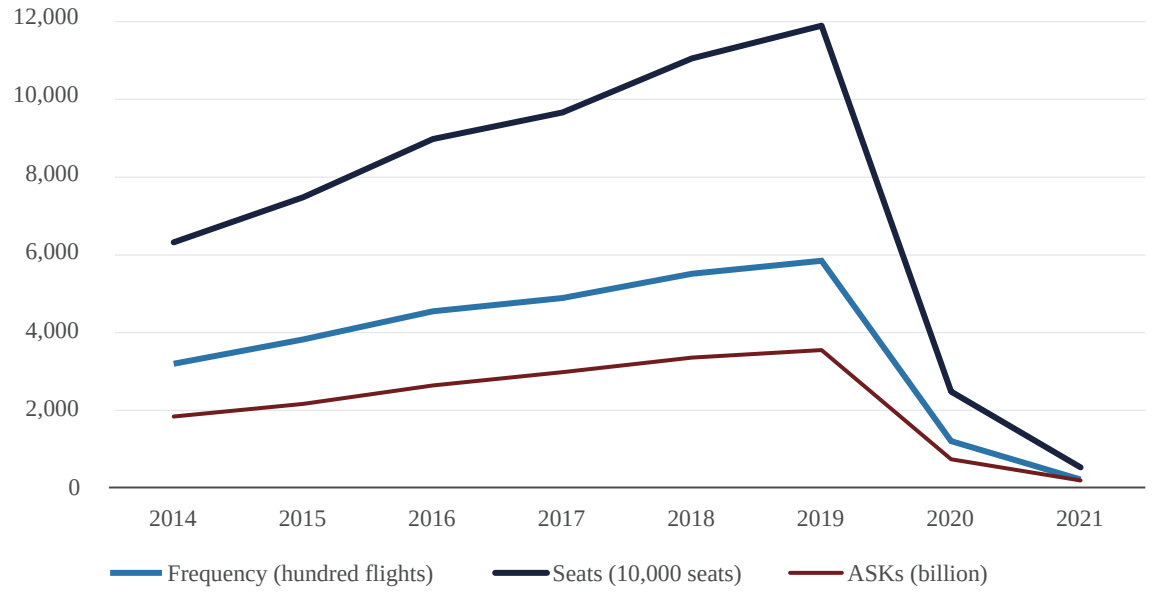
Regional Structure Characteristics of B&R Countries In-Service Fleet in 2021



Source: COMAC, Cirium

After "the Belt and Road" initiative was put forward, the scale of the air transport market in China and B&R countries gradually expanded. From 2014 to 2019, ASK between China and B&R countries grew at a CAGR of 14.1%, which was higher than the capacity growth rate of routes between B&R countries and other countries. Affected by the global pandemic, the ASK between China and B&R countries in 2021 is only 5.1% of 2019 in the same period, and 25% of the year 2020. International routes operation has been greatly affected.

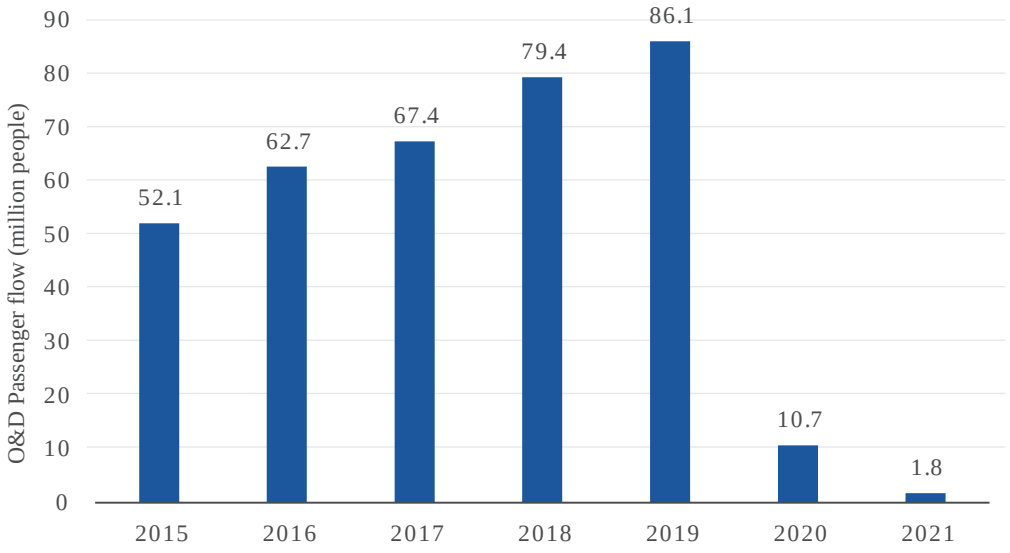
B&R Countries to China Airline Market ASK Trends (2014-2021)



Source: COMAC, OAG

In 2021, O&D passenger flow in China and B&R countries decreased to 1.8 million, only 2% of 2019.

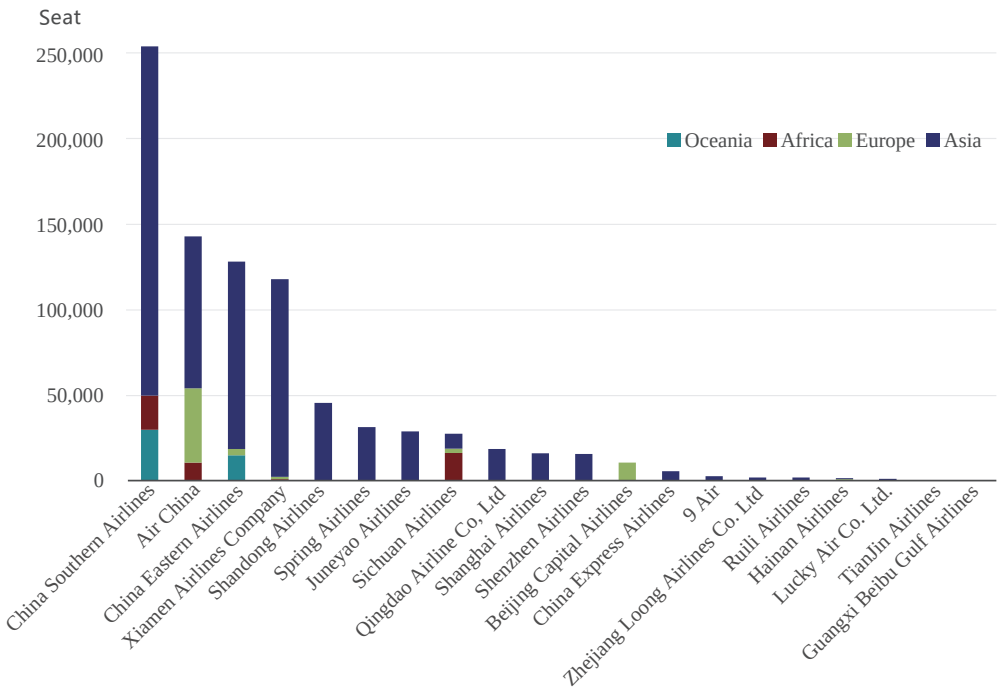
Trend of O&D Passenger Flow between China and B&R Countries (2015-2021)



Source: COMAC, IATA

In 2021, 10 airlines that have the highest capacity in the B&R national aviation market are: China Southern Airlines, Air China, China Eastern Airlines, Xiamen Airlines, Shandong Airlines, Spring Airlines, Juneyao Airlines, Sichuan Airlines, Qingdao Airlines and Shanghai Airlines. Affected by the pandemic, most of the capacity of these airlines is put in the Asian region surrounding China.

Available Seats Provided by China Mainland Carriers in B&R Aviation Markets by Regions in 2021



Source: COMAC, OAG

The research on the countries of "the Belt and Road" in 2021 indicates that "Belt and Road" territory is constantly expanding, which will have a positive impact on Chinese airlines going global in the future. In the long run, there are still many problems to be solved in the air transport industry which will bring uncertainty to the future development of the air transport industry. In the meantime, the air transport industry in the B&R countries will also be under the sway of this broader context.

5

Global Air Transport Market Forecast

5.1 Global Traffic Forecast

In 2021, with countries actively promoting vaccination against COVID-19 and improving prevention measures in combating the pandemic, the global aviation market recovered gradually. However, due to the impact of the more contagious Omicron pandemic in the later period, the overall recovery did not meet expectations. The global air passenger turnover recovered to 40% of the pre-pandemic level, slightly better than in 2020. The domestic market recovered to 71.8% of the 2019 level, and the international market recovered to 24.5%.

From the second half of 2021 to 2022, countries have gradually loosened international travel restrictions, and the international market has seen a slow and steady recovery. However, global geopolitical conflicts, high oil prices, tight supply chains, high inflation and other related issues have caused a slowdown in global economic growth and low consumer confidence, which have brought great pressure on airline operations in the post-pandemic period and will affect market for a period of time.

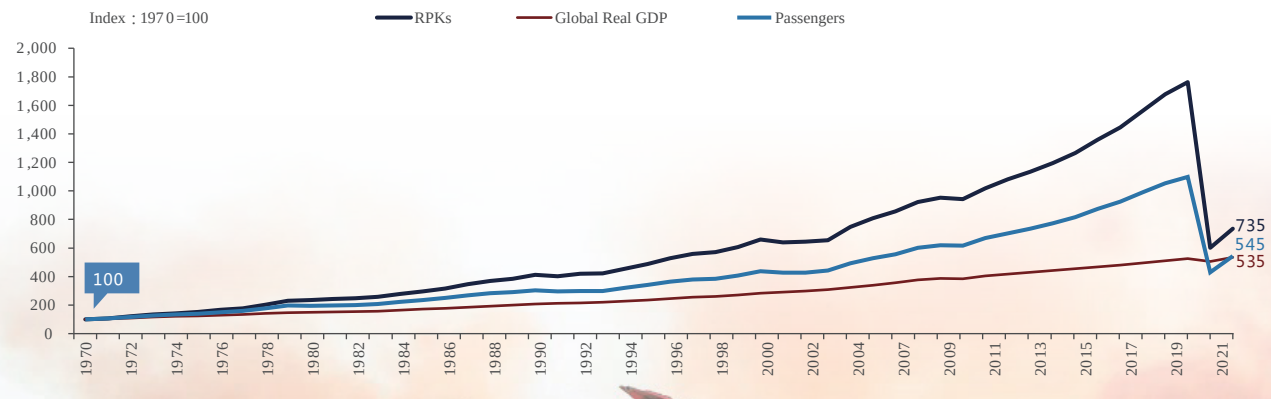
In 2021, the RPK of Russia's domestic aviation market exceeded the pre-pandemic level, an increase of 24% compared with 2019, making it one of the countries with the best recovery in the domestic market in the world. However, the outbreak of the conflict between Russia and Ukraine in 2022 will seriously drag down the aviation market demand of Russia, Ukraine and Eastern Europe in the future.

In 2021, RPK in Europe recovered to less than 40% of the pre-pandemic level, and is expected to recover to 80% in 2022. In 2021, RPK in North America recovered to 60% of the pre-pandemic level, of which the international market recovered to 35%, slightly better than in other regions. With the lifting of COVID restrictions and the further reopening of the global aviation market, North America market is expected to be the first to return to pre-pandemic levels in 2022.

In the first half of 2022, China's domestic aviation market suffered a sharp decline due to the pandemic wave of Omicron disease. After the pandemic was effectively controlled in June, the domestic market demand rebounded rapidly with RPK increased significantly by 70.2%. However, with the recurrence of the Omicron pandemic in key tourism markets such as Hainan, Xinjiang, and Yunnan during the Summer travel season, the market recovery has once again been held back. The recovery of the overall demand still under the sway of ups and downs of the pandemic and how effectively infection prevention and control measures are implemented.

In the long run, the development trend of the aviation market will still be closely related to the recovery and the development of the global economy after the pandemic and the Russia-Ukraine crisis. According to IHS forecast, the annual growth rate of the global economy will be 2.6% in the next 20 years (2019 as the benchmark). Based on this, it is forecast that the global RPKs will maintain a growth rate of 3.9%, reaching 19.9 trillion in 2041.

Trends of Global Passengers, RPKs and Real GDP (1970-2021)



Source: COMAC, IATA, IHS

Global Traffic in 2021 and 2041

Unit:Trillion 2021 2041

Note: Inner and regional RPKs has been allocated to each separate district

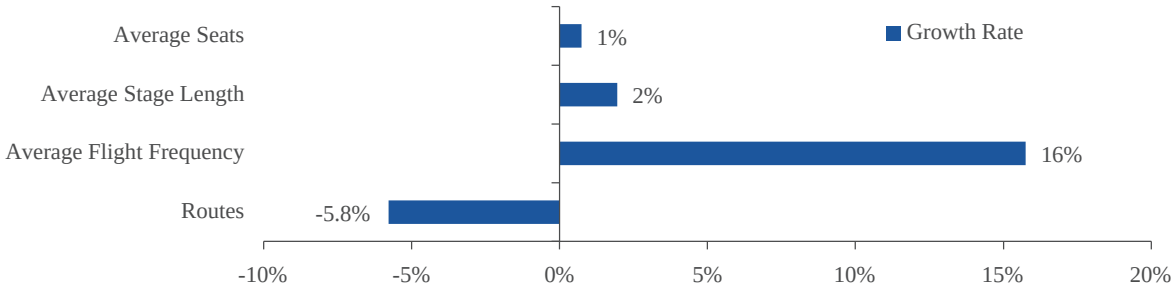
Source: COMAC, I CAO, IATA, OAG

5.1.1 Network

In 2021, the impact of the pandemic has not subsided, and the overall scale of the global airline network will continue to shrink, but the aviation market in some regions began to recover. According to OAG, a total of 29,862 routes were operated globally in 2021, a decrease of 5.8% compared to 2020. The average number of seats has risen from 153 in 2020 to 154 in 2021, which has not yet reached the level of 156 in 2019 before the pandemic. The average route distance has recovered from 1,291 kilometers to 1,316 kilometers, but there is still a gap from 1,441 kilometers in 2019.

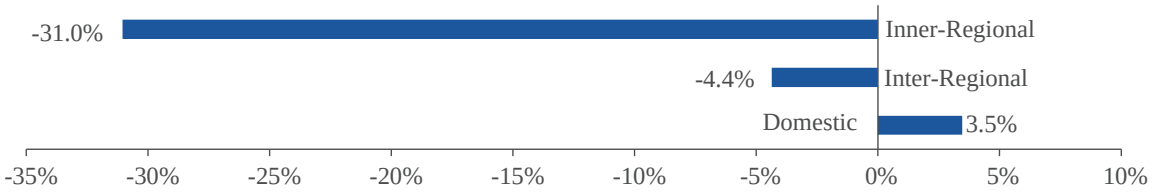
According to departure and destination airport, routes are divided into domestic, international intra-regional and international inter-regional routes (regional division is based on Comac region code). In 2021, the number of domestic routes increased by 3.5% compared with last year, while the number of intra-regional and inter-international routes decreased by 4.4% and by 31.0% respectively. The recovery speed of short- and medium-distance travel is significantly faster than that of cross-border and intercontinental travel. From the perspective of changes in the number of routes, the domestic air travel markets in Latin America and Africa were still shrinking, while the Russian and Central Asian markets had the strongest recovery momentum, with an increase of 12.4%; among intra-regional routes, only the market of Russia&CIS has achieved a positive growth of 40.83%. Routes from North America to Russia&CIS increased the most, reaching 68.2%, while routes from China to Asia Pacific and China to Russia&CIS decreased by 238.3% and by 276.2% respectively. The impact of the pandemic on the global aviation market has been uneven. Given factors such as vaccination rates and travel restriction policies, the speed of recovery in regions varied.

Global Network Growth in 2021 (Compared with 2020)



Source: COMAC, OAG

Network Growth in Each Market in 2021 (compared with 2020)



Source: COMAC, OAG

5.1.2 Retirement

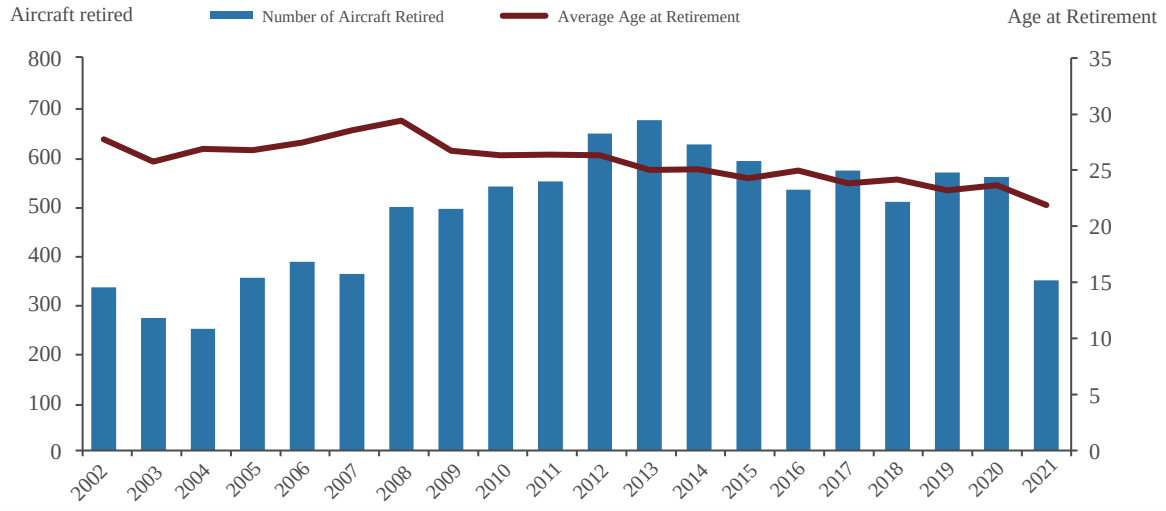
A total number of 347 passenger jets have retired in 2021, with the average aircraft retirement age of 22. The global average retirement age illustrates a slightly decrease trend in recent 20 years. Between 2001 and 2014, the average retirement age in the world remained at 25 to 29 years. During the period from 2006 to 2008, the global average retirement age in the world was relatively high, exceeding 27 years, and even close to 30 years in 2008. But since 2015, it has shown a downward trend. More aircraft have been stored than ever before due to the pandemic, and we may see a further decline in the age of retired aircraft in the near term.

From 2001 to 2013, the average number of retired passenger jets increased year by year, from 250 in 2001 to 673 in 2013. Since then, the number of aircraft retirement has declined, but they have all exceeded 500. Until 2021, affected by the sharp drop in the delivery of new aircraft due to the pandemic, the number of retired passenger jets will drop below 400. The trend of decreasing age of retired aircraft and increasing number of retired aircraft shows that the process of upgrading the global passenger aircraft fleet is accelerating, and as new types are produced, more old types are being replaced.

Judging from the global passenger aircraft retirement data in the past 20 years, the retirement age of passenger aircraft is concentrated in 15-35 years, of which 20-30 years old passenger aircraft take the largest proportion. Among the 347 retired passenger aircraft in 2021, 318 passenger aircraft are less than 30 years old, accounting for 92% of the total number of retired passenger aircraft.

In the past 10 years, rise in fuel prices has served as a major factor in decision makings on fleet retirement by airlines. The pressure of increasing fuel-related costs on profit tended to force airlines to replace old and relatively inefficient aircraft with new ones with better emission record.

Historical Passenger Fleet Retirement Trends(2002-2021)



Source: COMAC, Cirium

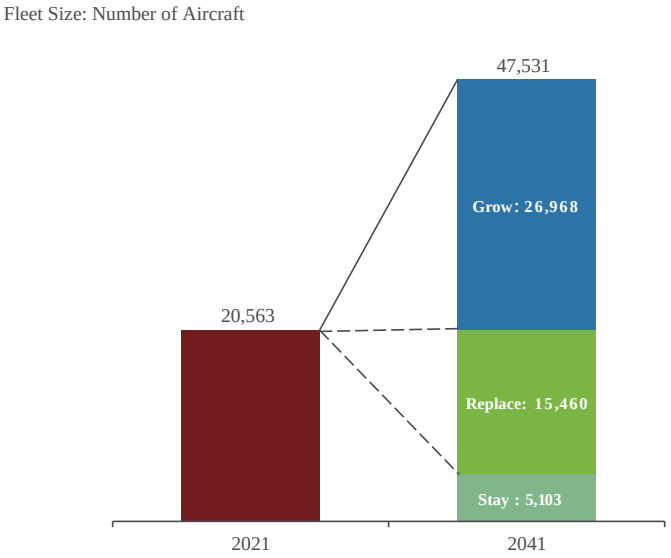
5.2 Global Fleet Forecast

5.2.1 Fleet Forecast Summary

Although the world is still affected by the pandemic in 2021, the number of passenger jets in service across the world by the end of 2021 was slightly higher than 2020. There were 20,563 aircraft in service in 2021, which has increased by 2,430 aircraft, representing an increase of 13.4% compared with the 2020 level. In terms of the regions, the fleet growth rate of Europe, Middle East and Latin America were higher than other regions, increasing by 37.1%, 21.6% and 19.7% respectively in 2021. However, in terms of in-service fleet, the number of passenger jets in North America accounted the largest scale, 6,124 aircraft in 2021, which has recovered to about 91.6% of 2019 levels. Followed by Europe, the number of passenger jets in service increased from 2,929 in 2020 to 4,017 in 2021. In China, the proportion of aircraft fleet affected by the Covid-19 is relatively small. China's in-service fleet number in 2021 was 3,695, a slight increase of 1.5% over 2020, and has recovered to 95.7% of the 2019 fleet level.

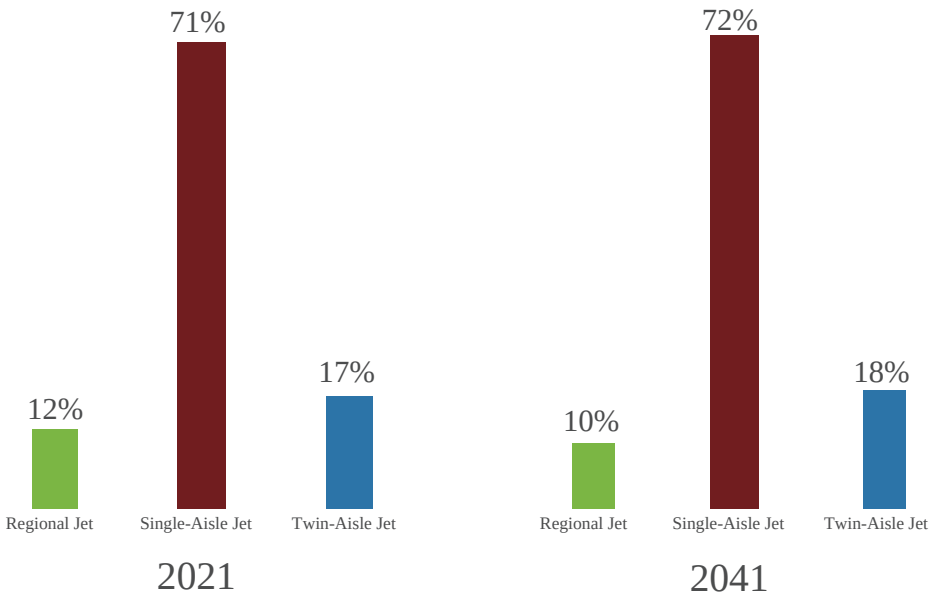
In the next two decades, COMAC expects the average annual growth rate of the global fleet to be 4.3%, decrease by 0.4% than 2020 forecast. By the end of 2041, the number of global passenger jets are expected to be 47,531. 42,428 new aircraft will be delivered globally and 16,604 aircraft (80.7% of the current fleet) will be retired by 2041.

Global Forecast Outlook



Source: COMAC, Cirium

Current and Forecast Fleet by Category



Source: COMAC, Cirium

Global Fleet Forecast by Category

	Regional Jet	Single-Aisle Jet	Twin-Aisle Jet	Total
2021	2,516	14,660	3,387	20,563
2026F	2,859	19,317	4,402	26,578
2031F	2,941	23,906	5,791	32,637
2036F	3,872	28,015	7,149	39,035
2041F	4,922	33,983	8,626	47,531

Source: COMAC

The single-aisle category will continue to be the largest among 3 passenger jet categories, accounting for 71.5% of the total in 2041. The share for twin-aisle fleet will rise from its current level of 16.5% to 18.1%. The share for regional jets will slightly decrease from 12.2% in 2021 to 10.3% in 2041.

Asia Pacific (including China) is the fastest growing market, with its share of the global fleet increasing from 31% today to 40% by 2041. The proportion of China's passenger aircraft fleet will increase from 16% to 21%. With the development of the emerging markets, North America's fleet size share which is largest currently will decline from 29% to about 20%. In next 20 years, the fleet size in Latin America will stay at the same level of 2021, which accounts for 7% across the globe. Fleet size in Russia and the CIS region will also decrease from the current level of 5% to around 3% by 2041.

Global Fleet Forecast by Region

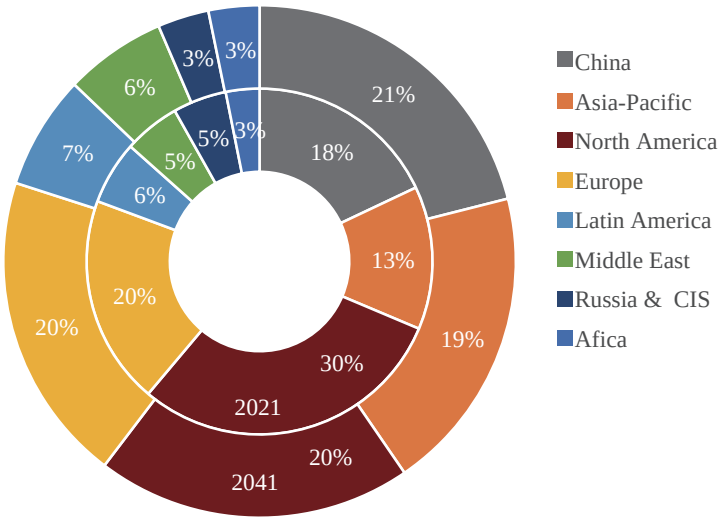
	2021		2041F		2022–2041
	Fleet	% of global total	Fleet	% of global total	Annual growth rate
China*	3,695	16%	10,007	21%	5.1%
Asia-Pacific**	2,752	15%	9,211	19%	6.2%
North America	6,124	29%	9,467	20%	2.2%
Europe	4,017	19%	9,322	20%	4.3%
Latin America	1,217	7%	3,412	7%	5.3%
Middle East	1,081	5%	3,048	6%	5.3%
Russia & CIS	1,031	5%	1,538	3%	2.0%
Africa	646	4%	1,526	3%	4.4%
Global	20,563	100%	47,531	100%	4.3%

*China includes Hong Kong, Macao and Taiwan

**Asia-Pacific excludes China, Hong Kong, Macao and Taiwan

Source: COMAC, Cirium

Current and Forecast Fleet by Region



Source: COMAC, Cirium

5.2.2 Delivery Forecast Summary

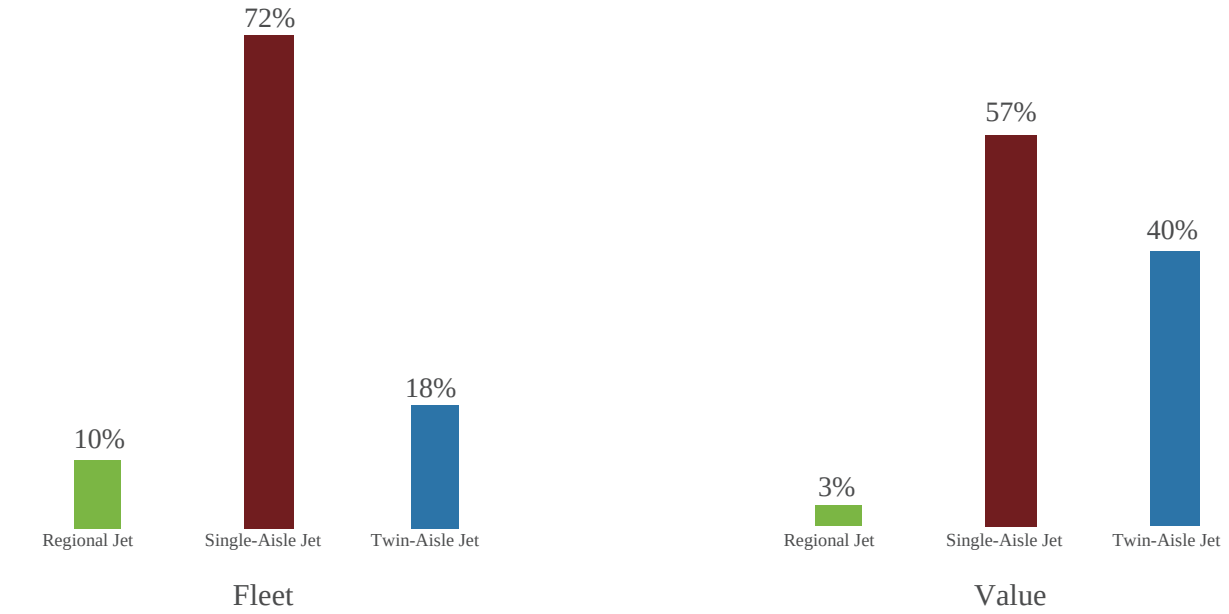
Over the next two decades, approximately 42,428 jetliners worth about $6.4 trillion (under 2021 aircraft list prices) will be delivered globally, driven by replacement demand for 75.2% of the in-service fleet and new demand in the aviation market.

2022-2041 Global Delivery Forecast by Category

	Regional Jet	Single-Aisle Jet	Twin-Aisle Jet	Total
2022-2041 deliveries	4,367	30,367	7,694	42,428
Market Value Billion $	221	3,643	2,538	6,402

Source: COMAC

2022-2041 Delivery Percentage by Volume and Value



Source: COMAC

Single-aisle aircraft types will account for around 72% of the forecast deliveries, while around 18% will be twin-aisle types, and 10% will be regional jets. In terms of delivery value, twin-aisle deliveries will account for 40% of the total amount, whereas single-aisle deliveries will account for 57%,and only 3% for regional jets.

Global Historical and Forecast Deliveries by Region

	2002–2021 historical deliveries		2022–2041 forecast deliveries	
China*	4,272	19%	9,284	22%
Asia-Pacific**	3,555	16%	8,413	20%
North America	6,002	26%	8,167	19%
Europe	4,721	21%	8,310	20%
Latin America	1,262	6%	2,941	7%
Middle East	1,240	5%	2,781	7%
Russia & CIS	1,041	5%	1,152	3%
Africa	676	3%	1,380	3%
Global	22,769	100%	42,428	100%

*China includes Hong Kong, Macao and Taiwan

**Asia-Pacific excludes China, Hong Kong, Macao and Taiwan

Source: COMAC, Cirium

In the next two decades, Asia Pacific (including China) will be the largest market in terms of aircraft deliveries, with 17,697 deliveries which account for 42% of the total amount. China is forecast to account for 22% of the world forecast deliveries. The two mature markets i.e., Europe and North America, are expected to receive 8,310 and 8,167 deliveries respectively. Latin American and Middle Eastern airlines will also enjoy great expansions in their fleets. It is estimated that the two regions' shares of new jet deliveries will reach 2,941 and 2,781 respectively.

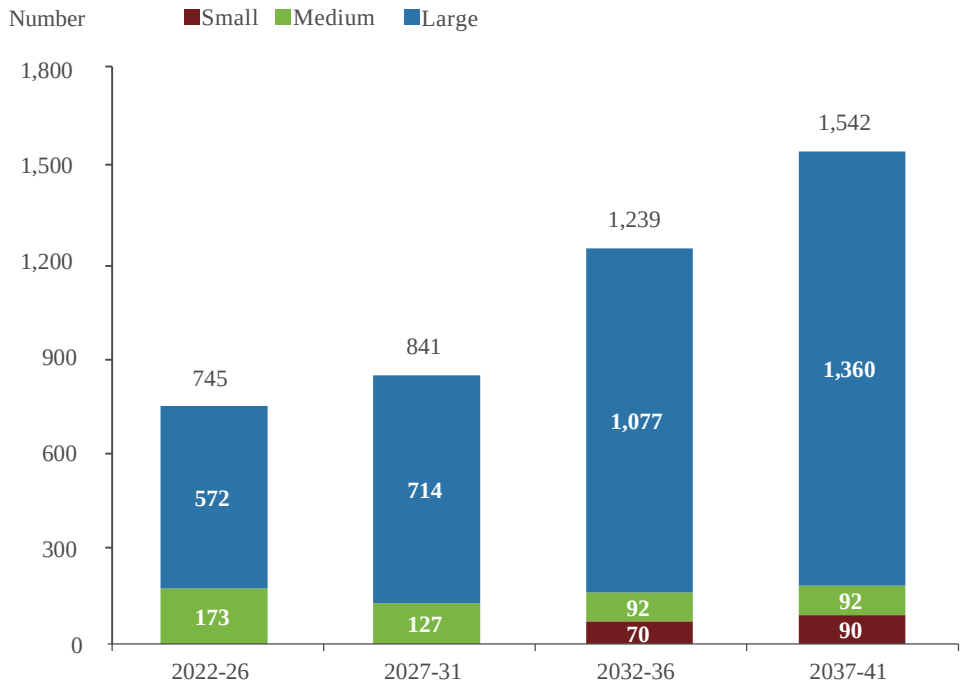
5.2.3 Regional Jets Forecast

By the end of 2021, regional jets accounted for 12.2% of the global passenger aircraft fleet, and this proportion is expected to drop to 10.4% by 2041. The future market demand will mainly focus on large regional jet.

In the next two decades, about 78% of the existing regional jets will be retired one after another. It is estimated that the delivery volume of regional jets will be about 4,367, of which 85.3% (about 3,723) will be large regional jets. ARJ21 aircraft is also included in this class. At present, orders for regional jets mainly concentrate on large regional jets. The lines between large turbofan regional jets and small single-aisle jets are blurring, with small single-aisle jets and large regional jets competing on many routes in North America and Europe.

The average number of seats of newly delivered regional aircraft is increasing over the next two decades, and by 2041 about 96% of the regional jet fleet will consist of medium and large regional jets. In the next two decades, the average annual growth rate of the regional jet fleet is 3.4%, the average annual growth rate of the number of available seats is 4.4%, and the fleet will reach 4,922.

2022-2041 Global Regional Jet Forecast Deliveries by Seat Size



Source: COMAC

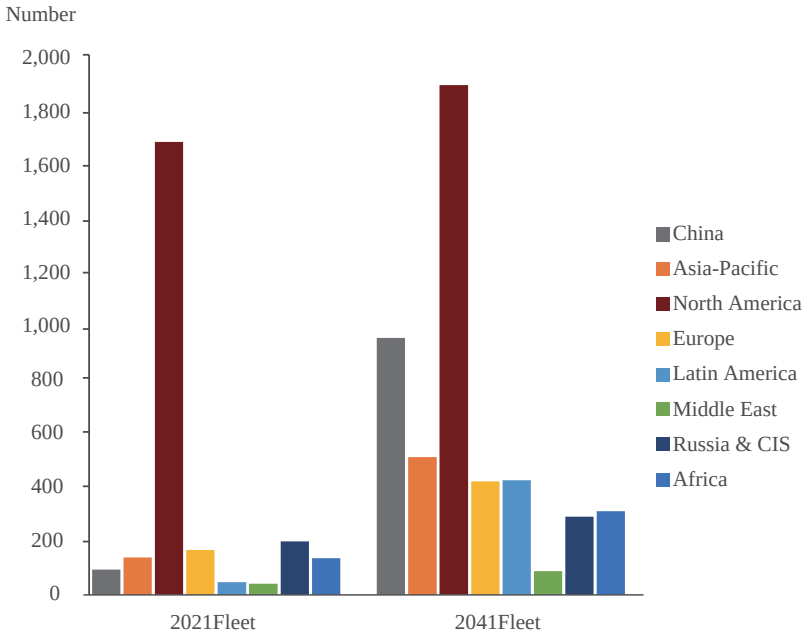
2022-2041 Global Regional Jet Forecast Delivery by Seat Size

	Small	Medium	Large
2022-26	0	173	572
2027-31	0	127	714
2032-36	70	92	1,077
2037-41	90	92	1,360
2021-2041 deliveries	160	484	3,723
Market Value (hundred million $)	50	231	1,924

Source: COMAC

In terms of fleet size, North America will remain the market with the largest demand for regional jets in the next 20 years, accounting for 34.3% of the global fleet of jets in this category. The size of China's regional jet fleet will grow rapidly, and the proportion of passenger aircraft in this category will increase from 3.7% in 2021 to 19.5% in 2041. This is mainly based on the development potential of China's regional aviation market and a series of policy support issued by the government to promote the regional passenger aircraft transportation market. The regional airline fleet in the Middle East is the smallest in the world, and the global fleet size will remain at about 2% in the next 20 years.

Current and Forecast Regional Jet Fleet by Region



Source: COMAC, Cirium

2021 and 2041 Current and Forecast Regional Jet Fleet by Region

	2021 Fleet	2041 Fleet
China*	94	960
Asia-Pacific**	140	515
North America	1,691	1,904
Europe	167	423
Latin America	47	428
Middle East	41	88
Russia & CIS	199	292
Africa	137	312
Global	2,516	4,922

*China includes Hong Kong, Macao and Taiwan

**Asia-Pacific excludes China, Hong Kong, Macao and Taiwan

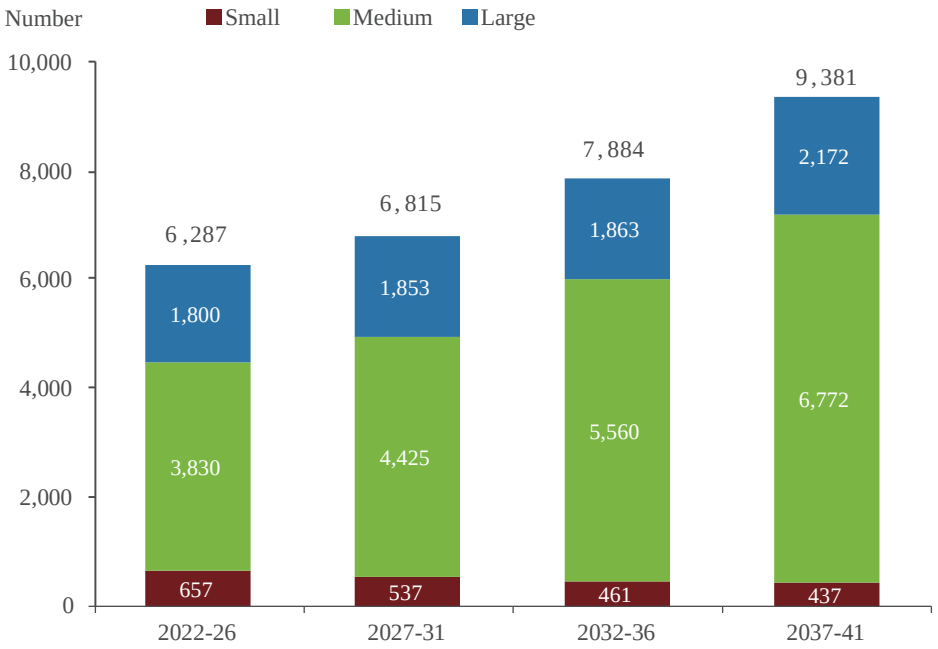
Source: COMAC, Cirium

5.2.4 Single-Aisle Passenger Jet Forecast

In the next two decades, the single-aisle passenger jet will still be the most in demand in the market. By the end of the forecast period, about 75% of the single-aisle jets in the in-service fleet are expected to be replaced by new, better fuel-efficient single-aisle jets. Growth in mainline air traffic in emerging markets and the development of global low-cost models are important drivers of single-aisle jet growth.

Over the next two decades, 30,367 single-aisle jets are expected to be delivered worldwide, of which 67.8% will be medium-sized single-aisle jets. The single-aisle jet fleet will grow at an average annual rate of 4.3% and the number of seats available will grow at an average annual rate of 4.6%, with the average number of seats rising from 165 to 175.

2022-2041 Single-Aisle Jet Forecast Delivery by Seat Size



Source: COMAC

2022-2041 Single-Aisle Jet Forecast Delivery by Seat Size

	Small	Medium	Large
2022-26	657	3,830	1,800
2027-31	537	4,425	1,853
2032-36	461	5,560	1,863
2037-41	437	6,772	2,172
2022-2041 deliveries	2,092	20,587	7,688
Market Value (hundred million $)	1,890	24,161	10,377

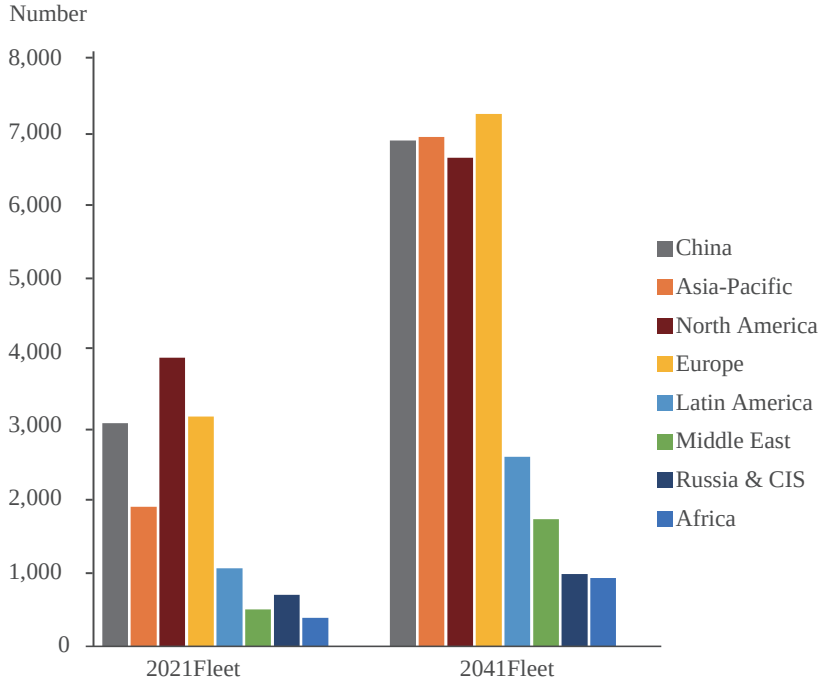
Source: COMAC

In the next 20 years, new-generation passenger jets produced by emerging single-aisle jet passenger aircraft manufacturers such as COMAC will be put into the market one after another. While improving the global supply capacity of single-aisle jet, it will also enrich the diversity of products.

Asia Pacific (including China) is forecast to become the largest market for single-aisle aircraft in terms of deliveries. The region as a whole is estimated to receive 41.8% of global 20 years'new aircraft deliveries. China alone is estimated to receive 20.7% of the global total deliveries. Most of emerging economies are located in Asia-Pacific, including China, domestic and intra-regional markets within and among China, India and Southeast Asia are all suitable markets for single-aisle aircraft operation.

Europe and North America will still be the main markets for single-aisle jets, accounting for 21.2% and 19.2% of global deliveries, respectively. The demand for replacement of older models in these mature markets, as well as the increase in the number and expansion of low-cost airlines will continue to drive growth in the number of single-aisle jets. The rapid development of the aviation market in Brazil, Mexico and other countries has promoted the growth of single-aisle jets in Latin America. In the African market, the replacement plan of airline fleets is constantly advancing.

Current and Forecast Single-Aisle Jet Fleet by Region



Source: COMAC, Cirium

2021 and 2041 Current and Forecast Single-Aisle Jet Fleet by Region

	2021 Fleet	2041 Fleet
China*	3,040	6,896
Asia-Pacific**	1,902	6,943
North America	3,931	6,657
Europe	3,131	7,255
Latin America	1,063	2,581
Middle East	503	1,735
Russia & CIS	704	983
Africa	386	933
Global	14,660	33,983

*China includes Hong Kong, Macau and Taiwan

** Asia-Pacific excludes the China region

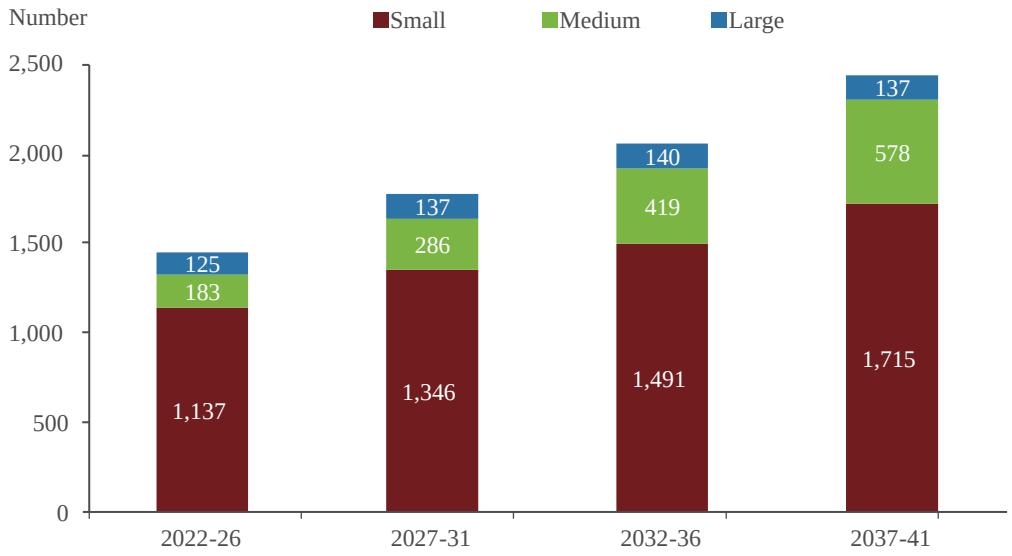
Source: COMAC, Cirium

5.2.5 Twin-Aisle Jet Forecast

Due to the impact of the Covid-19 pandemic, a large number of international routes have been grounded and a lot of twin-aisle aircraft entered into storage. Retirement of twin-aisle aircraft is therefore accelerated. However, as the pandemic has been effectively controlled, once the borders of various countries are reopened, twin-aisle aircraft will return to the market in the future and the demand of twin-aisle aircraft will emerge substantially.

In the next 20 years, a total number of 7,694 twin-aisle passenger jets are forecast to be delivered, with a total value of 2.5 trillion U.S. dollars. Among those deliveries, 74% will be small size aircraft, including aircraft types containing 200-300 seats. Those kinds of aircraft are believed to have high flexibility in operation and can be adapted to wider range of routes in different environments. Average annual growth rate for twin-aisle fleet is forecast to be 4.8%, with average seat number per aircraft rising from 291 to 316. In the next 20 years, 72% of the current in-service fleet are expected to be replaced by new jets.

2022-2041 Global Twin-Aisle Jet Forecast Delivery by Seat Size



Source: COMAC

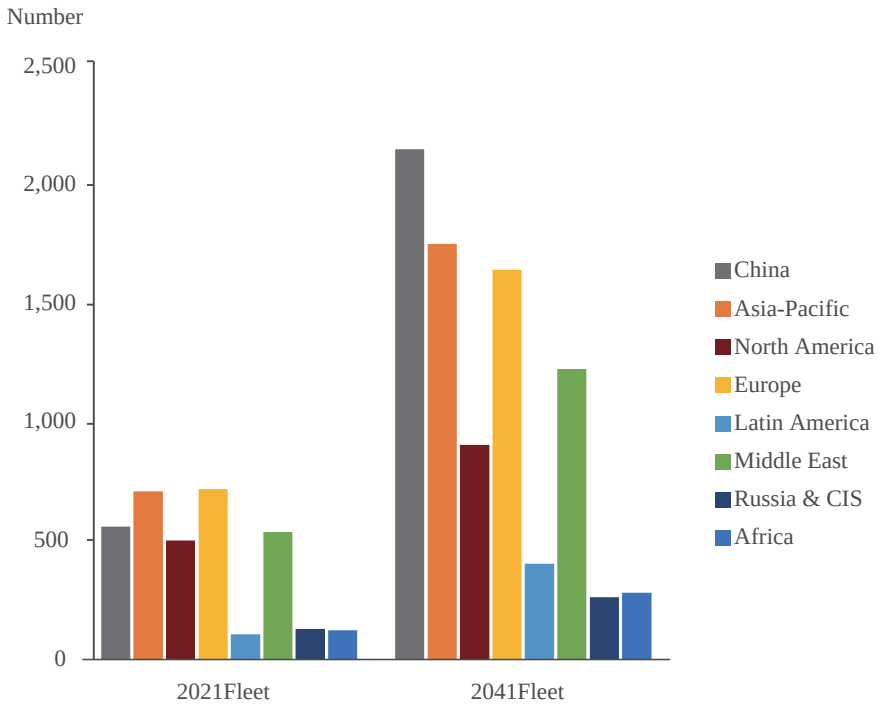
2022-2041 Global Twin-Aisle Passenger Jet Forecast Delivery by Seat Size

	Small	Medium	Large
2022-26	1,137	183	125
2027-31	1,346	286	137
2032-36	1,491	419	140
2037-41	1,715	578	137
2022-2041 deliveries	5,689	1,466	539
Market Value (hundred million$)	17,067	5,692	2,612

Source: COMAC

Domestic and regional routes with high density passenger flow will become an important target market for the twin-aisle passenger jet, especially in Asia Pacific area. In the next 20 years, airlines based in Asia Pacific, including China, are estimated to account for 45.2% of the total twin-aisle passenger jet deliveries; Europe and Middle East will have enormous demand for aircraft of this category as well.

2021 and 2041 Twin-Aisle Passenger Jet Fleet by Region



Source: COMAC, Cirium

2021 and 2041 Current and Forecast Twin-Aisle Passenger Jet Fleet by Region

	2021 Fleet	2041 Fleet
China*	561	2,152
Asia-Pacific**	710	1,753
North America	502	906
Europe	719	1,643
Latin America	107	403
Middle East	537	1,225
Russia & CIS	128	263
Africa	123	281
Global	3,387	8,626

*China includes Hong Kong, Macao and Taiwan

**Asia-Pacific excludes China, Hong Kong, Macao and Taiwan

Source: COMAC, Cirium

5.3 China

Deliveries	% of Global
9,284	21.9%

Value($Billion)	% of Global
$1,470	23.0%

Fleet	% of Global
10,007	21.1%

RPKs(Trillion)	% of Global
4.39	22.0%

Source: COMAC

5.3.1 Market

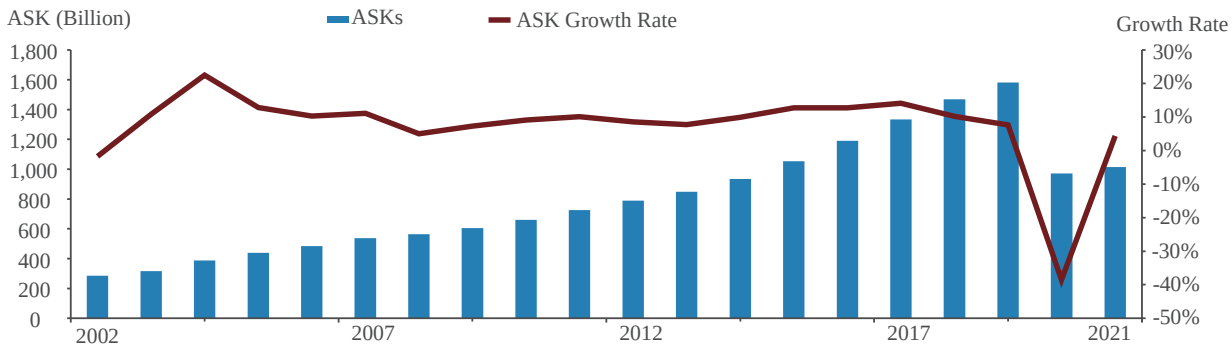
In 2021, the COVID-19 pandemic continued to hit the global market. China has put its coordinated effort both in pandemic control and economic development, as a result of which a trend of recovery has been maintained. In 2021, China's economy was generally stable, with GDP reaching 114.4 trillion yuan, an increase of 8.1% over the previous year, exceeding the expected annual growth rate of 6% set in early 2021.

According to IHS forecast, GDP in China will maintain a growth rate of 5% during the "14th Five-Year Plan" period. Under the current complex international situation, China's economic growth target will help boost global confidence. In sum China is playing an increasingly important role in the recovery and growth of the world economy.

In 2021, the passenger volume in China's aviation market was 652.97 billion, an increase of 3.5% over the previous year,among which domestic routes completed 643.91 billion, an increase of 9.7% compared with the previous year(Hong Kong, Macao and Taiwan routes completed 819 million, down 36.1% over the previous year); international routes completed 9.06 billion, a drop of 79.5%.

Facts like repeated outbreak of the Omicron pandemic in 2022, international geopolitical conflicts and high oil price has jointly dampened supply and demand of Chinese aviation market. However, in the short or medium term, the aviation market is expected to recover quickly with the of the pandemic and the relaxation of travel controls in the future. In the long run, under the background of dual circulation, the Civil Aviation Administration of China will actively promote the construction of civil aviation in the Greater Bay Area, and continuously strengthen the functions of ten international aviation hubs such as Chengdu, Kunming, Chongqing, Xi'an, Urumqi, and Harbin, etc. Together with China's self-developed civil aircraft constantly entering into the market to optimize the regional supply, the supply and demand of China's aviation market is expected to achieve sustained and healthy growth. In the future, with the steady rise of China's economy, China has accelerated the building of its strength in aviation industry, the Chinese civil aviation industry, will enter a period of quality improvement and horizon broadening , and will set off again towards higher and farther development goals to start a new journey of building a strong civil aviation country in multiple fields.

China Historical ASKs Trends（2002-2021）



Source: COMAC, OAG

5.3.2 Network

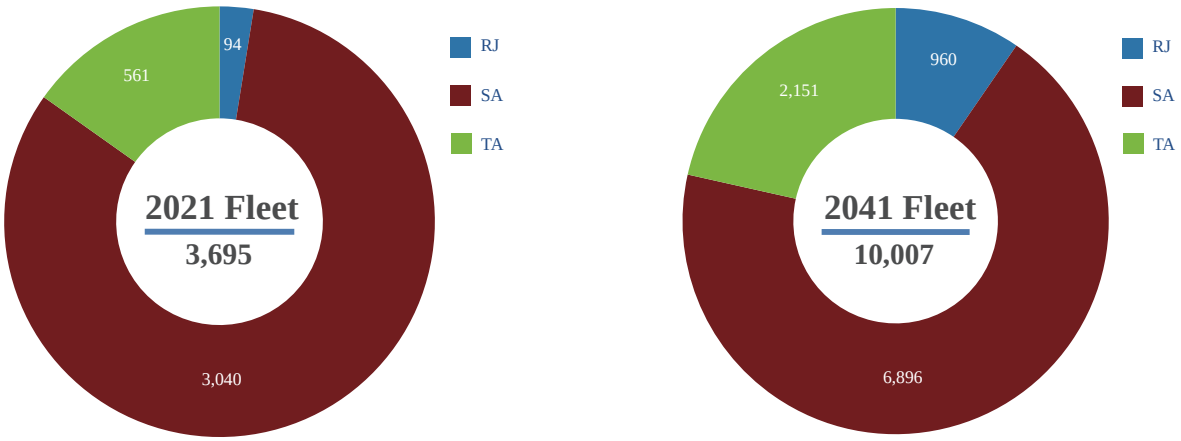
According to OAG, in 2021, the number of routes operated by Chinese carriers decreased by 9.1% compared with 2019 and 13.1% compared with 2020. The number of flights decreased by 13.7% compared with 2019 and increased by 10.9% compared with 2021.

Affected by the pandemic, the airline connectivity of the international market declined sharply. In 2021, the number of routes operated by Chinese carriers droped by 65.3% and 66.2% compared with 2019 and 2020 respectively. Before the pandemic, the China-Asia-Pacific market had always been the largest international route market for Chinese carriers. In 2019, among all international routes operated by Chinese carriers, the number of China-Asia-Pacific routes accounted for 72.9% of the total. Affected by the pandemic, it significantly reduced by 73.2% in 2021. In addition, the number of routes between China and Europe, North America, Russia, and the Middle East all decreased by around 40% to 60%.

In the domestic market, benefiting from China's efficient pandemic control measures and the rapid recovery of the economy, the number of routes operated by Chinese carriers continued to increase year by year after the pandemic, increased by 5.4% and by 5.5% in 2020 and 2021 separately. The capacity of regional aircraft was further improved. In 2021, the regional capacity of Chinese carriers increased by 5.6% compared with the pre-pandemic level in 2019, while the capacity of other types of aircraft all dropped significantly compared with 2019. The connectivity of regional airports continued to increase significantly by 9.6%. During the pandemic, regional aircraft has played an important role in ensuring transportation and promoting the steady recovery of the aviation market.

5.3.3 Passenger Fleet Forecast

China Fleet Growth

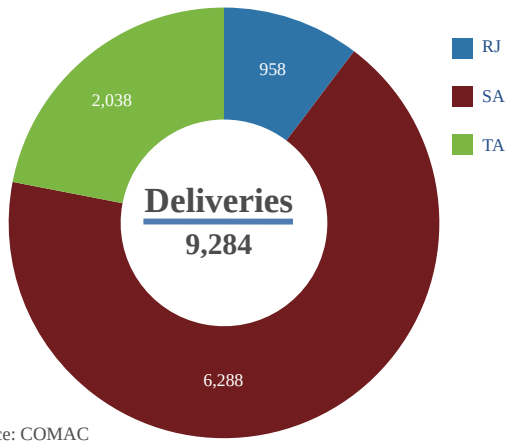


Source: COMAC, Cirium

Chinese aviation market is forecast to have 10,007 passenger aircraft in 2041, including 6,896 single-aisle jets, 2,151 twin-aisle jets and 960 regional jets, which will become the largest single aviation market in the world, leading the growth of the global aviation market in the future.

In the next two decades, 9,284 aircraft are expected to be delivered to the Chinese market, of which 6,288 will be single-aisle jets, accounting for nearly 70% of the total delivery. 79.3% of the single-aisle jets will be medium-sized single-aisle passenger aircraft. 2,038 twin-aisle jets will be delivered, accounting for 20% of the total delivery. The rest will be regional jets, with 958 to be delivered over the next two decades.

China Deliveries by Category &Seat Size 2022–2041



Source: COMAC

5.4 Asia-Pacific

Deliveries	% of Global
8,413	19.8%

Value($Billion)	% of Global
$1,288.1	20.1%

Fleet	% of Global
9,211	19.4%

RPKs(Trillion)	% of Global
4.28	21.6%

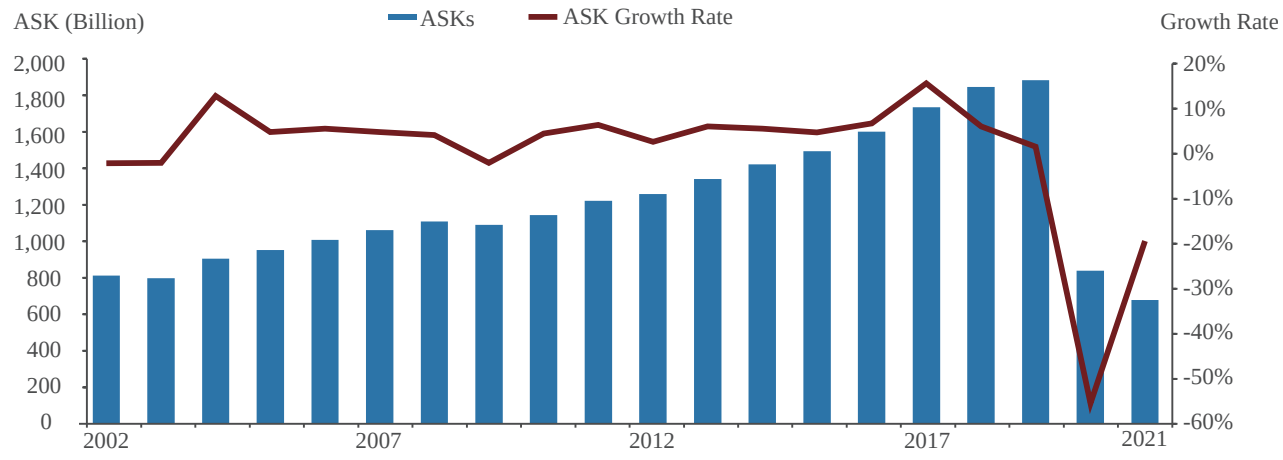
Source: COMAC

5.4.1 Market

The pandemic has been effectively controlled and the vaccination rate has risen throughout 2021, the economic growth in Asia-Pacific experienced both good and bad sides. However, the path of economic recovery in 2021 was very uneven, with new Covid-19 Delta and Omicron variant hitting many Asia-Pacific countries, including India,Japan and Association of Southeast Asian Nations (ASEAN) members.

The total GDP of Asia-Pacific region (excluding China) has risen from $8 trillion in 2000 to $14 trillion by 2021.The Asia-Pacific region is forecast to grow at a pace of 4.9% year on year in 2022. By 2040, the economic weight of the Asia-Pacific region is forecast to rise to around 18.4% of world GDP, underpinned by the further economic expansion of China, India and the 10 Southeast Asian countries comprising ASEAN based on IHS economics forecast.

Asia-Pacific Historical ASKs Trends（2002-2021）



Source: COMAC, OAG

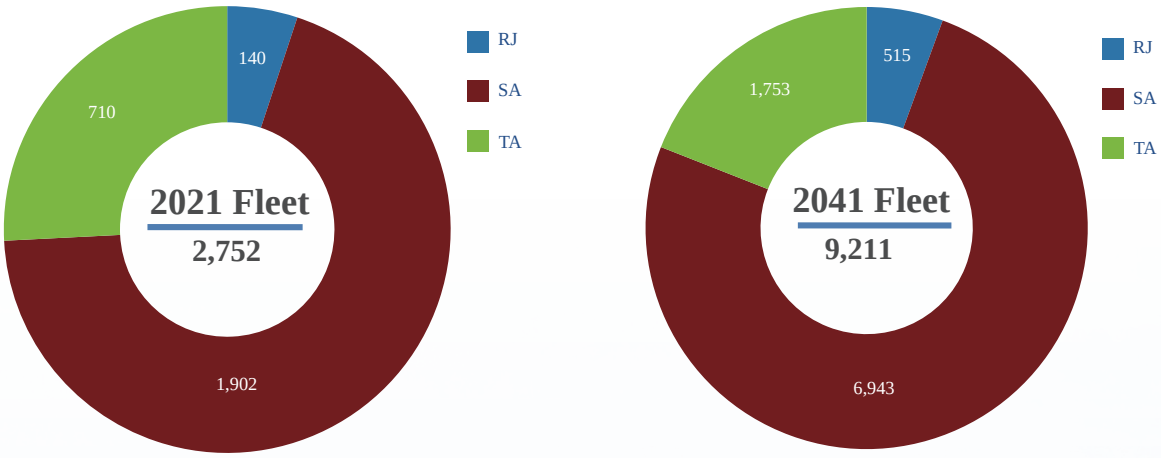
5.4.2 Network

Affected by the Covid-19 pandemic, the number of seats provided by Asia-Pacific carriers in 2021 has dropped by13.9%% compared with 2020, and the frequency of flights has dropped by 12.9% and the ASKs declined by 19.2%. However, the number of routes in the Asia-Pacific region in 2021 reduced from 4,633 in 2020 to 3,746. The recovery of international market in Asia-Pacific showed a slower pace than domestic markets, almost all capacity was devoted to inner Asia-Pacific regions.

Several countries in Asia-Pacific adopted boarder block strategies owing to Covid-19 variants, carriers in this region provided 88.4% seats in regional market during Asia-Pacific. On cross national markets, the Asia Pacific carriers has a relative large amount of seats provided on routes between North America, Europe and the Middle East, taking shares by 10.1%, 6.9% and 6.8% of the total seats provided.

5.4.3 Fleet

Asia-Pacific Fleet Growth



Source: COMAC, Cirium

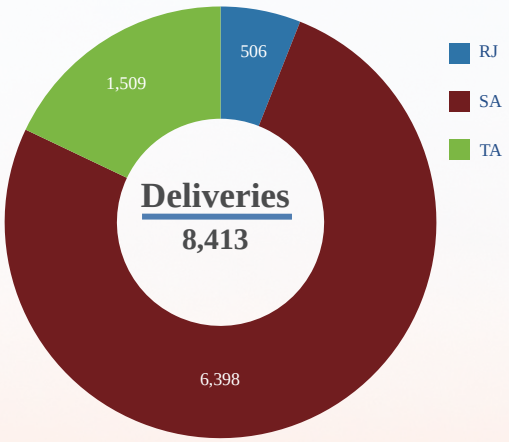
In 2021, the amount of aircraft in service in the Asia Pacific region has slightly risen to 2,752 from 2,745 in 2020. It is estimated till 2041, the fleet size in the Asia Pacific region will grow to 9,211 aircraft, which has increased by 603 aircraft than 2020 forecast. For the next 20 years, 8,413 new aircraft will be delivered in the region, which has a small increase of 145 aircraft compared to 2020 forecast, with a total value of approximately 1,288.1 billion U.S. dollars.

In the next 20 years, 6,398 new single-aisle passenger jets will be delivered to Asia Pacific region, and fleet size of Asia Pacific will grow to 6,943 aircraft. 1,509 new twin-aisle passenger jets will be delivered in next 20 years. By 2041, the fleet size of Asia Pacific twin-aisle passenger jets is estimated to reach 1,753 aircraft, which has reduced 141 aircraft than last year forecast.

The regional market in the Asia-Pacific region is relatively small, with a fleet of 140 aircraft in 2021, which decrease by 12 aircraft than 2020 and accounting for 5.6% of the global regional fleet. It is estimated that by 2041, the regional jet fleet in this region will grow to 515 aircraft, of which 506 new aircraft will be delivered, accounting for 11.6% of the global regional jets delivery.

Asia-Pacific Deliveries by Category & Seat Size

2022-2041



Source: COMAC

5.5 North America

Deliveries	% of Global
8,167	19.2%

Value($Billion)	% of Global
$1,041.5	16.3%

Fleet	% of Global
9,467	19.9%

RPKs(Trillion)	% of Global
3.16	15.9%

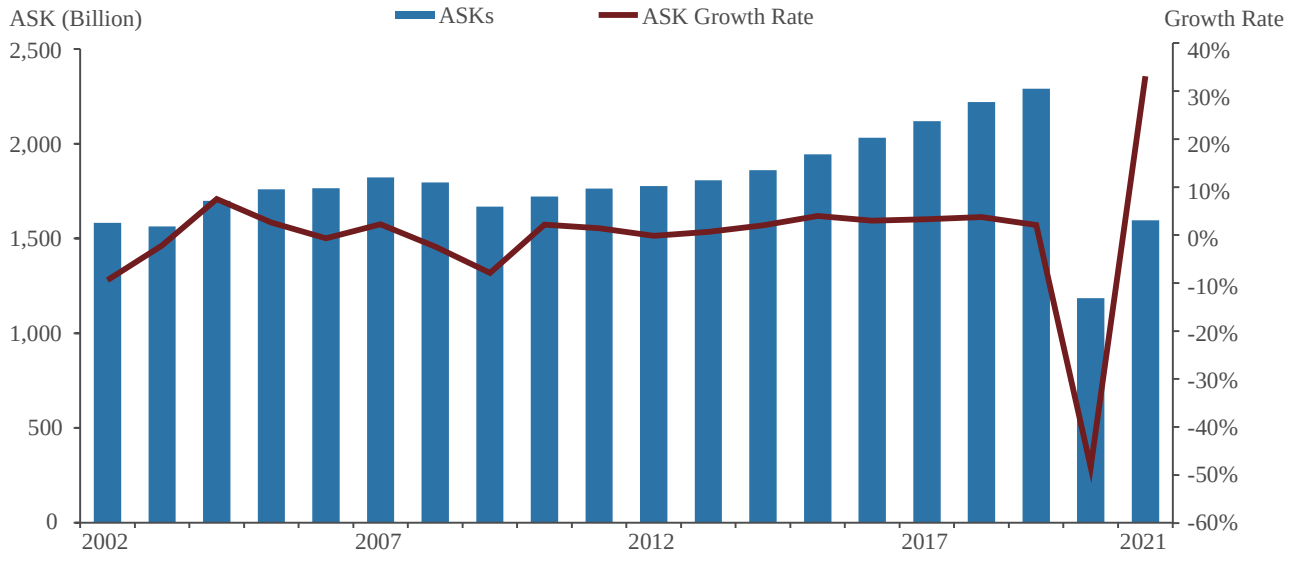
Source: COMAC

5.5.1 Market

In 2021, the trillions of dollars the U.S. government has invested in COVID-19 relief will ultimately lift the economy, even as the pandemic, supply chains, and inflation weigh on growth. After contracting to 3.4% in 2020, the largest decline in 74 years, U.S. GDP rebounded to 5.7% in 2021, the highest level since 1984. Rapidly hoarding inventories by companies, brisk consumer activity and a surge in private investment are the main reasons for GDP growth.

The U.S. aviation market will recover significantly in 2021. According to the U.S. Civil Aviation Industry Development Report released by the American Airlines Association, the average daily planned flights and available seats at U.S. airports in 2021 have recovered to 75% and 77% of those in 2019. According to IATA forecasts, North America will be the strongest performing region in 2022. It will also be the only region to return to profitability this year. Net profit in 2022 is expected to reach $8.8 billion, supported by the reopening of the U.S.'s huge domestic market and international markets, including the North Atlantic. Demand is expected to recover to 95% of 2019 levels, with capacity reaching 99.5%.

North America Historical ASKs Trends（2002-2021）



Source: COMAC, OAG

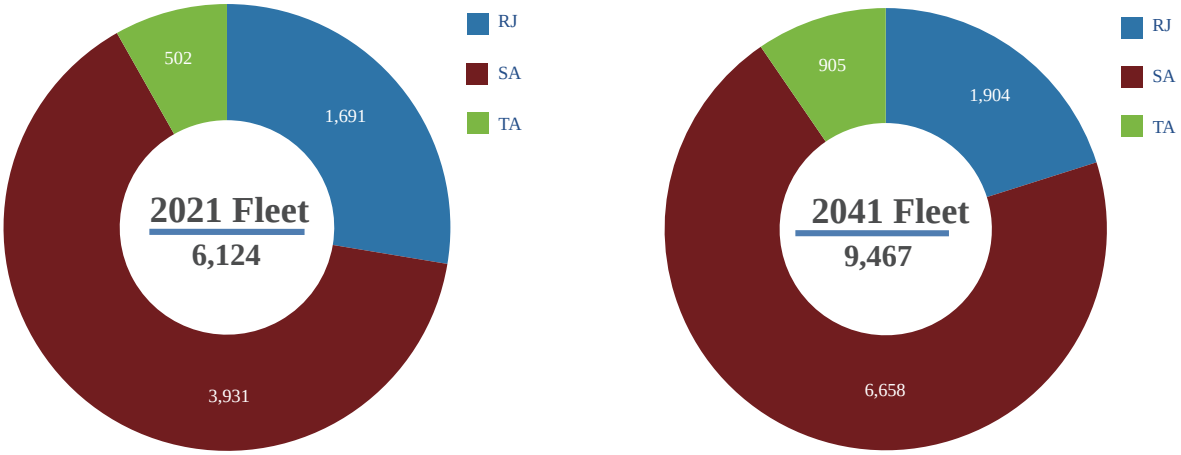
5.5.2 Network

In 2022, the number of available seat kilometers in North America will increase by 34.6% compared with 2021. Carriers in North America operated a total of 5,568 routes, covering approximately 18.6% of the global route network, and the number of routes increased slightly by 0.5% compared with 2019. Among the routes operated by North American carriers, 80.6% are routes within North America.

In terms of the number of seats available, in 2021, carriers in North America will account for 88% of the total in North America, an increase of 27.4%. The cross-regional market grew by 51.3%. The top three markets were North America-Latin America, North America-Europe, and North America-Asia Pacific, accounting for 9.5%, 1.6%, and 0.5% respectively.

5.5.3 Fleet

North America Fleet Growth

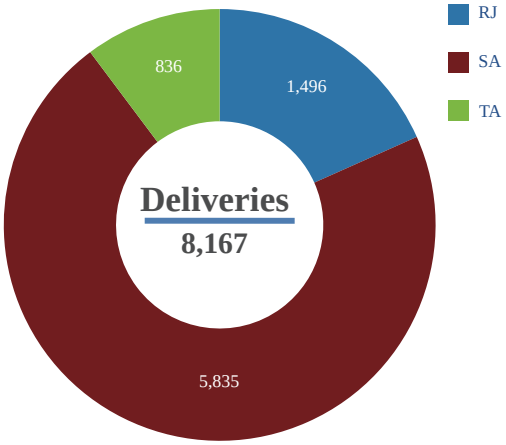


Source: COMAC, Cirium

In 2021, there will be 6,124 passenger jets in service in North America, of which single-aisle jets account for 64.2% and regional jets account for 27.6%. By 2041, the regional fleet will reach 9,467 , accounting for 19.9% of the global proportion.

Over the next two decades, 8,167 new jets will be delivered in the region, valued at approximately $1,041.5 billion. Single-aisle jets remained the main force for fleet growth, with 5,835 delivered, accounting for 19.2% of the global single-aisle jets delivery; 1,496 turbofan regional jet deliveries, accounting for 34.3% of the global regional jet deliveries; 836 twin-aisle jets were delivered, accounting for only 10.9% of the world total.

North America Deliveries by Category & Seat Size 2022-2041



Source: COMAC

5.6 Latin America

Deliveries	% of Global
2,941	6.9%

Value($Billion)	% of Global
$395.1	6.2%

Fleet	% of Global
3,412	7.2%

RPKs(Trilloon)	% of Global
1.17	5.9%

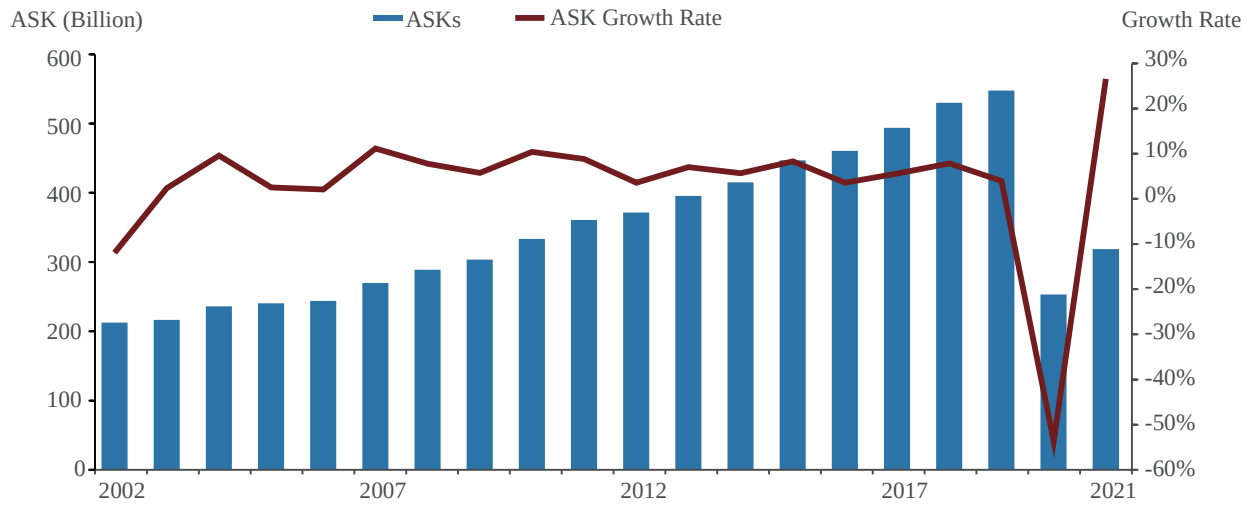
Source: COMAC

5.6.1 Market

Latin America's economic growth of 7.4% in 2021 exceeds the average of emerging market and developing economies and is significantly higher than that of advanced economies. The adaptability of the international economy and society to the new crown pneumonia pandemic (hereinafter referred to as the "pandemic") is gradually increasing, and vaccination in Latin America is progressing rapidly, as of early January 2022, 60% of the region's population has been fully vaccinated, and the job market is gradually increasing. After the recovery, the labor force participation rate increased from 57.2% in 2020 to 60.5%, employment also slowly recovered, and the unemployment rate fell slightly to 10%. Driven by both the demand side and the supply side, the Latin American economy will recover more than expected in 2021.

According to IATA statistics, compared with the same period in 2019, passenger traffic in the Latin American aviation market will drop by 66.9% in 2021. Capacity fell 62.2% and load factor fell 10.2 percentage points to 72.6%, the highest among all regions. IATA expects a strong recovery in passenger traffic in Latin America in 2022, with demand returning to 94.2% of 2019 levels. During the pandemic, many airlines in Latin America filed for bankruptcy protection, and these airlines will see the light in 2022. The bankruptcy and reorganization plan of LATAM, the largest airline in Latin America, has been approved and is expected to emerge from bankruptcy protection in the second half of 2022. In May 2022, Brazil's GOL Airlines (GOL) and Colombian Avianca (AVIANCA) Airlines announced the merger of businesses, and the two parties will jointly form the ABRA Group.

Latin America Historical ASKs Trends（2002-2021）



Source: COMAC, OAG

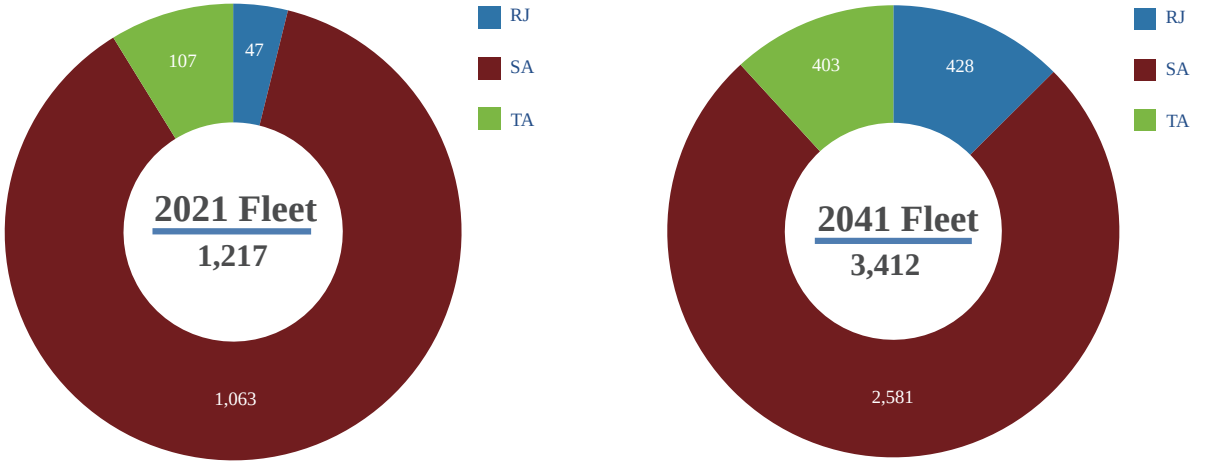
5.6.2 Network

The number of available seat kilometers in Latin America in 2021 increased by 25.8% compared with 2020. Carriers in Latin America operated a total of 1,798 routes, covering about 6% of the global route network, and the number of routes is 169 fewer than in 2020. Among them, domestic routes decreased by 9 and international routes decreased by 160. Among the routes operated by carriers in Latin America, 86.7% are routes within Latin America.

From the perspective of the number of seats available, in 2021, Latin American carriers accounted for 91% of the deployment in Latin America, an YoY growth of 31.9%. The cross-regional market grew YoY by 37.1%, and the top three markets were Latin America-North America, Latin America-Europe, and Latin America-Asia Pacific, accounting for 7.7%, 1.2%, and 0.02% respectively.

5.6.3 Fleet

Latin America Fleet Growth

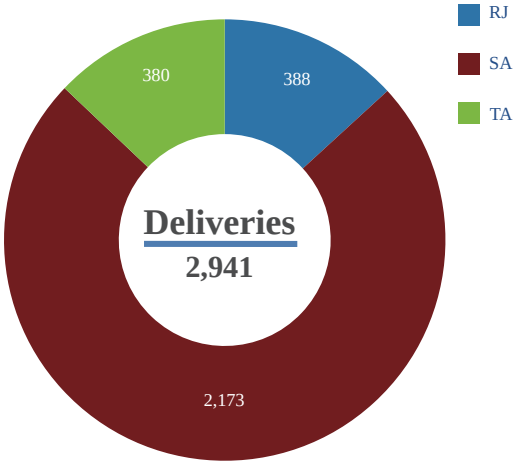


Source: COMAC, Cirium

The Latin American fleet in 2021 was 1,217 , an increase of 19.7% over the previous year, of which single-aisle jets account for 87.3% and twin-aisle jets account for 8.8%. The region's fleet will reach 3,412 by 2041, accounting for 7.2% of the global fleet.

In the next two decades, 2,941 aircraft will be delivered to Latin America, including 388 regional jets, accounting for 13.2% of the regional jet deliveries. It is expected that by 2041, the number of regional jets will reach 428; more than 2,100 single-aisle jets will be delivered, accounting for 73.9% of deliveries in the region, and the fleet will increase to 2,581 from 1,063 in 2021; 388 twin-aisle jets will be delivered, bringing the fleet to 408.

Latin America Deliveries by Category & Seat Size 2022-2041



Source: COMAC

5.7 Europe

Delveries	% of Global
8,310	19.6%

Value($Billion)	% of Global
$1,268	19.8%

Fleet	% of Global
9,322	19.6%

RPKs(Trillion)	% of Global
3.5	17.6%

Source: COMAC

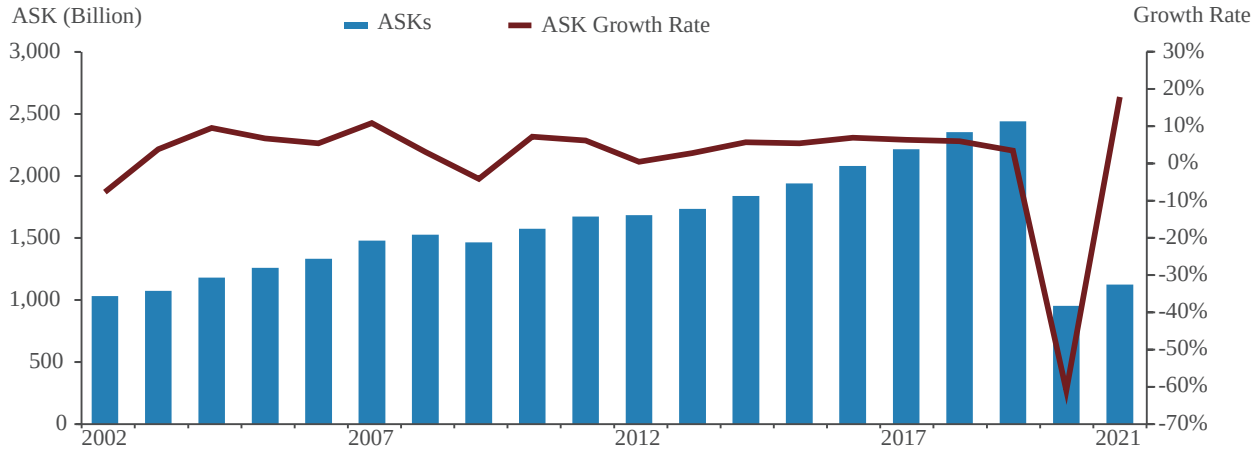
5.7.1 Market

In 2021, the European economy achieved a certain degree of recovery under the influence of the relatively low base of the previous year, stimulated by the recovery of consumption, investment, import and export trade brought about by the large-scale vaccination of vaccines and the gradual relaxation of pandemic prevention and control measures. The GDP of the entire 27 EU countries is close to $14.6 trillion, with a per capita GDP of $33,000, a growth rate of 5.3%, and an economic growth rate of 5.4% in the euro area. Due to many factors such as rising energy and food prices, highly uncertain global economic prospects, and the conflict between Russia and Ukraine, the European economic outlook is subject to great uncertainty and downside risks, and the economic recovery will be hindered and long.

According to data from ACI Europe, compared to 2020, the traffic in European region increased 37% in 2021, but it is still a 59% decrease compared to 2019, which equates to a loss of 1.4 billion passengers compared to pre-pandemic. In the first half of 2021, the delta-variant virus hit the market hard. With the implementation of blockades and strict travel restrictions, most intercontinental markets were out of reach, and traffic volumes fell by 77.7% year-on-year. As the launch of the EU digital COVID certificate and the reopening of the transatlantic market, the market gradually recovered in the second half of the year, and the traffic volume saw a narrowed decline by 42.4% year-on-year, but then Omicron broke this situation and the market reversed again.

The busiest airport in Europe in 2021 was Istanbul Airport, followed by Moscow Sheremetyevo Airport, which experienced a decline in turnover of 46% and 38% respectively compared to 2019. Smaller regional airports are recovering faster than larger airports, With many states and markets effectively still closed due to strict travel restrictions, the recovery was mainly in intra-European and domestic markets.

Europe Historical ASKs Trends（2002-2021）



Source: COMAC, OAG

5.7.2 Network

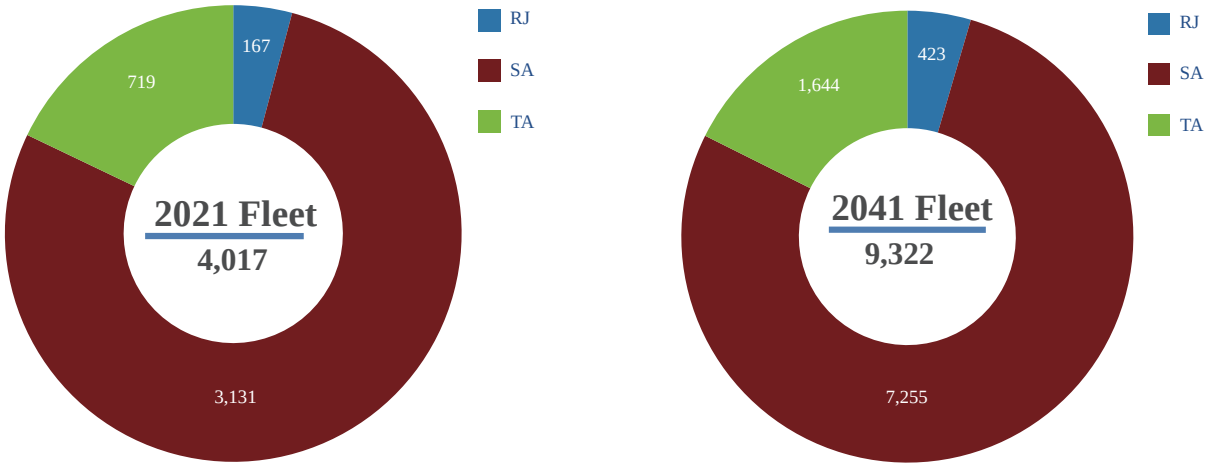
International routes are the focus of European carriers' capacity deployment. In 2021, the number of international routes accounted for 85.7% of the total number of European carriers' routes, and the number of available seats accounted for 83.3%. In terms of available seats, the overall capacity of the European market increased by 16.1%, and in terms of available seat kilometers, the growth rate was 18.1%. In terms of the number of routes, the number of routes in the European region increased by 118 in 2021, which was not returned to the pre-pandemic level.

5.7.3 Fleet

In 2021, there were 4,017 passenger aircraft in service in Europe, increased by 1088 compared with 2020, accounting for 19.6% of the global fleet. By 2041, the fleet size in this region will reach 9,322, accounting for 19.6% of the global share, with a delivery value of $1.27 trillion.

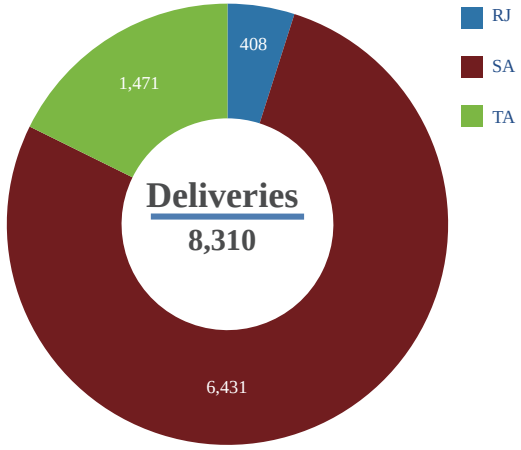
In the next two decades, 8,310 aircraft will be delivered to Europe, valued at approximately $1,268.3 billion. Single-aisle jets remained the main force for fleet growth, with 6,431 delivered, accounting for 21.2% of the global single-aisle jets delivery; 408 turbofan regional jet deliveries, accounting for 9.3% of the global regional jet deliveries; 1,471 twin-aisle jets were delivered, accounting for 19.1% of the world total.

Europe Fleet Growth



Source: COMAC, Cirium

Europe Deliveries by Category 2022-2041



Source: COMAC

5.8 Russia & CIS

Delveries	% of Global
1,152	2.7%

Value($Billion)	% of Global
$146.6	2.3%

Fleet	% of Global
1,538	3.2%

RPKs(Trillion)	% of Global
0.64	3.3%

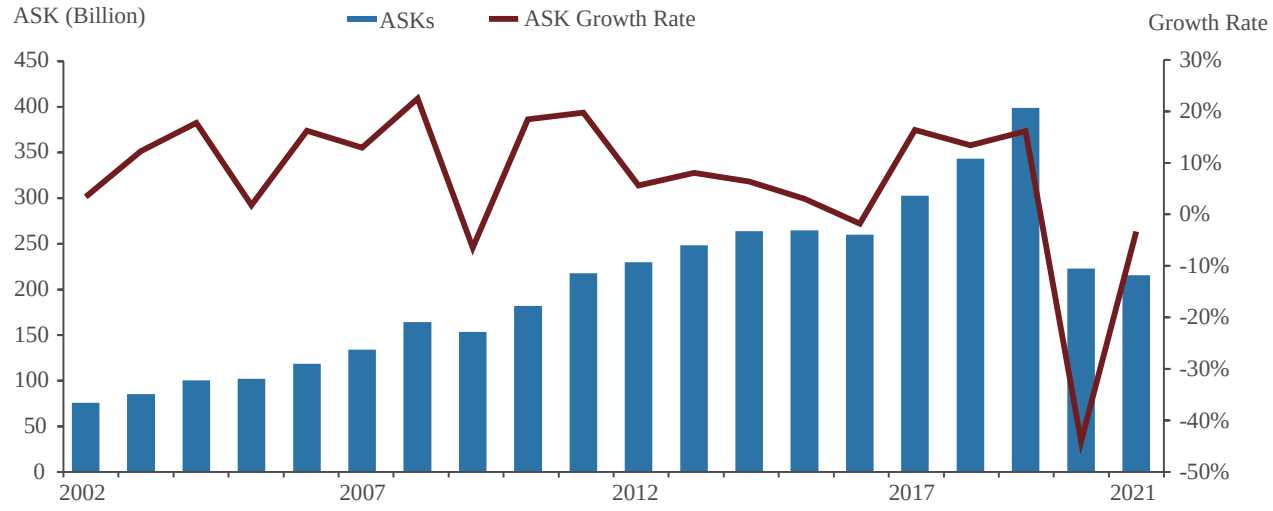
Source: COMAC

5.8.1 Market

After experiencing a certain degree of contraction in 2020, the Russian economy ushered in a clear rebound in 2021, with a GDP of 1.5 trillion US dollars, a year-on-year increase of 4.7%. Since the outbreak of the Russian-Ukrainian conflict in February 2022, Western countries have imposed comprehensive sanctions on Russia. Although the Russian economy as a whole has not suffered a huge impact in the short term and economic performance has been better than expected, as the conflict continues, Russia will face more problems and the market outlook is uncertain.

The IMF's forecast report released in July mentioned that Russia's crude oil and non-energy exports performed better than expected. In addition, as the impact of sanctions on Russia's domestic financial sector was contained and the weakness of labour market was less than expected, its domestic demand also showed a degree of resilience. Therefore, the Russian economy is expected to contract by 3.5% in 2023, an improvement from the 8.5% contraction forecast in April.

Russia&CIS Historical ASKs Trends (2002-2021)



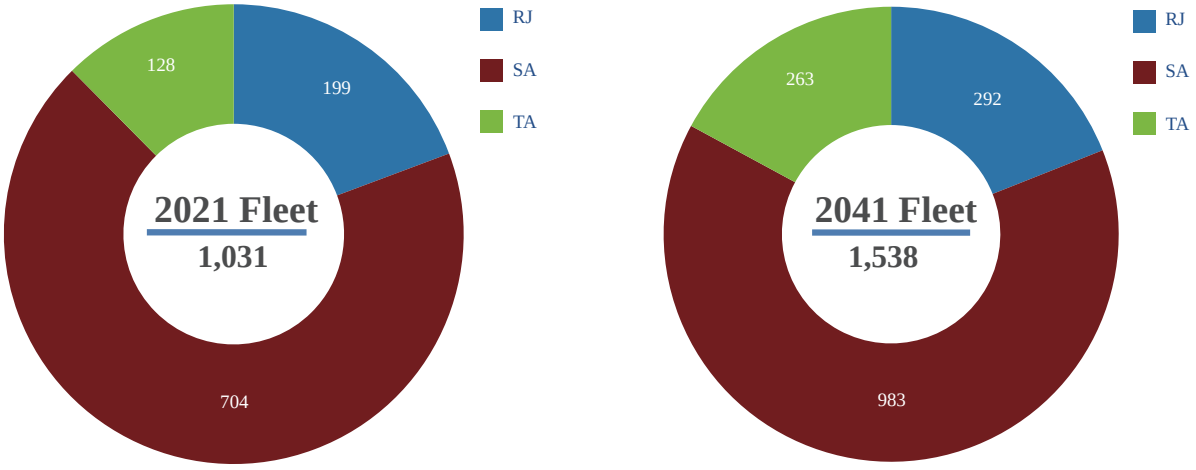
Source: COMAC, OAG

5.8.2 Network

In 2021, the capacity (seats) of carriers in Russia and CIS increased by 28.5%, of which the number of seats in the intra-regional route market increased by 31.6%. In the cross-regional market, the largest Russian and CIS-European markets saw a 26.2% increase in capacity, while the former second largest market, Russia and the CIS-Asia-Pacific market, saw a 69% drop in capacity. The CIS-Middle East market became the second largest market, with an 11.8% increase in capacity. The third largest cross-regional market was Russia and the CIS-Africa market, with an increase of 152.7% in capacity.

5.8.3 Fleet

Russia & CIS Fleet Growth

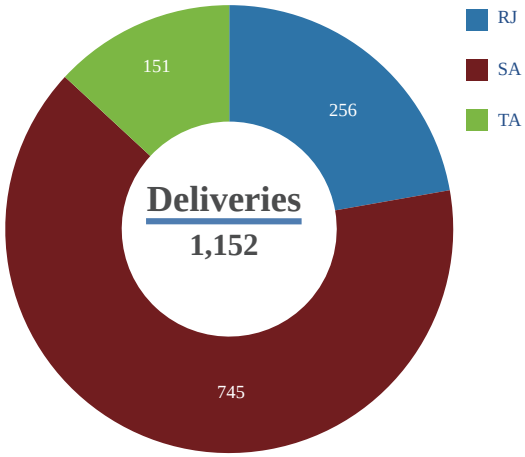


Source: COMAC, Cirium

In 2021, there were 1,031 passenger aircraft in service in Russia & CIS, of which single-aisle jets accounted for 68.3%, and regional jets accounted for 19.3%. By 2041, the fleet size in this region will reach 1,538, accounting for 3.2% of the global fleet. The pandemic and the conflict between Russia and Ukraine are both uncertain factors for the Russian aviation industry, and the recovery of the aviation industry is hindered and long.

In the next 20 years, Russia & CIS region is expected to witness 1,152 aircraft deliveries, valued at approximately $146.6 billion, of which 64.7% are single-aisle aircraft; 256 regional jets are expected to be delivered;151 wide-body aircraft are expected to be delivered.

Russia & CIS Fleet Deliveries by Category 2022-2041



Source: COMAC

5.9 Middle East

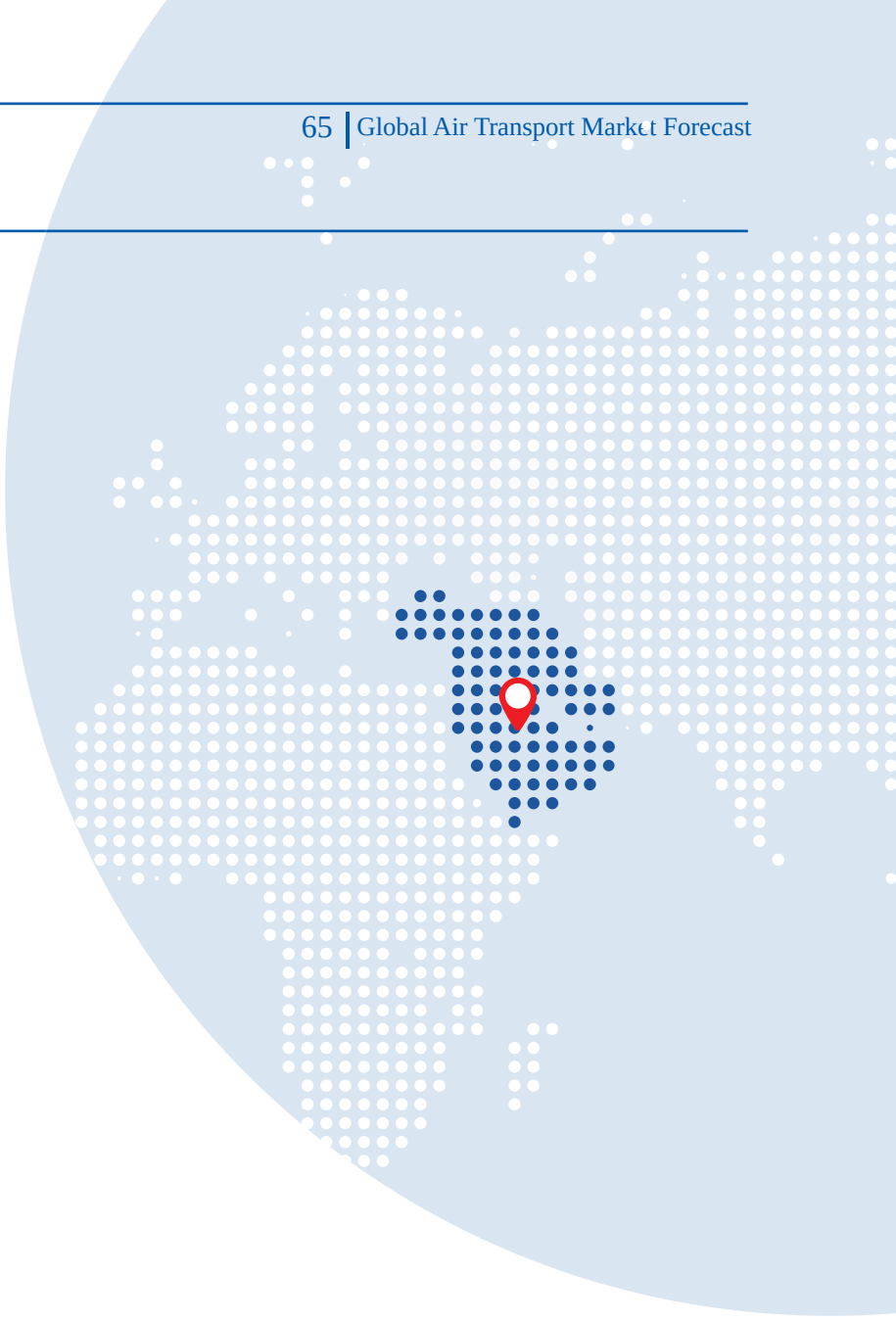
Deliveries	% of Global
2,781	6.6%

Value($Billion)	% of Global
$607.5	9.5%

Fleet	% of Global
3,048	6.4%

RPKs(Trillion)	% of Global
2.23	11.2%

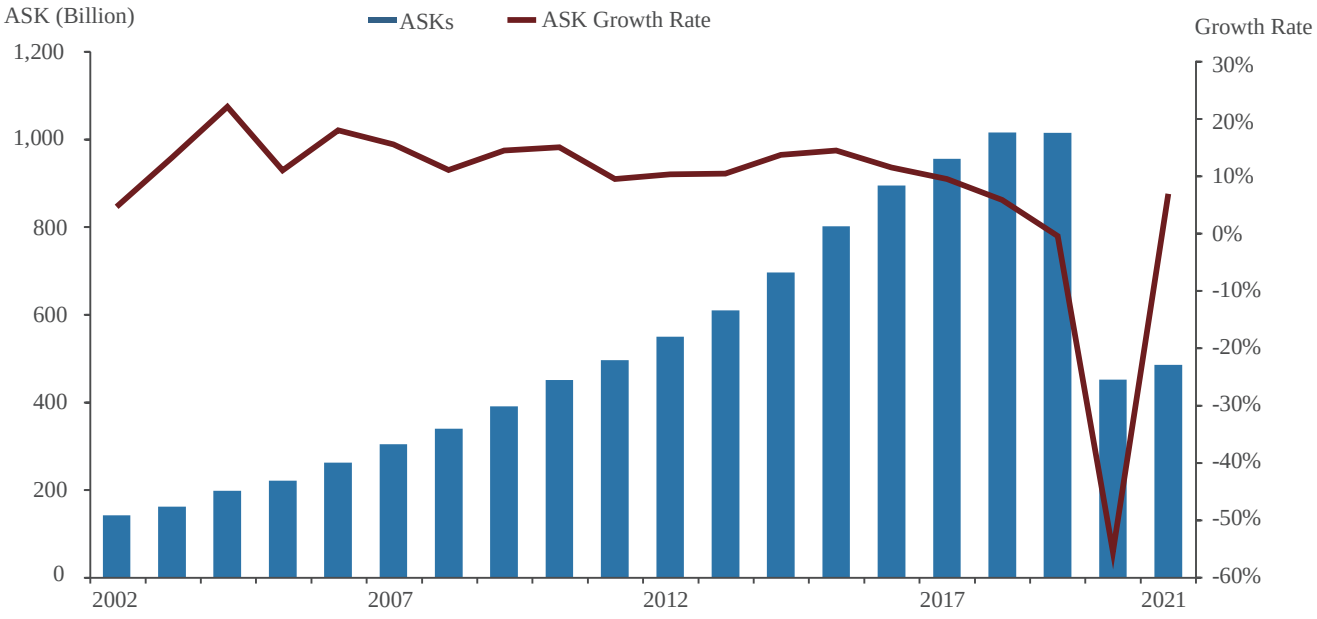
Source: COMAC



5.9.1 Market

In 2021, the regional security and economic situation generally presented the three following characteristics: First, the regional security tense has eased to a certain extent, and the relationship between regional powers has improved; The trend of policy adjustment of great powers outside the region grew clearer based on newly emerging factors and their criss-crossing interests; third, due to the regional achievements in the fight against the COVID-19 pandemic and the rebound in international oil and gas prices, the economy in the Middle East has experienced recovery, but imbalance persisted.
Driven by rising oil prices and a more friendly business environment in the region, economic in the Middle East will continue going upward. Economic growth in the Middle East is expected to rise to 4.3% in 2022 from 3.7% in 2021 due to rising oil production and continued recovery in the non-oil sector. Growth will be led by regional oil exporters, whose economy will grow by 4.4% in 2022, which is higher than the last year's. In addition, economic growth in the Gulf countries will rise to nearly 5% this year. According to the IHS Economic Forecast, the Middle East will see an average annual GDP growth rate of 2.4% in the two decades from 2019 to 2041.

Middle East Historical ASKs Trends（2002-2021）



Source: COMAC, OAG

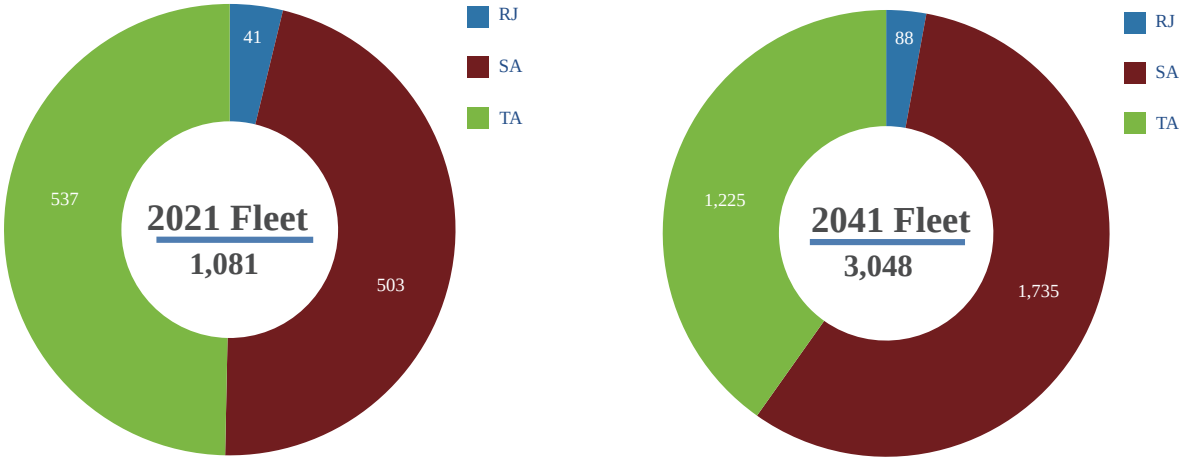
5.9.2 Network

In 2021, the impact of the pandemic went on, and the capacity (available seat kilometers) of the entire Middle East region recuperated to 47.8% of 2019's. Carriers in the Middle East mainly focused on international routes, accounting for 92.5% of the total capacity, and international routes accounted for 86.9% of the total number of routes.

In terms of changes in routes, the number in the entire Middle East region in 2021 increased by 229 compared to the previous year. The international routes increased by 16.9% and the domestic ones increased by 10.4%.

5.9.3 Fleet

Middle East Fleet Growth

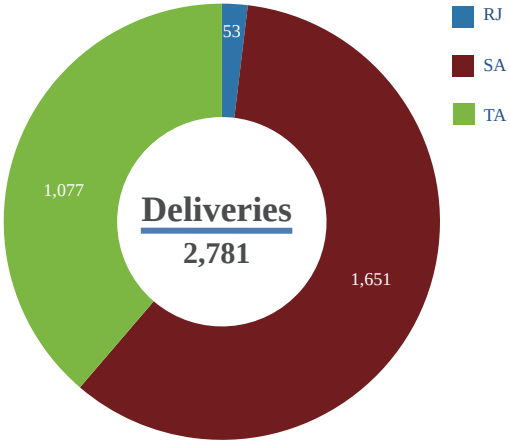


Source: COMAC, Cirium

The passenger aircraft fleet in the Middle East in 2021 was 1,081, an increase of 192 compared to the previous year, accounting for 5.3% of the global fleet. By 2041, the Middle East fleet is expected to reach 3,048 aircraft, accounting for 6.4% of the global fleet. Over the next two decades, 2,781 new aircraft will be delivered in the Middle East with a delivery value of $608 million.

The scale of turbofan regional jets in the Middle East is relatively small, and the fleet of regional jets currently in service only accounted for 1.6% of the world's total, mainly in the large size. It is estimated that by 2041, there will be 88 regional turbofan jets in the Middle East, and only 53 large regional turbofan jets will be delivered in the next two decades.

Middle East Deliveries by Category & Seat Size 2022-2041



Source: COMAC

With 1,651 single-aisle jets expected to be delivered in the Middle East over the next two decades, single-aisle jets in the region will overtake twin-aisle jets by 56.9% of the fleet by 2041. Among the single-aisle jets currently in service, the medium-sized is the main model, accounting for 76.7% of the total single-aisle jets in the region. In the next two decades, 660 of the large class will be delivered, accounting for 38.2% of the single-aisle fleet.

In 2021, there were 537 twin-aisle jetliners in the Middle East, accounting for 15.9% of the global twin-aisle jet fleet. Over the next two decades, the Middle East is expected to deliver 1,077 twin-aisle jetliners, of which 643 are in the small-sized category, accounting for 52.5% of the region's total twin-aisle jets. By 2041, the scale of twin-aisle jetliners in the Middle East will reach 1,225, and the small-sized will still be the main model, and the large-sized ones will account for 25.2% and the scale will reach 309.

5.10 Africa

Deliveries	% of Global
1,380	3.3%

Value($Billion)	% of Global
$183.4	2.9%

Fleet	% of Global
1,526	3.2%

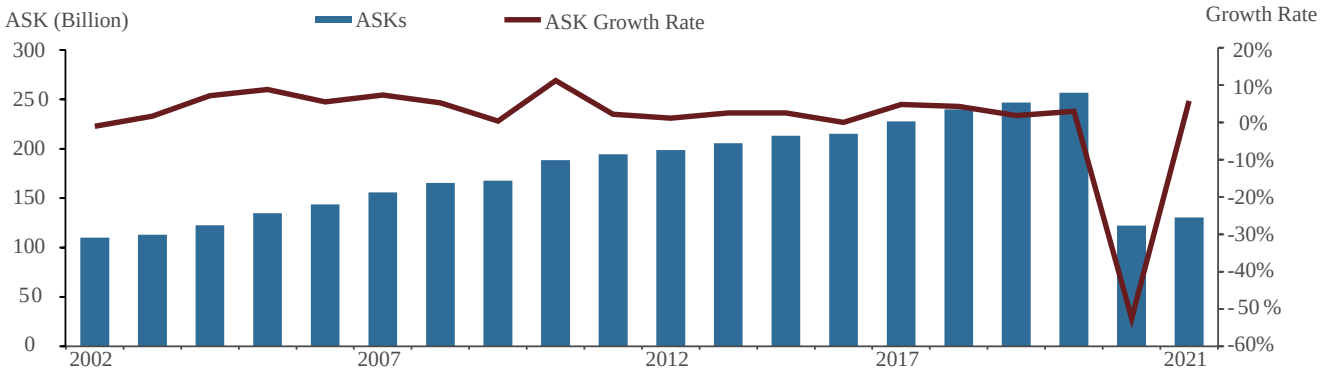
RPKs(Trillion)	% of Global
0.57	2.9%

Source: COMAC

5.10.1 Market

While overall levels of poverty on the continent of Africa have decreased over the past ten years, the wealth gap has grown wider. The COVID-19 pandemic has been particularly severe in Africa since the end of 2019. Over the years, the rampant virus has significantly hampered the continent's economic endeavors. Africa is experiencing its worst economic downturn in 50 years, and by 2020, 31 million more people will be living in abject poverty. The economy of Sub-Saharan Africa expanded by 3.7% in 2021, a notable increase over 2020, yet the region experienced the world's weakest economic recovery. The 2018 establishment of the African Continental Free Trade Zone has advanced the process of regional integration, which enhances the ability to recover from the pandemic and attracts investment, jobs, and other economic activity. In the two decades from 2019 to 2041, the African continent's GDP will expand at an average annual rate of 3.2%, predicts the IHS Economic Forecast.

Africa Historical ASKs Trends (2002-2021)



Source: COMAC, OAG

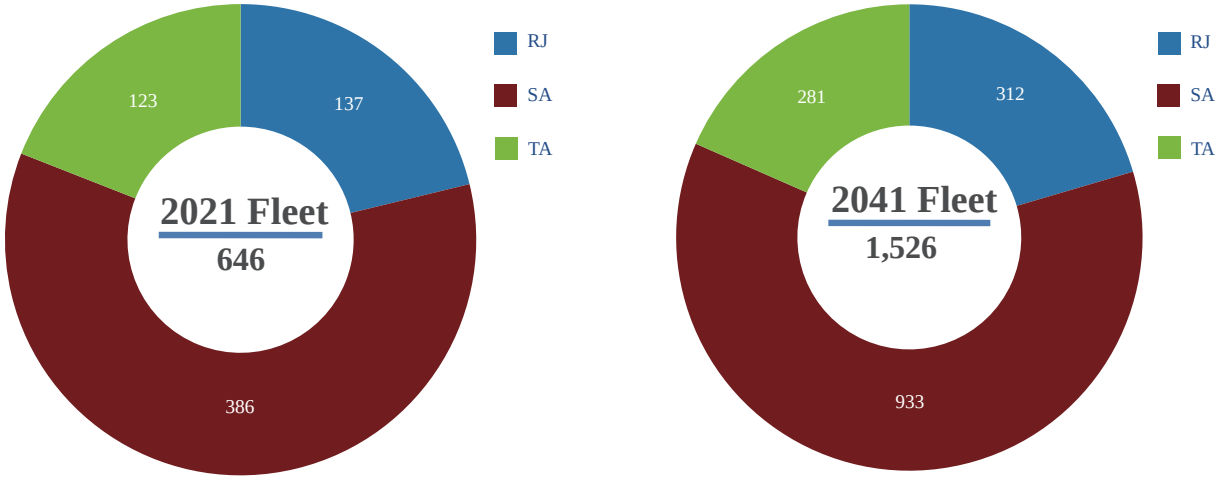
5.10.2 Network

In 2022, the entire African region accounted for 8.8% of global market in terms of transport capacity (ASK). African airlines mainly focus on international routes, accounting for 92.5% of the total capacity and 65.2% of the total number of international routes. In terms of route changes, there were 121 fewer routes across Africa in 2021 compared to the previous year. To be specific, the number of international routes decreased by 15%, while domestic routes increased by 10.8%.

Due to the slow progress in vaccination and the effect of the public health crisis on developing economies, the outlook for passenger travel in Africa has deteriorated in the short term. Passenger traffic to and from Africa, as well as routes within Africa will steadily increase in the following years, reaching 76%of 2019 levels and surpassing pre-pandemic level in 2025 (up to 101% of 2019).

5.10.3 Fleet

Africa Fleet Growth



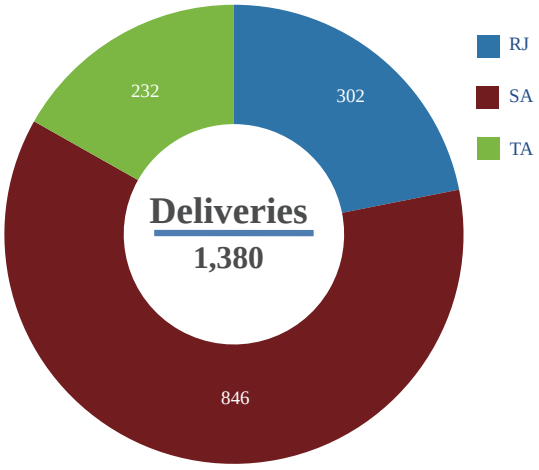
Source: COMAC, Cirium

African passenger aircraft made up 3.1% of the worldwide fleet in 2021 with a fleet size of 646 aircraft, a decline of 657 aircraft from 2019. The African fleet is anticipated to grow to 1,526 aircraft by 2041, representing 3.2% of the world fleet. A total of $183.4 billion worth of passenger aircraft will be supplied to Africa during the next 20 years.

The fleet of regional jets currently in service accounted for 5.4% of the world fleet, mostly in the small regional jet class. Over the next 20 years, 302 regional turbofan aircraft, more than 80% of which will be the large-sized ones, are anticipated to be produced in Africa. Single-aisle passenger aircraft dominate the continent of Africa, making up 59.8% of the fleet in 2021 and projected to increase to 61.1% by 2041. There will be 846 deliveries during the next 20 years, with the medium class accounting for roughly 86% of those. Only 3.6% of the world's fleet of twin-aisle aircraft are in Africa, and this situation is unlikely to alter dramatically over the next two decades. A total of 232 twin-aisle passenger aircraft, with a concentration on 250 seats, are anticipated to be delivered by 2041.

Africa Deliveries by Category & Seat Size

2022-2041



Source: COMAC

6

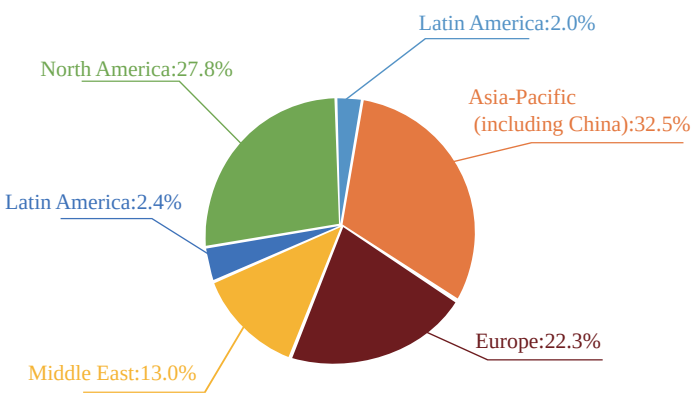
Freighter Market Forecast

6.1 Status of Global Air Cargo Market

In 2021, the global air cargo market appeared a steady upward trend. Accordingly to IATA, by the end of 2021, the global Available Cargo Ton-Kilometers (ACTKs) recover to 95.3% compared with that of 2019, and increased by 13.8% compared to 2020. In 2021, all the global air cargo volumes reached 6.434 million tons, illustrating a year-on-year increase of 18.7%.

In 2021, the global air Cargo Load Factor (CLF) was 63.9%, increasing by 9.3% compared to 2019. The lack of cargo capacity pushed up the price of air cargo, and increased the revenue of air cargo market. According to IATA statistics, in 2021, measuring the air cargo volumes in six regions of the world (excluding Russia&CIS, China is included in Asia-Pacific) with Cargo Ton-Kilometers (CTKs), Asia-Pacific region (including China) occupied the largest share with a proportion of 32.5%. North America and Europe followed closely, accounting for about 27.8% and 22.3% respectively. The share of Middle East was about 13.0%. For the weak economic and small volumes of cargo in Latin America and Africa, the share of them only accounted for 2.4% and 2.0% respectively. Additionally, the global cargo was dominated by international cargo, accounting for about 85.9% of the total, and domestic cargo accounted for the rest part.

The Proportion of CTK of Several Regions in the World in 2021



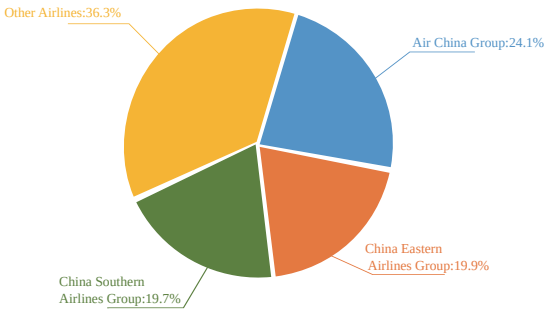
Source: COMAC, IATA

6.2 Status of Chinese Air Cargo Market

In 2021, the cargo and mail turnover of Mainland China was about 27,816 million ton-kilometers, increasing by 15.8% compared to the previous year. The cargo and mail turnover of domestic routes was 7,059 million ton-kilometers, increasing by 4.0% compared to the previous year. Among of which, the cargo and mail turnover of Hong Kong, Macao and Taiwan routes was 229 million ton-kilometers, increasing by 10.8% compared to the previous year. The cargo and mail turnover of international routes was 20,757 million ton-kilometers, increasing by 20.5% compared to the previous year.

In 2021, the cargo and mail volumes of Mainland China was about 7,3184 million tons, increasing by 8.2% compared to the previous year. Air China Group, China Eastern Airlines Group and China Southern Airlines Group have completed the cargo and mail volume of 1,7637 million tons, 1,4548 million tons and 1,4420 million tons respectively, the volume of three groups accounted for 63.7% of the total volumes.

The Proportion of Cargo and Mail Transportation Volume of Several Transportation Groups (Companies) in Mainland China in 2021

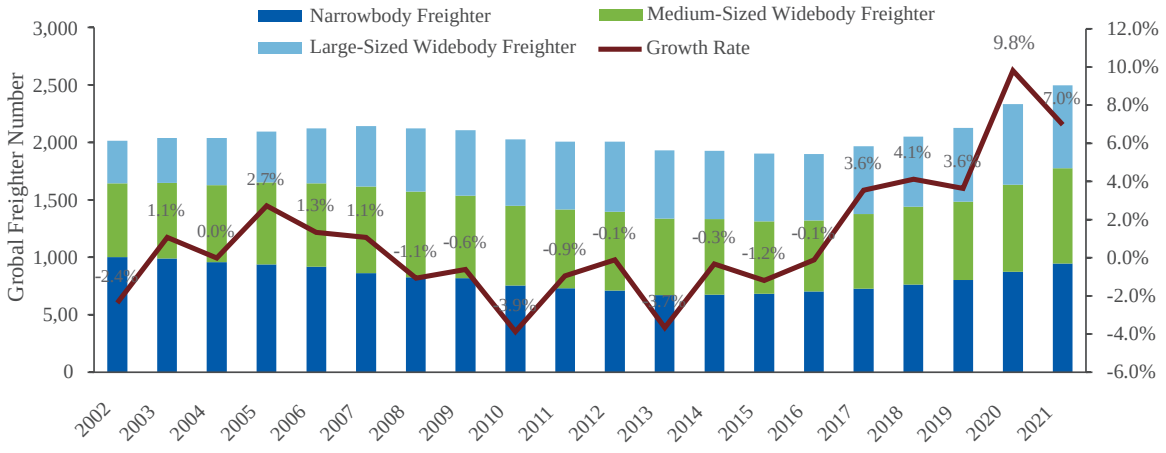


Source: COMAC, CAAC

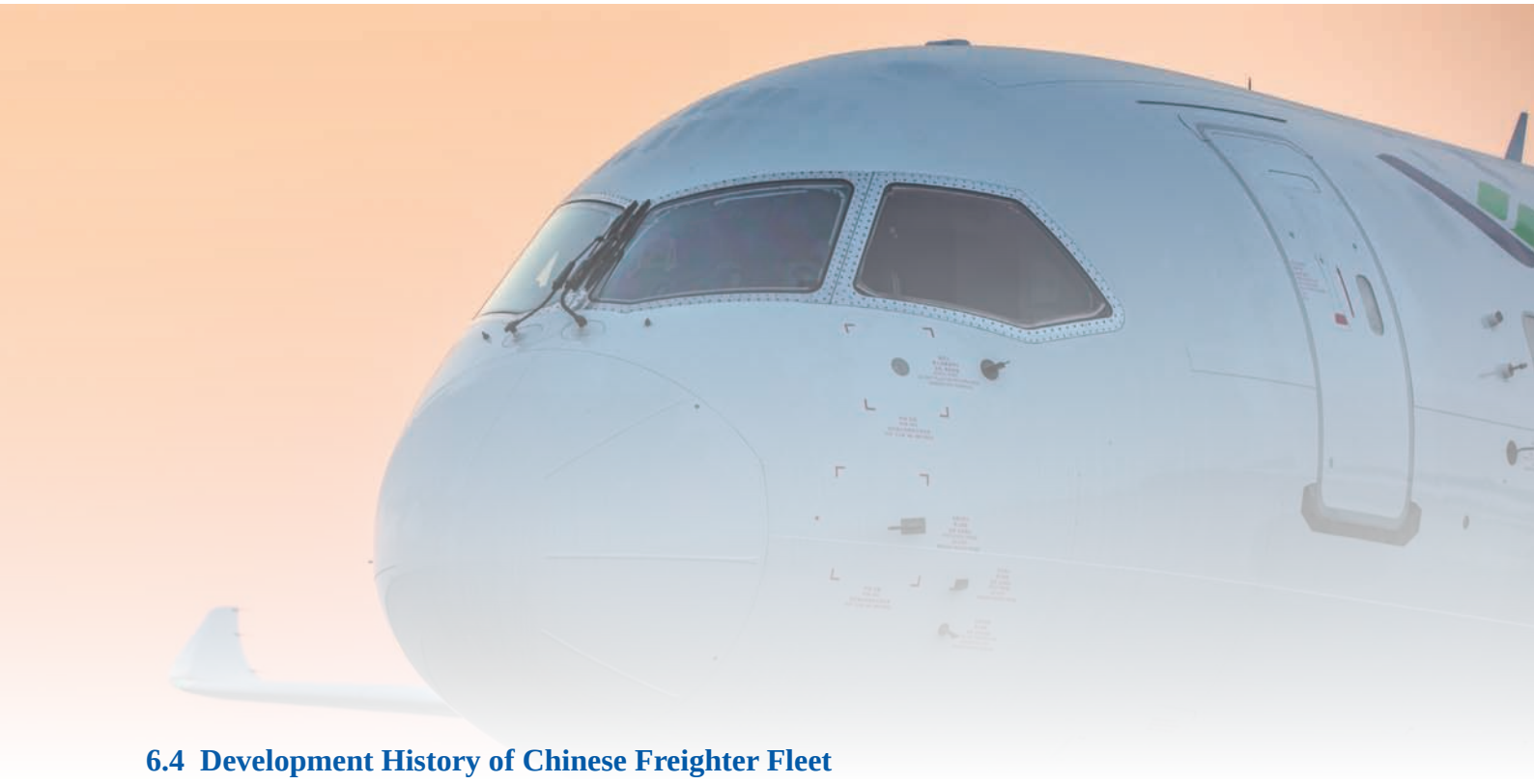
6.3 Development History of Global Freighter Fleet

In the past two decades, the global jet freighter fleet maintained a scale of around 2,000, until the outbreak of the pandemic in 2020 and 2021. The fleet size grew rapidly, the growth rate of 2020 and 2021 account for 9.8% and 7.0% respectively. By the end of 2021, there were 2,510 jet freighters around the world, including 952 narrow-body freighters, 832 medium-sized wide-body freighters, and 726 large-sized wide-body freighters.

Trend of Global Jet Freight Fleet (2002 -2021)



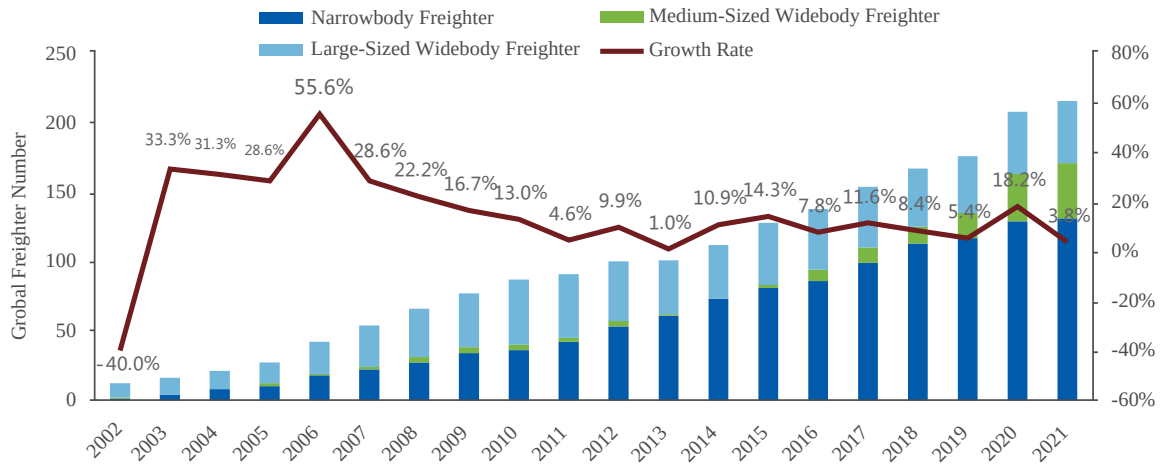
Source: COMAC, Cirium



6.4 Development History of Chinese Freighter Fleet

Since the re-organization of the three major domestic airlines in 2002, various airlines launched the strategy of "Simultaneous development of passenger and cargo", and established specialized cargo companies or departments to carry out aviation logistics business. Since then, Chinese all-cargo fleet has grown for 20 years (2002-2021), with an average annual compound growth rate of 15.5%. From 2020 to 2021, due to the significant reduction in passenger aircraft capacity, with the decline in the belly capacity of routes, the demand for cargo aircraft increased rapidly. On one hand, the number of all-cargo aircraft increased. On the other hand, passenger aircraft were exempted from airworthiness by removing seats, and the number of passenger-to-cargo aircraft increased rapidly. The annual growth rate of freighter number reached by 18.2%.

Trend of Chinese Freighter Fleet (2002-2021)



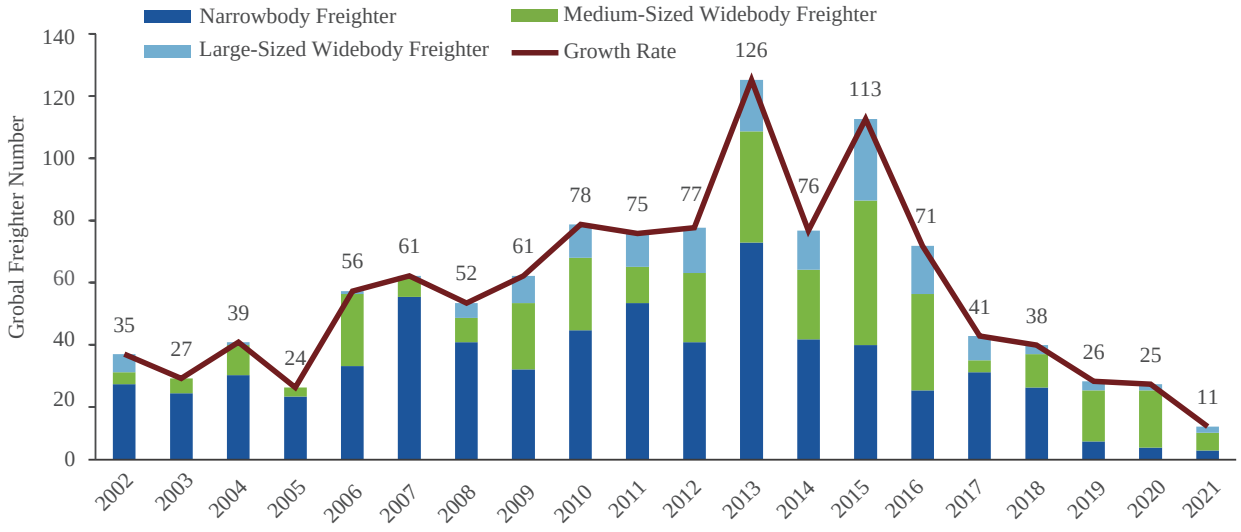
Source: COMAC, Cirium

By the end of 2021, There were 216 freighters in China, including 131 narrow-body freighters, 40 medium-sized wide-body freighters, and 45 large wide-body freighters.

6.5 Retirement of Global Freighter Aircraft

From 2002 to 2021, a total of 1,112 freighters retired worldwide, of which 623 were narrow-body freighters, 338 were medium-sized wide-body freighters, and 151 were large-sized wide-body freighters. Retired narrow-body freighters accounted for 56% of all the retired freighters. In the past two decades, the number of retired freighters in the world was on the rise year by year before 2013, and the number started to decline year by year after 2013. It reflected the delay of the global freighter retirement time and the freighter market demand increasing.

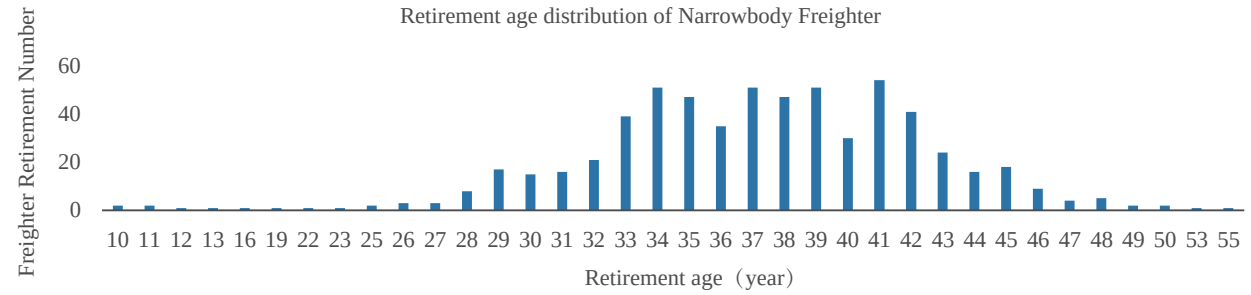
Retirement of Global Freighter (2002-2021)

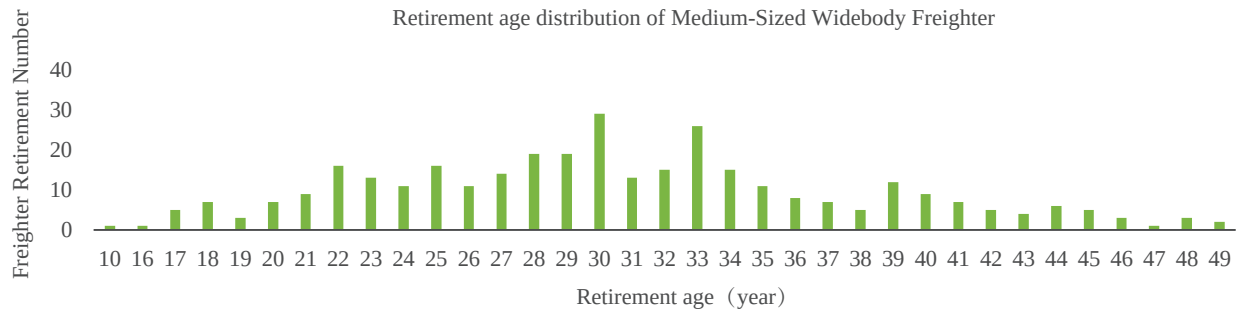


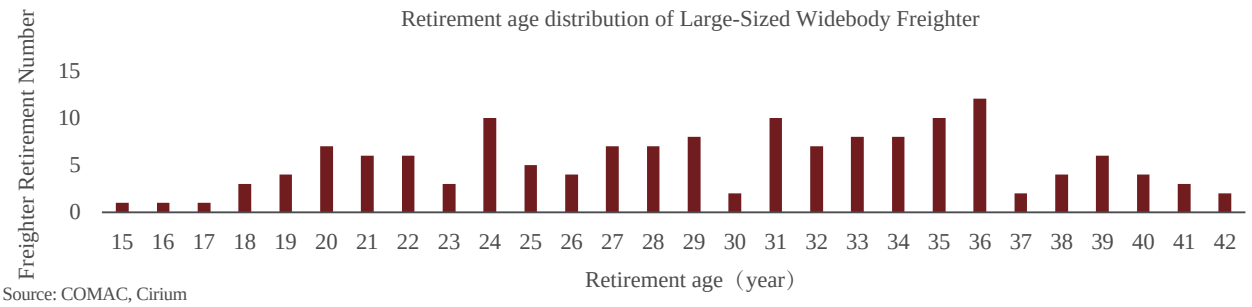
Source: COMAC, Cirium

In the past two decades, the average retirement age of the 623 narrow-body freighters in the world was 37.1 years, of which 447 were retired between 33 and 42 years, accounting for 71.7% of the total; of which 95 were retired under 33 years, accounting for 15.2% of the total; of which 81 were retired over 43 years, accounting for 13.1% of the total.
The average retirement age of the 338 medium-sized wide-body freighters was 30.6 years, of which 229 were retired between 22 and 35 years, accounting for 67.8% of the total; of which 33 were retired under 22 years, accounting for 9.8% of the total; of which 77 were retired over 35 years, accounting for 22.6% of the total
The average retirement age of the 151 large wide-body freighters was 29.6 years. The retirement age distribution of large wide-body freighters is relatively scattered. Of the 151 freighters, 56 were retired between 20 to 29 years, accounting for 37.1% of the total; of which, 55 were retired between 31 to 36 years, accounting for 36.4 % of the total; of which, 40 were retired in other ages, accounting for 26.5 % of the total.

Retirement age distribution of three types of freighter (2002-2021)







Source: COMAC, Cirium

In 2021, only 11 freighters worldwide retired permanently, with an average retirement age of 38.7 years.

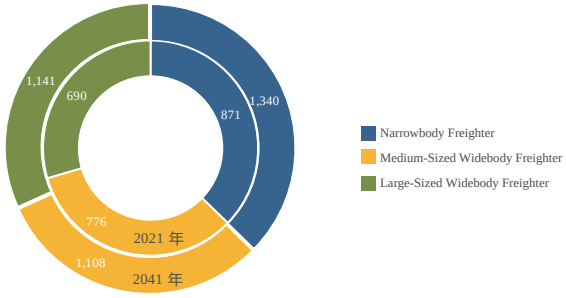
6.6 Forecast of the global freighter fleet over the next two decades

Since 2020, the Covid-19 pandemic has spread around the world. In the short term, global cross-border logistics demand increases and air cargo price rises, and freighter demand and load factor increases significantly; in the long run, the pandemic will have a profound impact on the global logistics supply chain, and air cargo will also usher in new development opportunities, which will drives the growth of demand for freighter in the future. Fundamentally, economic and trade growth remain the key indicators and drivers driving the freight market over the next two decades.

By 2041, the global jet freighter fleet will reach to 3,589, including 1,340 narrow-body freighters, 1,108 medium-sized wide-body freighters, and 1,141 large wide-body freighters. Of 950 new freighter deliveries, 388 were medium wide-body freighters and 562 were large wide-body freighters. In addition, 2,041 passenger aircraft will enter the freighter market by passenger-to-cargo conversion, including 1,283 narrow-body freighters, 465 medium-sized wide-body freighters, and 293 large-sized wide-body freighters.

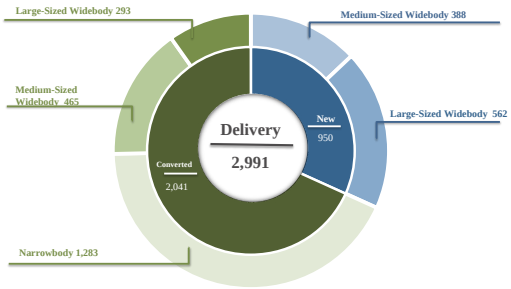
In a global perspective, North America remains the region with the largest demand for freighters. There will be 1,104 freighters delivered over the next 20 years, with a fleet size of 1,368. The Asia-Pacific region still maintains a good development trend. In the next two decades, Asia-Pacific (excluding China) will delivery 309 freighters, with a fleet size of 354; China will have 650 freighters entering the market, with a fleet size of 736; The demand for freighter aircraft in the Asia-Pacific (including China) market is close to that of North American market. The development trend of European region is stable and rising, and the fleet size will reach to 471 in the next 20 years. Russian market is affected by international situation. The demand for new freighters will be dominated by wide-body freighters made in Russia, and the source of passenger-to-cargo passenger freighter will be affected to a certain extent. It is estimated that by 2041, the freighter fleet of Russia and the CIS countries will reach to 192. During the pandemic, air cargo market shows strong development resilience. With the pandemic under control, air cargo demand will be further released, and show a more significant growth trend.

Global Historical and Forecast Freighter Fleet Size



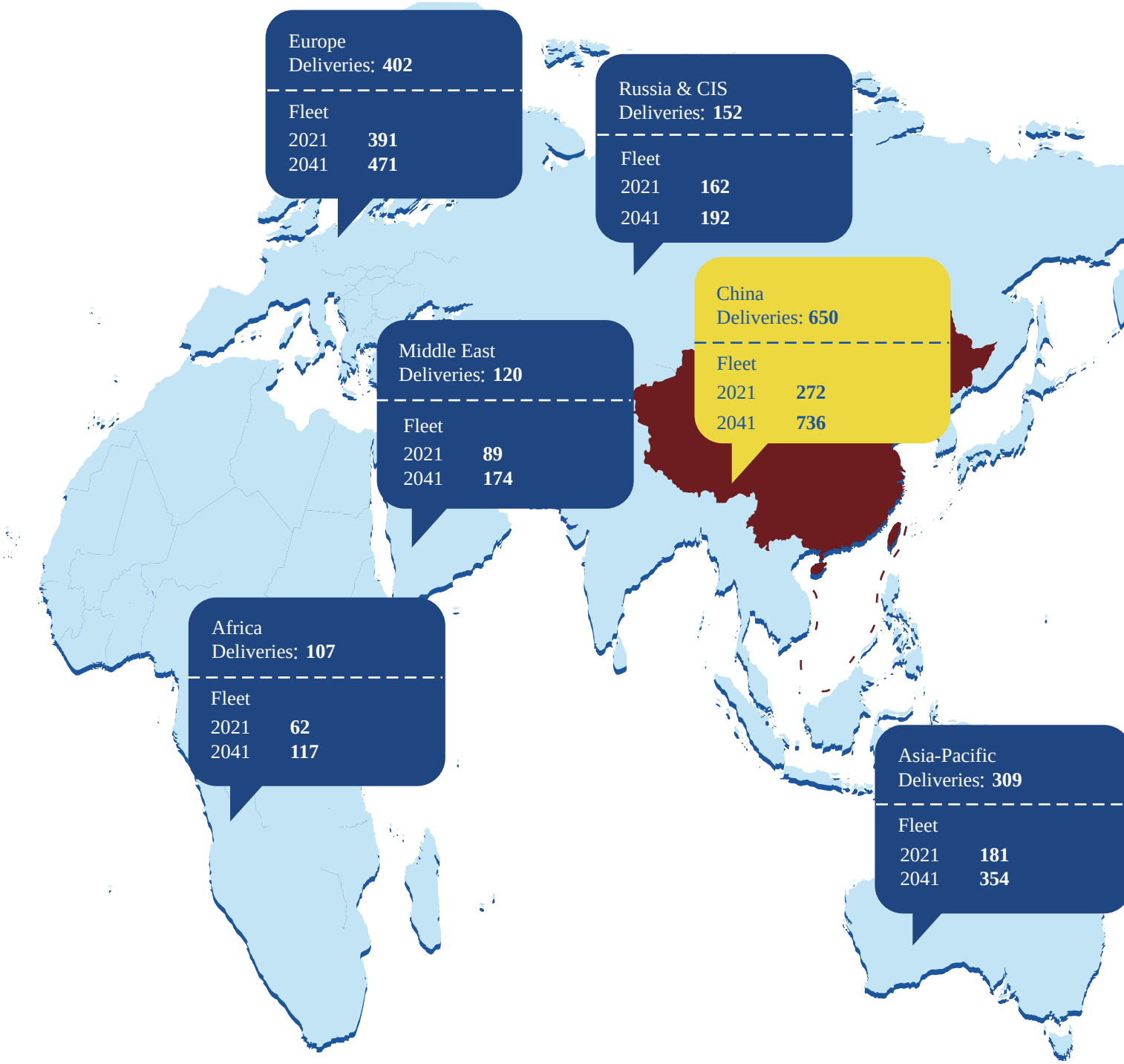
Source: COMAC, Cirium

Global Delivery Forecast of Various Types of Freighter (2022-2041)



Source: COMAC

Forecast Delivery and Fleet Size of Freighters by Region

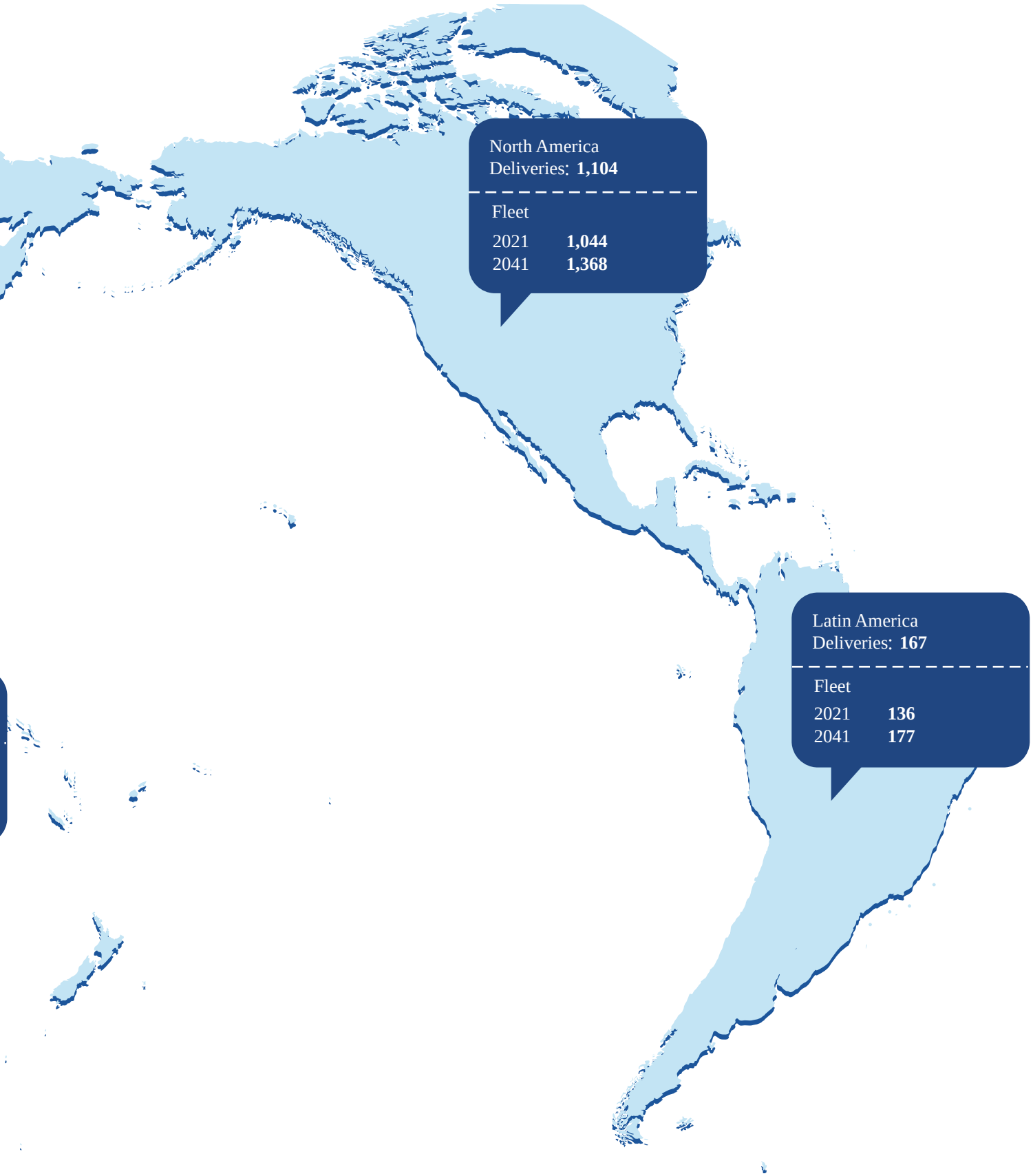


Global Fleet

2021 Fleet	**2,337**
2041 Fleet	**3,589**

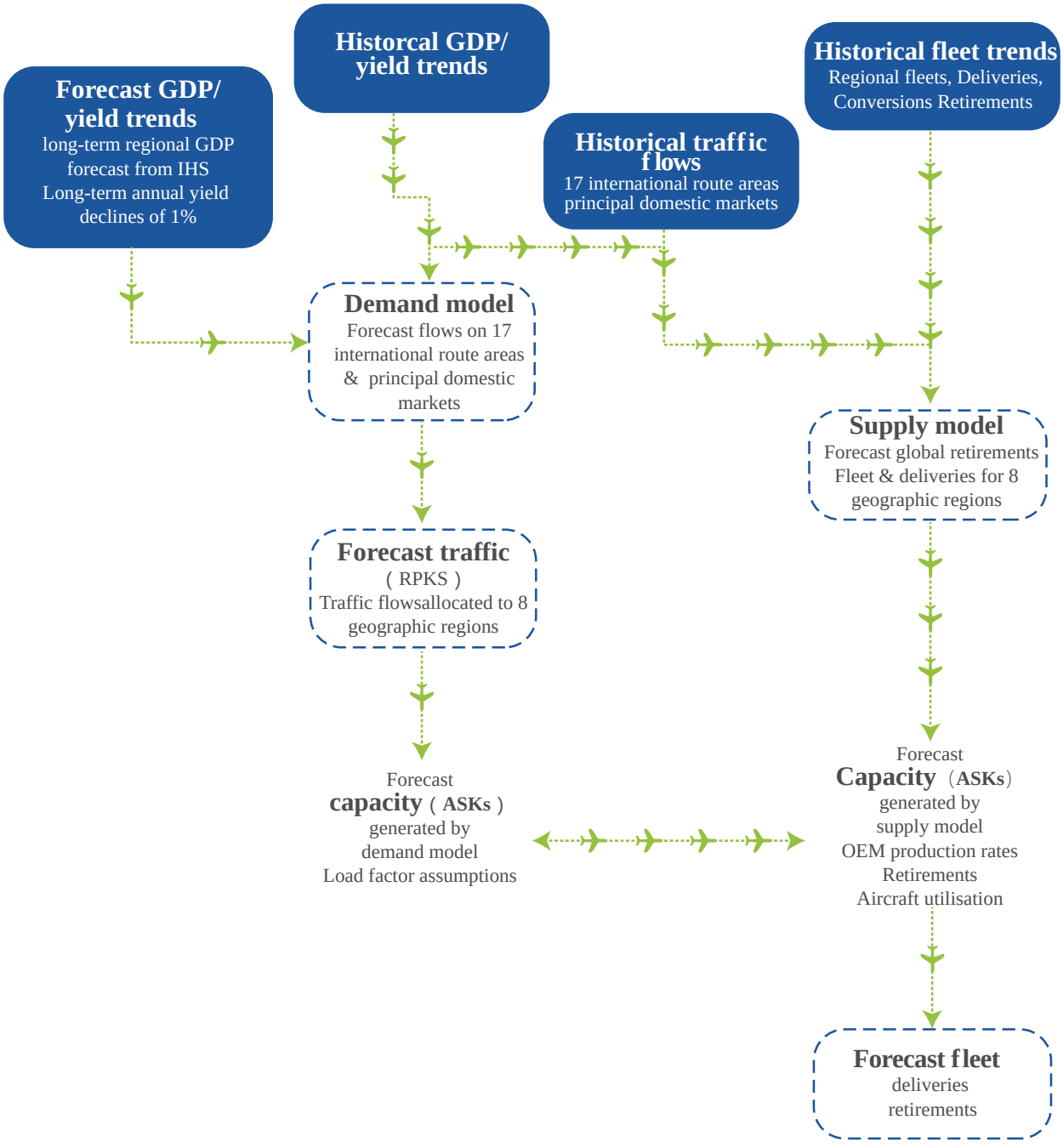
Sources: COMAC, Cirium

China including Hong Kong, Macau and Taiwan


North America
Deliveries: 1,104
Fleet
2021 1,044
2041 1,368
Latin America
Deliveries: 167
Fleet
2021 136
2041 177

Appendices & Data Tables

Methodology



Aircraft Size Category Definition

	Passenger Regional Jets	Passenger Single-Aisle Jets	Passenger Twin-Aisle Jets
Small Regional Jets	Embraer ERJ145		
	Bombardier CRJ100 / 200		
	Dornier 328Jet		
	Embraer ERJ135/140		
	UAC Yak-40		
Medium Regional Jets	BombardierCRJ700		
	Embraer E170,E175		
	Antonov An-148		
	Mitsubishi Spacejet M100		
	BAE System 146-100		
	Fokker 70		
Large Regional Jets	**COMAC ARJ21**		
	BombardierCRJ900 / 1000		
	Mitsubishi Spacejet M90		
	UAC Superjet 100		
	Antonov An-158		
	FokkerF28-1000		
	BAE System RJ85/RJ100		
	BAE System 146-200/300		
Small Single-Aisle Jets		**Embraer E190 / 195 / 190-E2 / 195-E2**	
		Airbus A318 / A319 / A319neo	
		Airbus A220-100/300	
		Boeing 737-600 / 700 / MAX 7	
		Boeing 717	
		Boeing 737-200 / 300 / 500	
		McDonnell Douglas DC-9	
		Tupolev Tu-134	
		UAC Yak- 42	
Medium Single-Aisle Jets		**Airbus A320 / A320neo**	
		Boeing 737-800 / MAX 8 / MAX 200	
		COMAC C919	
		UAC MC-21-300	
		Boeing 727-200	
		Boeing 737-400	
		McDonnell Douglas MD-80 / -90	
		Tupolev TU-154	
Large Single-Aisle Jets		**Airbus A321/ A321neo**	
		Boeing 737-900ER / MAX 9	
		Boeing 737 MAX 10	
		Tupolev TU-204	
		Boeing 737-900	
		Boeing 757-200 / 300	
		Ilyushin Il-62	

Aircraft Size Category Definition

	Passenger Regional Jets	Passenger Single-Aisle Jets	Passenger Twin-Aisle Jets
Small Twin-Aisle Jets			**Airbus A330-200 / 300 / 800neo / 900neo**
			Airbus A350XWB 900
			Boeing 777-200ER / LR
			Boeing 787-8 / 9 / 10X
			Boeing 767-300ER
			Airbus A300
			Airbus A310
			Airbus A340-200 / 300 / 500
			Boeing 767-200 / 300 / 400
			Boeing 777-200
			Ilyushin IL-86 / 96
			Lockheed L1011
			McDonnell Douglas DC-10 / MD-11
Medium Twin-Aisle Jets			**Airbus A350XWB-1000**
			Boeing 777-300ER
			Boeing 777-8
			Airbus A340-600
			Boeing 777-300
Large Twin-Aisle Jets			**Boeing 777-9**
			Boeing 747-8
			Airbus A380-800
			Boeing 747-400
			Boeing 747 Classics

Note: Aircraft in Bold represents "In Production"

Freighter Size Category

Small Narrowbody Freighter	Medium Widebody Freighter	Large Widebody Freighter
Antonov An-72	Airbus A300	Airbus A380
Antonov An-74	Airbus A310	Antonov An-124
Antonov An-148	Airbus A330	Antonov An-225
Antonov An-178	Boeing 767	Beoing 747
BAE 146	IIyushin II-76	Boeing 777
Boeing 707	Lockheed L-1011	IIyushin II-96
Boeing 727		McDonnell Douglas DC-10/MD-11
Boeing 737		
Boeing 757		
Bombardier CRJ		
Caravelle		
Embraer ERJ 145		
IIyushin II-62		
McDonnell Douglas DC-8/-9		
McDonnell Douglas MD-80		
SukhoiSuperjet 100		
Tupolev TU-204		
Tupolev TU-144/145		
Yakovlev Yak-40		
Yakovlev Yak-42		

Note:Standard-body <40 tonnes,medium widebody 40-80 tonnes,large freighter >80 tonnes.

Global RPK Traffic Forecast Summary

	2021	2026	2031	2036	2041	2019-2041 CAGR
International RPKs (billions)						
Between North America and Central America/ Caribbean	75	131	157	190	229	3.6%
Between and within Central America and the Caribbean	5	13	17	20	24	4.7%
Between Bermuda, Canada, Mexico and the United States	80	163	185	210	237	2.3%
Between North America/ Central America/ Caribbean and South America	65	187	235	288	350	4.1%
Local South America	7	26	36	49	66	3.1%
Local Europe	403	1,025	1,145	1,258	1,350	2.3%
Local Middle East	18	52	63	71	77	2.6%
Local Africa	25	55	67	92	133	5.0%
Between Europe and Middle East	126	352	428	498	573	2.9%
Between Europe/Middle East and Africa	156	358	489	652	821	4.9%
North Atlantic	318	907	1,015	1,136	1,256	2.1%
Mid-Atlantic	100	185	207	226	237	1.3%
South Atlantic	43	131	170	202	237	3.0%
Local Asia/Pacific	112	1,352	1,906	2,505	3,212	5.8%
Between Europe/Middle East/Africa and Asia/ Pacific	358	1,332	1,838	2,362	3,003	5.4%
North/Mid-Pacific	111	544	670	811	977	3.8%
South Pacific	12	94	114	136	162	3.3%
Total International	2,018	6,910	8,742	10,707	12,945	4.0%
Domestic RPKs (billions)						
Europe	140	208	238	272	305	3.2%
Japan	53	82	85	89	93	0.9%
China	782	1,213	1,662	2,183	2,757	5.5%
US	991	1,385	1,509	1,652	1,802	2.2%
Other	518	990	1,278	1,622	2,032	3.4%
Total Domestic	2,485	3,878	4,772	5,819	6,989	3.7%
World Total	4,503	10,788	13,514	16,526	19,934	3.9%

COMAC

中国商用飞机有限责任公司

Commercial Aircraft Corporation of China, Ltd.

No.1919, Shibo Avenue, Pudong New Area, Shanghai, China

200126

+86-21-20888888

+86-21-68882913