



WORLD AIR CARGO FORECAST 2020–2039



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The Boeing Company issues the biennial World Air Cargo Forecast (WACF) to provide a comprehensive, up-to-date overview of the air cargo industry. The forecast summarizes the world's major air trade markets, identifies major trends, and presents forecasts for the future performance and development of markets, as well as for the world freighter airplane fleet.

This document would not be possible without the efforts of several contributors. The Boeing World Air Cargo Forecast 2020 production team included the Boeing Content Studio and our colleagues in the Market Analysis Group. We extend special thanks to Divya Gupta, who managed all aspects of the WACF update. We also give special thanks to Adin Herzog, who, along with Wendy Moore, Kitt Forsyth-Burton, Aaron Tayler and Sarah Nizolek, thoroughly updated our Airline Cargo Traffic Database (ACTD), which includes historical traffic data for nearly 850 airlines. Thank you also to Wendy Moore, who researched and modeled the air freight yield curves in the Air Cargo Industry Overview; Kimberly Tornabene, who analyzed and compiled historical airline cargo revenues; Katrina Krebs, who developed the North America chapter; Jacqueline Kaye, who authored the Latin America and Europe chapter; Staci Strickland, who authored the Domestic China and Latin America and North America chapters; Allison Corrigan, who authored the South Asia chapter; Amine Benkirane, who authored the Middle East chapter; Carl Allen, who authored the East Asia and North America chapter; Don Lim, who authored the Europe and East Asia chapter; Jayden Lee, who developed the insights and analysis behind the Intra-East Asia and Oceania chapter; and David Franson, who led our freighter fleet forecast effort. Lastly, we would like to acknowledge the professional work accomplished by our summer interns, Kaitlyn Elgart and Portia Uwase Zuba, who assisted in the research and authoring of the Intra-Europe and Europe and North America chapters, respectively.

The next update to the WACF will appear in fourth quarter 2022. The authors welcome any questions or comments. All queries and suggestions should be directed to the following:

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EXECUTIVE SUMMARY



Air cargo markets disrupted in 2020 by COVID-19 pandemic

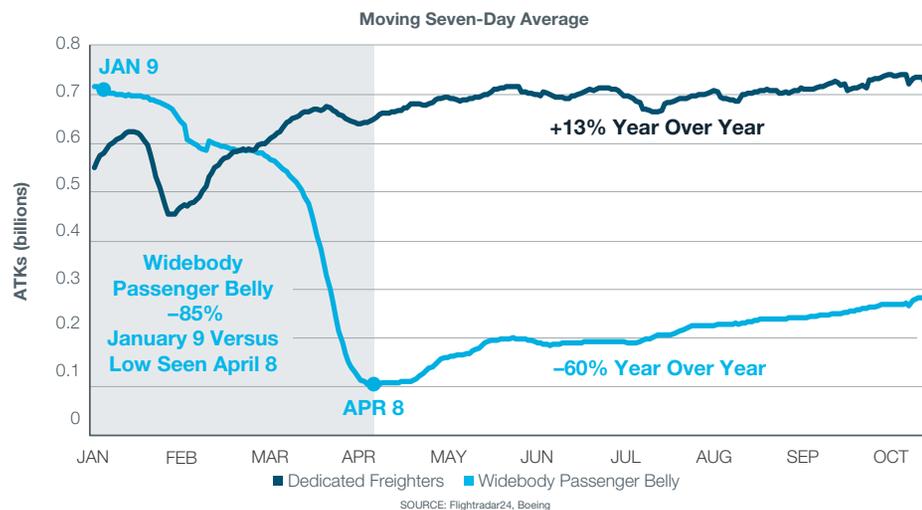
As the new decade began, the air cargo market was poised to benefit from improvement in the world economy.

This followed a weak 2019, in which the effects of tariffs, tepid world economic growth and weakened industrial production resulted in air cargo traffic decreasing by 3%.

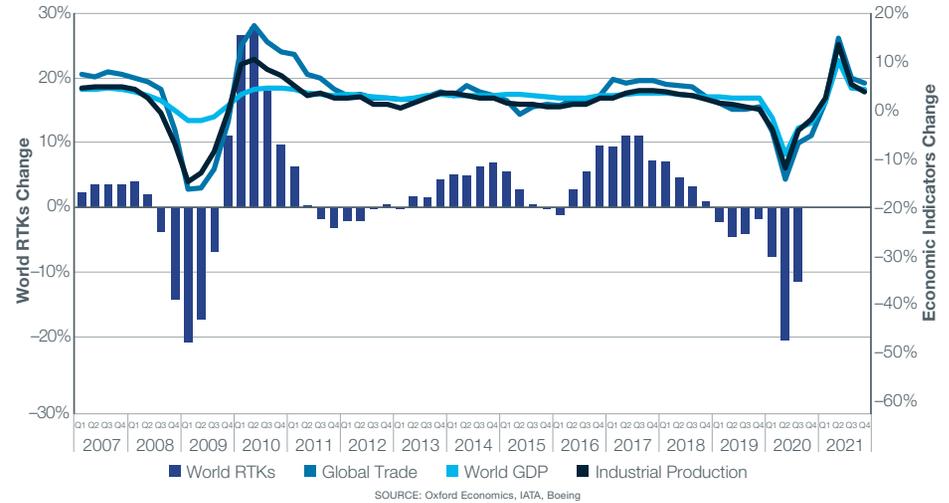
As COVID-19 quickly spread to all corners of the world early this year, the impact from the loss of long-haul passenger

belly capacity from widebody fleets created a significant air cargo capacity shortfall. Passenger belly cargo capacity typically accounts for 54% of the world air cargo capacity. Freighters have responded by operating above normal utilization levels to fill the lower cargo hold shortfall.

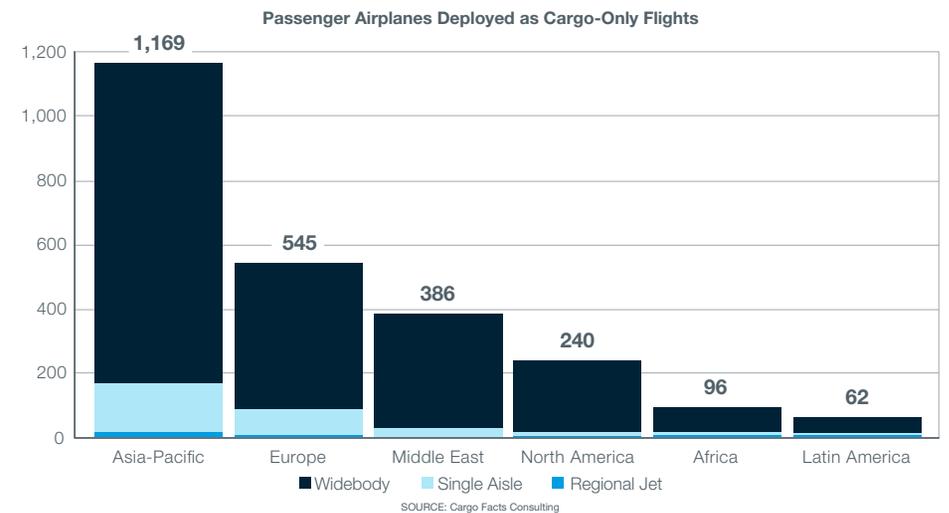
Major Reduction of Passenger Service Is Creating High Demand for Freighter Capacity



Anticipated Economic Recovery Expected to Bolster Air Cargo Traffic Growth



Widebodies Account for Nearly 90% of Passenger Airplanes Used for Cargo-Only Flights



In addition, the urgent need to meet demands for transporting medical supplies to all regions in response to COVID-19 created a unique and unprecedented environment. The decline in air cargo capacity plus urgent demand for medical supplies led to a spike in yields to high double-digit levels in second quarter 2020. With these market conditions, freighter operators have been in a unique position to meet market demands that require a high level of speed, reliability and security, as only air cargo can do.

With high air cargo yields and greatly reduced long-haul international networks, conditions have been favorable for many airlines to use some of their passenger widebody fleets for cargo-only operations to generate much-needed cash flow. These “preighters” have taken up some of the capacity shortfall and, even in some cases, have generated quarterly profits for carriers despite minimal passenger operations. As of the end of September, nearly 200 airlines have

COVID-19 pandemic accelerating express and e-commerce market

In contrast to disrupted passenger markets, the higher-than-market-average growth seen in express markets over the last decade has increased during the COVID-19 pandemic. E-commerce, which was already growing at double-digit rates prior to the pandemic, has accelerated its impact on the air cargo market. Express carriers have fared well as a result of the market turmoil in 2020. Through the end of September,

operated 2,500 passenger airplanes exclusively for cargo operations.

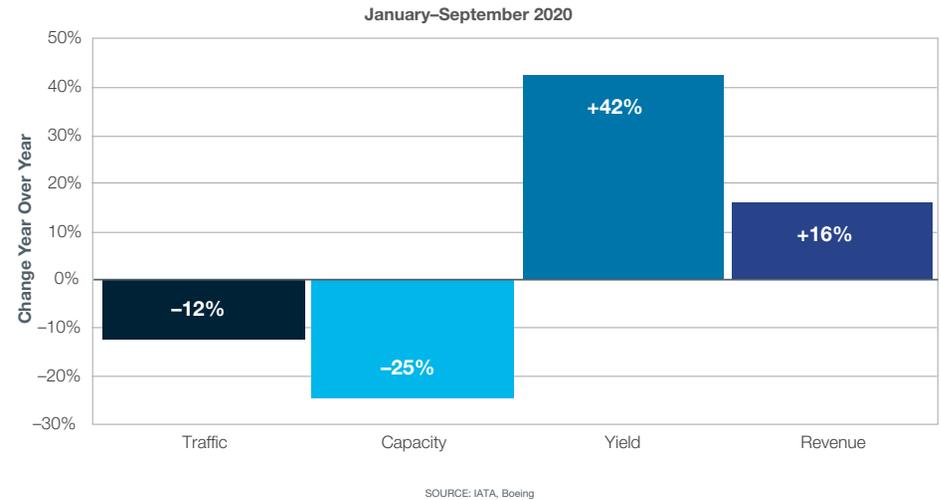
Through September, air cargo traffic was down 12%, rivaling declines in past recessions. In a normal year, this would translate to poor financial performance for air cargo operators. However, in 2020 almost a quarter of air cargo capacity has been lost. As a result of the constrained air cargo capacity, yields were up over 40% and overall air cargo industry revenues were up 16%.

The 2020 World Air Cargo Forecast incorporates the near-term disruption to air cargo markets but does not assume the current dynamics of constrained widebody passenger belly capacity will continue into the long term. Long-haul widebody passenger traffic will return in the coming years, and air cargo will then reflect market dynamics much closer to what we have seen in the years prior to the COVID-19 disruption.

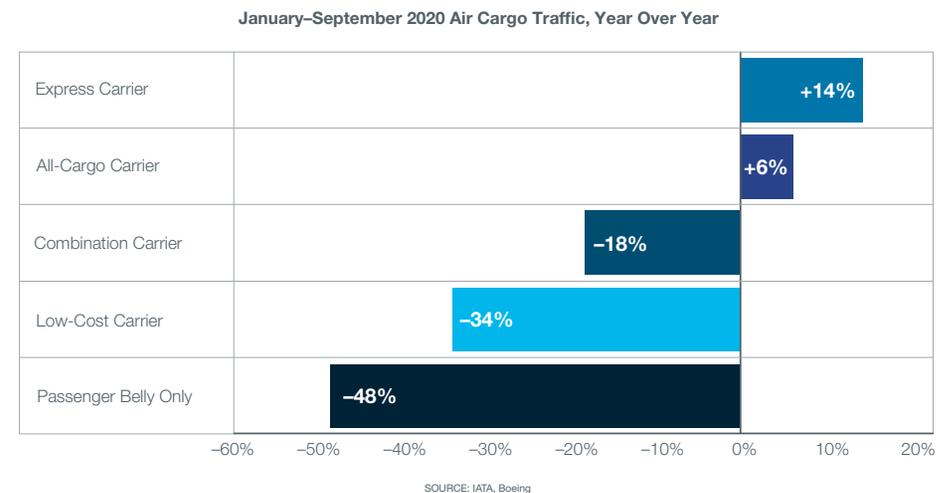
they had increased their traffic by 14%. All-cargo carriers, at 6%, are the only other air cargo business model to show growth. This forecast incorporates this continued structural growth and surge in demand that we have observed because of COVID-19.

Another consideration of structural shifts affecting air cargo growth, and a topic of intense debate in recent years, is the trajectory

Constrained Cargo Capacity Is Driving Higher Yields and Revenue



Dedicated Cargo Carriers Lead in Challenging Market Conditions



of globalization on global supply chains. Geopolitical tensions and trade disputes have percolated and increased in many major economies around the world. Air cargo is highly sensitive to global industrial production output and worldwide manufacturing supply chains.

However, even prior to the COVID-19 pandemic, some shifting of supply chains was already occurring. China, the location of choice for many Western manufacturing companies during the past 20 years, had slowly lost its low-labor-cost advantage relative to other developing countries. As a consequence, some manufacturing has moved away from China to other Asia-Pacific countries in the past few years. However, the movement of supply chains, depending on the complexity of the product, can take years to implement. The magnitude of air cargo imports from China to the United States, for example, is nine times that of the next Asia-Pacific country. This further highlights the current dominance of China as a manufacturing source and supplier. Early indications show trends

toward diversification of supply chains, rather than onshoring, to lessen risk.

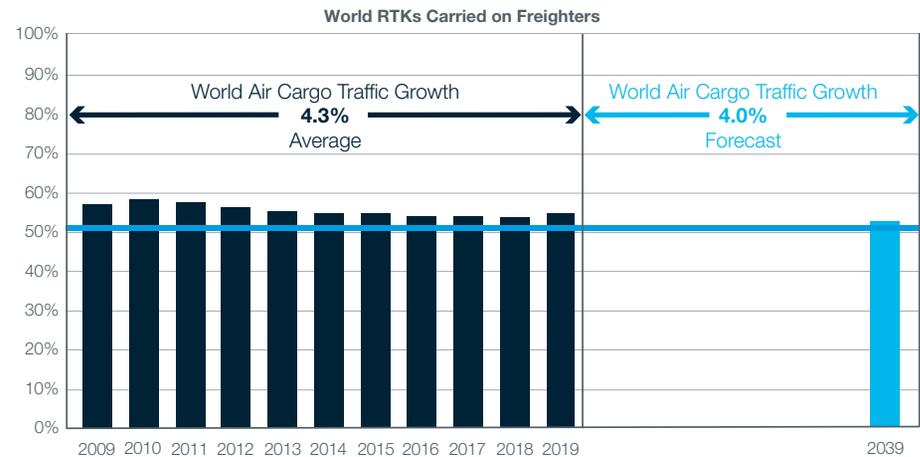
Developments in other modes of freight transport may affect air cargo industry growth. The maritime industry, which transports almost 90% of world merchandise trade, has experienced significant market disruption over the past decade. Several years of overcapacity and weakening trade led to collapsing yields. Ultra-large containerships (those vessels with more than 15,000 20-foot equivalent units of capacity) introduced by the major shipping operators contributed to the overcapacity as trade slowed. In the past five years, the industry has seen consolidation of players, reduced capacity growth and firming yields. While normally the maritime sector is not a competitor to air cargo, the changing nature of container shipping may benefit the air cargo sector. Containership operator capacity discipline, plus manufacturers seeking to de-risk their supply base and disperse manufacturing sites into lower-cost Asia-Pacific regions, may lead to the increased use of air cargo.

Importance of main deck freighters

In addition to the long-term trend of dedicated freighters carrying more than 50% of global air cargo traffic despite growing widebody passenger fleets, the COVID-19 pandemic has highlighted the importance of main-deck freighters in our global air transportation system. While increasingly capable passenger widebody airplanes have helped the air cargo industry grow during the past decade, dedicated freighters are anticipated to continue to comprise at least 50% of the world air cargo traffic carried. There are several key reasons for freighter preference in

air cargo flows: 1) Most passenger belly capacity does not serve key cargo trade routes; 2) twin-aisle passenger schedules often do not meet shipper timing needs; 3) freight forwarders prefer palletized capacity, which is not available on single-aisle aircraft; 4) passenger bellies cannot serve hazardous materials and project cargo, a key sector in air cargo flows; and 5) payload-range considerations on passenger airplanes may limit cargo carriage, which decreases the likelihood that cargo will arrive at its destination on time.

Freighters Will Continue to Carry Over 50% of World Air Cargo Traffic



SOURCE: IATA, ICAO, Boeing

World air cargo traffic growth outlook

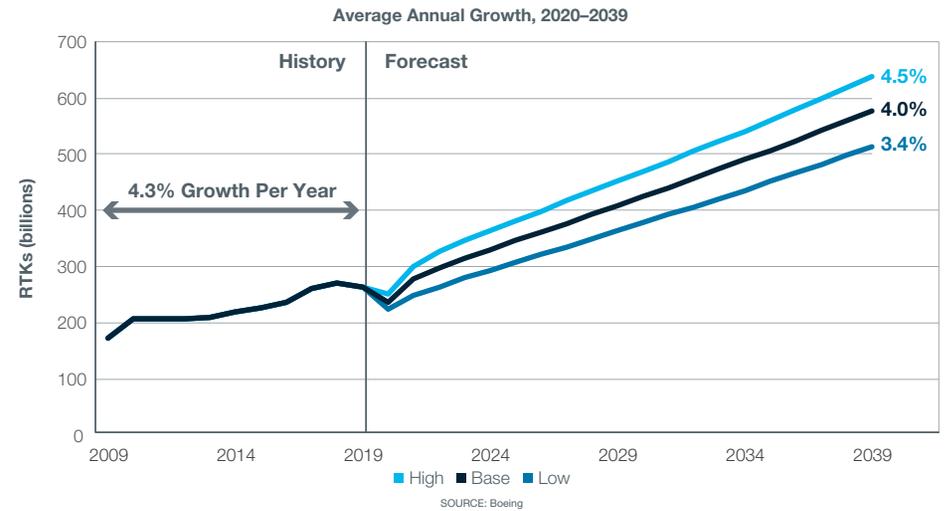
World air cargo traffic is forecast to grow at 4.0% per year over the next 20 years.

In terms of revenue tonne-kilometer (RTK) growth, air freight, including express traffic, is projected to grow at 4.1% while airmail will grow at a slower pace, averaging 1.7% annual growth through 2039. Overall, world air cargo traffic will more than double over the next 20 years, expanding from 264 billion RTKs in 2019 to 578 billion RTKs in 2039.

The Asia-Pacific region will continue to lead the world in average annual air cargo growth, with domestic China

and intra-East Asia and Oceania markets expanding 5.8% and 4.9% per year, respectively. Supported by faster-growing economies and growing middle classes, the East Asia-North America and Europe-East Asia markets will grow slightly faster than the world average growth rate. In the more established and mature trade flow between North America and Europe, growth will be below the world average growth rate.

World Air Cargo Traffic Will Grow 4.0% Per Year Over the Next 20 Years



Air Cargo Growth Rates Vary by Region

| Region | History 2009–2019 | 2019 | Forecast 2020–2039 |
|-----------------------------|-------------------|-------|--------------------|
| World | 4.3% | -3.0% | 4.0% |
| East Asia–North America | 3.1% | -7.5% | 4.3% |
| Europe–East Asia | 4.2% | -3.2% | 4.4% |
| Intra–East Asia and Oceania | 5.2% | -5.4% | 4.9% |
| Europe–North America | 3.4% | -4.7% | 2.3% |
| North America | 3.3% | 3.2% | 2.6% |
| Domestic China | 4.9% | 3.5% | 5.8% |
| Latin America–Europe | 3.9% | -1.2% | 4.1% |
| Latin America–North America | 2.1% | -3.6% | 2.6% |
| Africa–Europe | 2.8% | 4.0% | 3.3% |
| South Asia–Europe | 4.1% | 3.7% | 4.3% |
| Middle East–Europe | 4.8% | 10.6% | 2.4% |
| Intra–Europe | 4.8% | 6.0% | 2.3% |

SOURCE: IATA, ICAO, ACI, AAPA, U.S. DOT, U.S. DOC, Eurostat, IHS Market GTA, CAAC, AAI, DGCA, FAVT, Airline Reports, Airport Statistics, Boeing

Freighters and passenger lower-hold dynamics

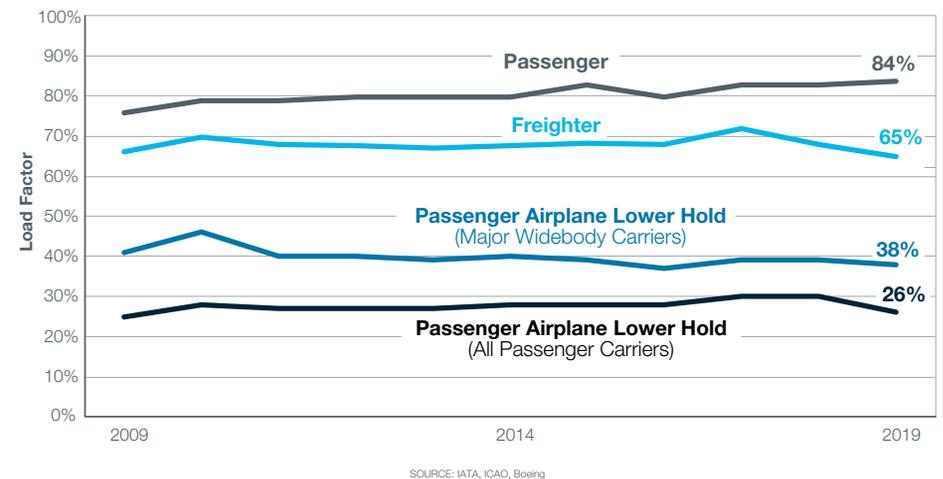
There are two options for air cargo transport — dedicated freighters and passenger aircraft lower holds (also referred to as passenger belly capacity) — and each offers unique advantages. Freighters are particularly well suited for transporting high-value goods because they provide highly controlled transport, direct routing, reliability and unique capacity considerations (volume, weight, hazardous materials and dimensions). These distinct advantages allow freighter operators to offer a higher value of service and generate nearly 90% of the total air cargo industry revenue. With the introduction of a new generation of widebody passenger airplanes with larger lower-hold capacity, more airlines are combining cargo transport with passenger operation to capitalize on additional revenue opportunities. Belly cargo space offers unique value on non-cargo routes by feeding dedicated freighter networks and providing new business opportunities for integrators. However, while lower-hold capacity in widebody airplanes serving long-haul missions has increased in recent years, several parameters can limit

the cargo operations in passenger aircraft. The reduced height of the lower deck can limit volumes. Different security standards and regulations may restrict commodities that can be shipped in passenger airplane lower holds. From a network standpoint, freighter routes are highly concentrated on relatively few trade lanes, especially in the world's two largest trade routes, East Asia–North America and Europe–East Asia.

In contrast, passenger networks are much broader and often include destinations where cargo demand is minimal. This difference in passenger and cargo traffic distribution explains the considerable load factor difference in belly space and freighters, which average approximately 30% and 75%, respectively over the last decade. In addition, range restrictions on fully loaded passenger aircraft and limited passenger service to major cargo airports make freighter operations essential. For these structural reasons, freighters are forecast to carry more than half of the world's air cargo for the next 20 years.



Freighter Cargo Load Factors Double That of Passenger Lower Holds



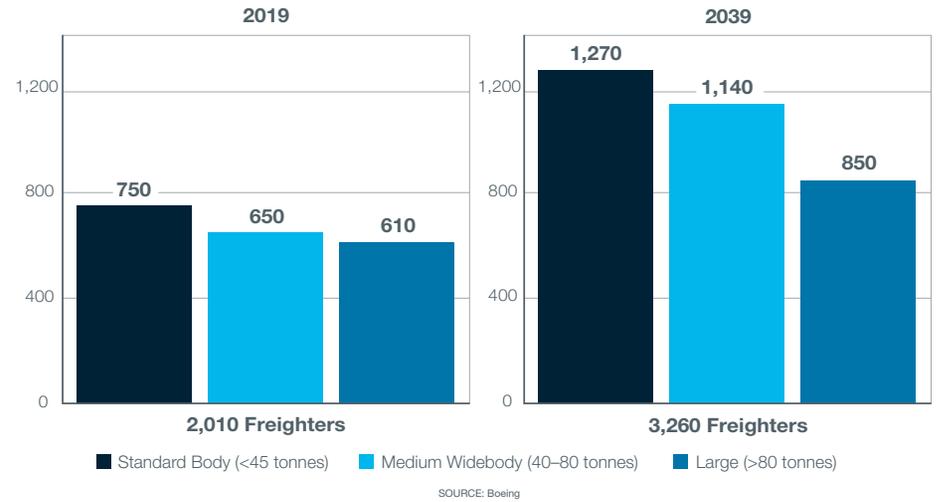
Freighter fleet forecast

The combination of 4.0% annual average RTK growth, in addition to the proven need for dedicated freighter capacity to support our global transportation system, results in the need for a 60% larger fleet during the next two decades.

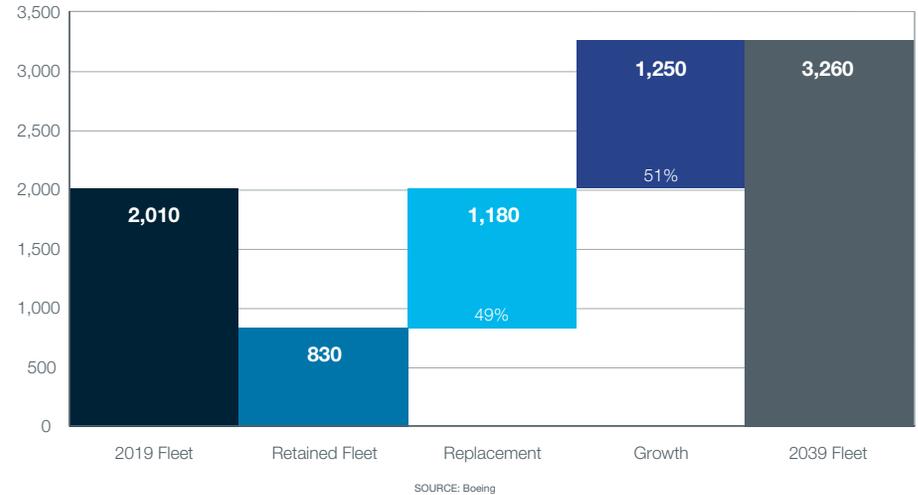
Over the next 20 years, the freighter fleet will grow more than 60% from 2,010 to 3,260 units. There are 2,430 freighters forecast to be delivered, with approximately half replacing retiring airplanes and the remainder expanding the fleet to meet projected

traffic growth. More than 60% of deliveries will be freighter conversions, 72% of which will be standard-body passenger airplanes. Of the projected 930 new production freighters, just over 50% will be in the medium widebody freighter category.

Freighter Fleet Will Grow More Than 60%



2,430 Freighters Required for Growth and Replacement



AIR CARGO INDUSTRY OVERVIEW



Wide range of factors influence the air cargo and global freighter markets

In addition to economic factors, a range of issues beyond cyclical trends influence the growth of air cargo

markets, including modal competition, globalization, market liberalization and new air-eligible commodities.

Multiple Forces and Constraints Affect Air Cargo Growth



SOURCE: Boeing

Economic drivers of air cargo hit by COVID-19 pandemic, but a recovery is taking hold

The global economy faces its deepest recession in decades as the COVID-19 pandemic continues to have a tight grip on economic activity. Growth is expected to fall by more than twice as much as it did during the 2008–2009 Global Financial Crisis. All major economies are affected, albeit by differing degrees. The crisis is also of a very different nature compared to previous recessions. As a large external shock, most of the economic damage does not stem from economic imbalances or needed corrections,

but rather from an externally imposed restriction on economic activity. As such, it was unprecedentedly swift and deep. The vast majority of countries are now growing again on a quarterly basis, but the recovery remains incomplete and uneven across industries and geographies.

Among large emerging economies, China is leading the economic recovery and will continue to contribute significantly to incremental GDP, combining size and a 4.3%

Asian Economies Lead Economic Growth

Annual GDP Growth, 2019–2039

| | |
|-------------------------|------|
| South Asia | 5.0% |
| China | 4.3% |
| East Asia | 3.5% |
| Africa | 2.8% |
| World | 2.5% |
| Latin America | 2.2% |
| Middle East | 2.1% |
| Oceania | 2.1% |
| North America | 1.9% |
| Russia and Central Asia | 1.5% |
| Europe | 1.2% |

SOURCE: IHS Markit GTA

average GDP growth rate over 20 years. At closer to 5.0% on average, South Asia, including India, will post even faster growth rates in the next 20 years. But India in particular is severely affected by COVID-19 in the near term. Overall, continued dynamic growth in emerging markets will be a key contributor to trade growth, as many of these countries have open economies and rely on the international exchange of goods to participate in the world economy. Advanced economies, growing at less than 2.0% in the longer term, will continue to be sources and destinations for advanced consumer goods and high-tech industrial demand.

The response to the pandemic has been primarily focused on sectors with higher degrees of social interactions and many service sectors remain severely constrained. However, industrial output and investment have also struggled. In particular, during

the first and second quarters of 2020, factory shutdowns and disruptions to supply chains held output in check, while investment was curtailed by extreme uncertainty. More recently, a recovery has taken hold, however. Industrial production in emerging markets, driven by a large contribution from China, has turned positive year over year, and the global numbers are set to show growth starting early next year. The investment picture is similar, with a recovery driven by government support and historically low interest rates. As a consequence, goods trade has started to recover as well and, at the end of the summer, was down only slightly compared to 2019.

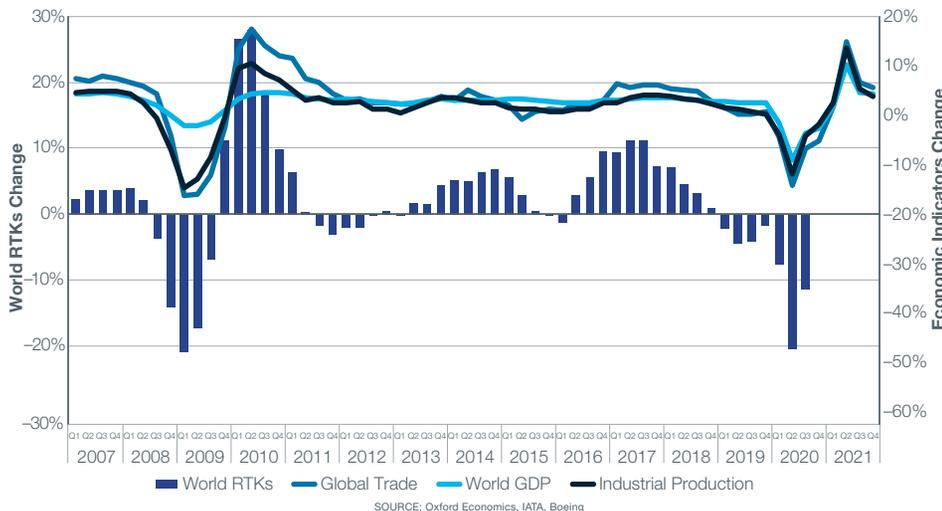
Global trade is seen growing at 4.7% from 2020 to 2025 and 2.8% on average over the 20-year forecast period, with many of the longer-term economic drivers reestablished after the near-term disruptions from

the pandemic subsides. That does not mean the pre-crisis trend will quickly be recouped, since some lost activity will likely not be made up. It does mean that trade still grows faster than GDP, however.

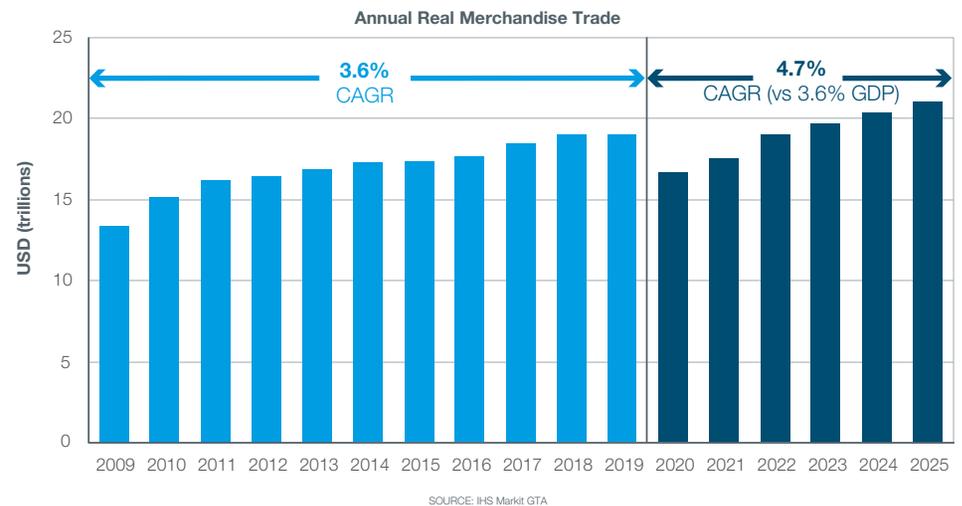
The pandemic has shown the importance of a fast and flexible trade solution, such as air cargo. Shipments of personal protective equipment and medical devices were key to the early pandemic response. In the near term, increased goods consumption at the expense of restricted services consumption will further help merchandise trade recover. Some of the more lasting impacts of the economic disruptions, such as a shift to more online work and shopping, are positives for growth in air cargo. Eventually, faster technology adoption could lead to increased demand in traditional air cargo-intensive sectors such as semiconductors.

Risks to this economic outlook are plentiful. The unpredictable nature of the COVID-19 pandemic remains the key variable. While a recovery to pre-pandemic levels by late 2021 or early 2022 remains the baseline, renewed outbreaks that require intensified restrictions on economic activity could delay this. Even with a gradually improving public health situation, many businesses remain cash strapped and governments face challenging fiscal outlooks. On the other hand, a decisive solution to the health crisis, potentially from an effective vaccine, could release pent-up demand driven by excess savings. In any case, the recovery from one of the deepest recessions in history will dominate economic and trade patterns for the next few years. For global trade, additional risks such as trade-related protectionism and populism will continue to be a challenge.

Anticipated Economic Recovery Expected to Bolster Air Cargo Traffic Growth



Global Trade Expected to Rebound to 2019 Levels by 2022, Outpacing Global GDP Growth



Air cargo offers a unique value proposition relative to other modes of global goods transport

Air cargo is only one part of the global goods distribution network. Shippers demand that shipments arrive at their destination on time, undamaged and at a reasonable price, regardless of transport mode. Different transport modes — road, rail, maritime and air — can often move the same commodities. But shippers usually have only two choices for intercontinental freight: air and maritime. Maritime transport offers the primary benefit, low cost; air transport offers the benefits of speed and reliability.

The maritime transport industry is much larger than the air cargo industry when measured in tonnes of goods transported. In 2019, the

world maritime industry carried an estimated 11.9 billion tonnes compared to 60.9 million tonnes for the air cargo industry. By weight, more than 86% of world maritime trade is in raw materials and other bulk items. Most of these commodities, such as oil, metal ores and grains, are low value, not time sensitive, and shipped by sea in specialized tankers or bulk carriers. This maritime trade cannot be directly compared to the high-value, dry commodities associated with transport by air. It is estimated that less than 1.0% of world trade tonnage is carried by air cargo, but because of the high value of these goods, they represent about 35% of the value of goods shipped globally.

Containership transportation

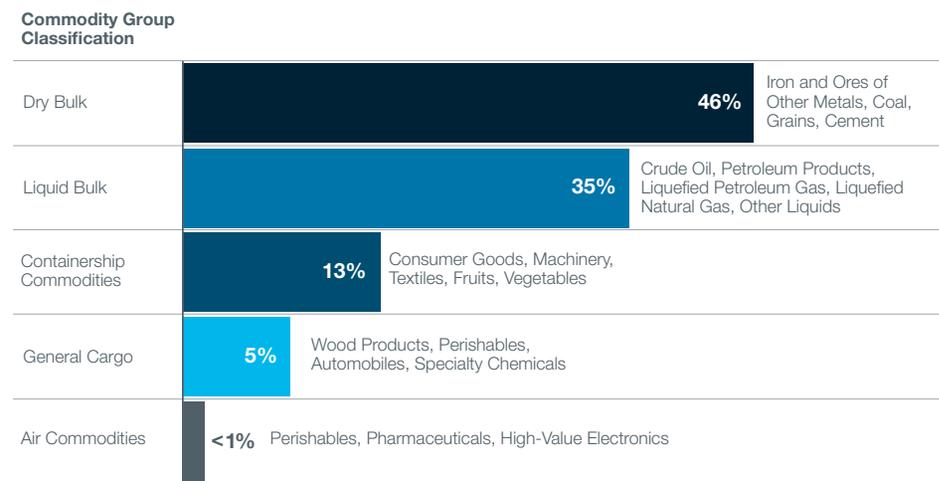
Containerized cargo is the maritime sector that most closely corresponds to air cargo. While the majority of maritime cargo is bulk and low value, containerships also carry some of the same commodities as air cargo and offer a low-cost alternative for goods that do not require the speed and reliability of air shipment.

Although containership pricing is generally 10 to 20 times less expensive than air cargo per-unit weight, the transit times are longer and less reliable than air cargo. The goods shipped by air are high value, time sensitive and perishable, and they require speed and reliability when

transported. To continue to compete effectively with containerships, the air cargo industry must ensure that the service benefits of air transport warrant the price premium charged.

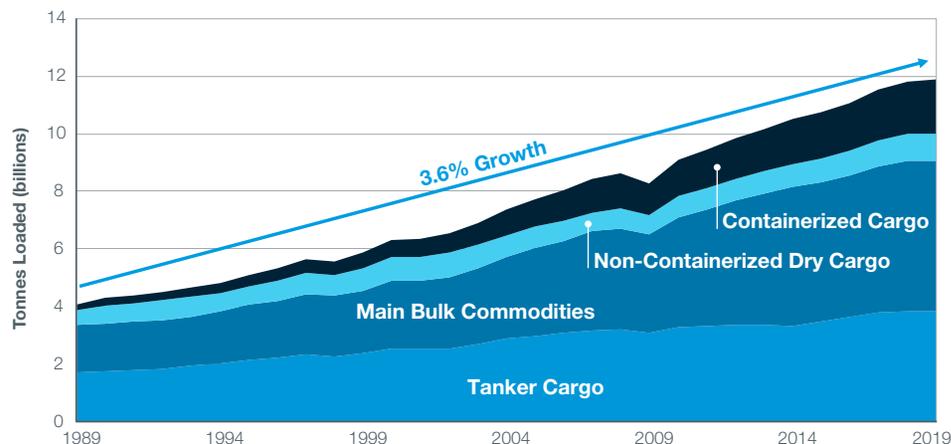
Globalization and regional specialization of industry have driven rapid growth in containership freight flows. Worldwide containership traffic by weight in 2019 was estimated to be 1.9 billion tonnes. Containership tonnage has historically grown faster than other maritime transport segments. From 1989 to 2019, the containerized cargo tonnage growth rate averaged 7.2% annually while tanker cargo,

World Trade Is Focused on Bulk Commodities



SOURCE: IHS Market GTA

Containership Traffic Has Grown by Taking Market Share From Other Maritime Segments



SOURCE: CRSL

main bulk commodities and non-containerized dry cargo averaged 2.7%, 3.9% and 2.2%, respectively.

Many of the world's trade markets have a directional imbalance, with finished products filling available

capacity in one direction and fewer goods being shipped back. This imbalance results in an abundance of return capacity available at a low price. Taking advantage of this situation, many bulk and low-cost goods are being shipped by

containerized cargo instead of bulk maritime transport. Containership growth has been primarily in transporting these types of products instead of the high-value goods shipped by air. Freight networks have the flexibility to mitigate this directional imbalance through more flexible and directional routings.

In second quarter 2020, the disruption from the COVID-19 pandemic led to canceled voyages (“blanked sailings”). At one point, 11% of containerships were idle. However, by third quarter 2020, the easing of lockdowns and various national stimulus packages led to increased trade demand. Idle ships dropped to 3.0% of available capacity, shipping rates firmed, and it is projected that containership transport will contract only 4.0% overall in 2020 compared to 2019. Much of the 2020 recovery in the

containership sector can be attributed to liner company consolidation and increased capacity discipline since the 2008–2009 Global Financial Crisis.

Containership industry capacity discipline, coupled with other emerging freight transport trends, may bolster air cargo. Supply chains are being reconfigured by the pandemic and the ongoing China-U.S. trade dispute as manufacturers seek to mitigate risk in their supplier base. As manufacturing shifts from coastal China to other parts of the Asia-Pacific region, manufacturing sites will proliferate in other regions, potentially leading to more use of air freight. Furthermore, changes in consumer behavior, particularly the tendency toward same-day or next-day delivery of e-commerce business-to-consumer shipments, point toward the increased use of air cargo.

Types of air cargo service vary to serve different air cargo market requirements

From an end-user perspective, general freight and express offerings are fairly easy to distinguish based on commodity and time definiteness. However, from a business-model perspective, the difference between express and general air cargo continues to blur. Traditional providers

are expanding their time-definite offerings, and express carriers, freight airlines and postal authorities often provide general cargo offerings as well. Ultimately, cargo customers benefit from increased service options and lower prices as competing service offerings enter the market.

General freight

General freight transport comprises the majority of total world air cargo, including all goods shipped by air except mail products. General freight comprises 81% of worldwide

revenue tonne-kilometers (RTK) and is integral to the global supply chain worldwide. Carriers specializing in general freight generate 56% of total air cargo industry revenues.

Business Characteristics Vary for Express Versus General Freight Cargo

Express Cargo



General Freight



NOTE: Mail accounts for the remaining 3% of international air cargo traffic.

SOURCE: Boeing

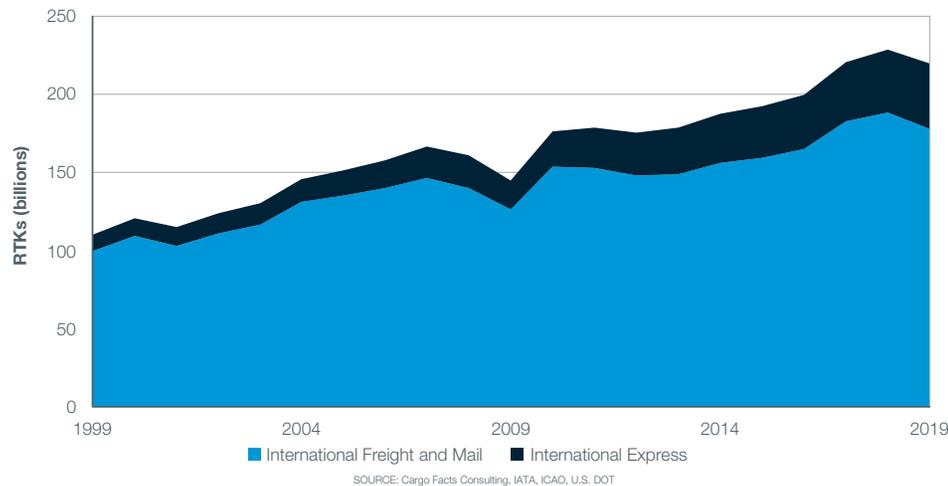
International express growth outpacing the overall air cargo market

Since 2009, the international express market has continued to grow at a healthy average rate of 8.5% per year through 2019. Growth in 2019 was an impressive 11.5%.

Higher-than-average annual growth boosted the express share of international air cargo traffic from

4.1% in 1992 to 13.4% in 2008. The international express share remained at about 13% of total international traffic during the Global Financial Crisis from 2008 through 2010. Share growth resumed in 2011, and market share reached 19% in 2019.

Express Carriers' Share of Overall International Air Cargo Traffic Grew to 19% in 2019



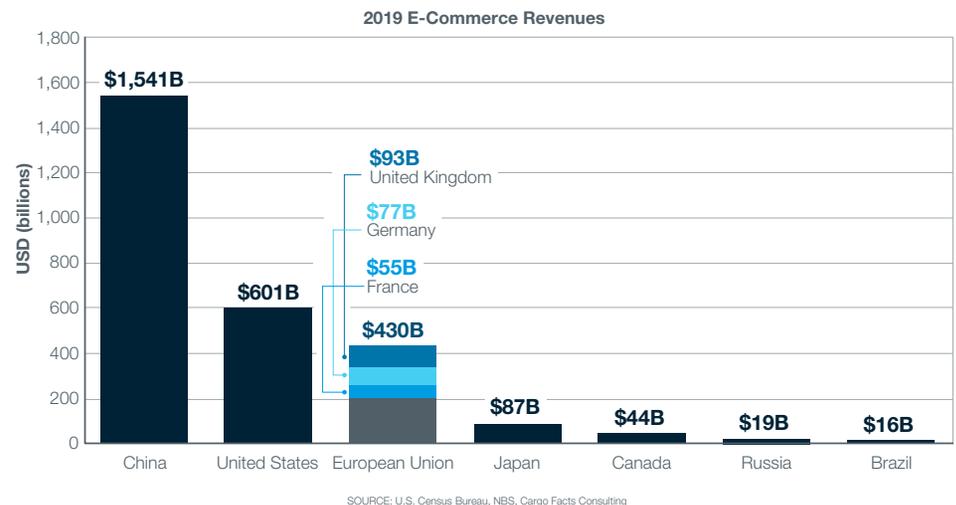
E-commerce continues to capture the attention of the air cargo industry

In the last two decades, the evolution of internet technology has led to the explosive growth of e-commerce. As more and more people move online, businesses have followed suit, setting up digital platforms that ease access to media and goods for consumers. Not only does this shift in consumer buying behavior, from traditional brick-and-mortar to digital, require many retailers to shift strategies, but the expectations of rapid delivery times also present a challenge that ripples through entire supply chains. In 2019, global retail e-commerce sales increased to 14% of all retail sales, valued at US\$3.5 trillion, more than double the US\$1.5 trillion spent in 2015. Growing at a faster rate than traditional retail, e-commerce continues to evolve as the driving

force behind the retail industry and shows no signs of slowing down.

While e-commerce is a global phenomenon, the market size and growth varies by country. China represents the largest e-commerce market in the world after overtaking the United States in 2013. The gap widened further in 2019 after China grew 13%. Alibaba, China's prevailing e-commerce platform, had another record-breaking sale event. Singles' Day, held November 11, generated nearly US\$40 billion from one day of sales. As the second-largest e-commerce market in the world, the United States grew 15% in 2019 to US\$601 billion, led by Amazon, which accounts for the majority of U.S. e-commerce revenues. Both

China's E-Commerce Market Is the Largest in the World

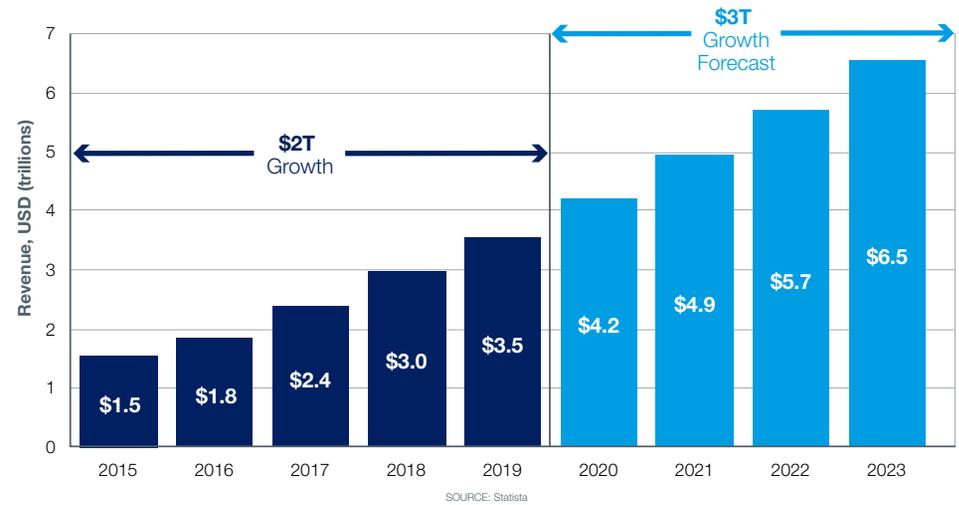


China and the United States saw an increase to 16% in e-commerce penetration as a share of total retail sales, up from 15% in 2018.

Rapid expansion in e-commerce is expected to boost air cargo growth, though its precise contribution to air cargo traffic is difficult to quantify. The complex logistics of e-commerce rely heavily on local postal systems; express networks; and, in some cases, extensive insourced distribution networks managed by the retailer. Air cargo packages are generally not identified specifically as e-commerce

by shippers, and airmail shipments are typically bundled in bags with an assortment of documents and parcels. However, it is clear that e-commerce is revolutionizing customer expectations and air cargo logistics. In the next four years, the market size is forecast to increase over US\$3 trillion, to US\$6.5 trillion in 2023. While domestic e-commerce business is often supported by large ground networks, growth in cross-border e-commerce as well as emerging markets without well-established postal and ground networks will promote an increased role of air cargo.

Strong Global E-Commerce Revenue Growth Nearly Doubles Every Four Years

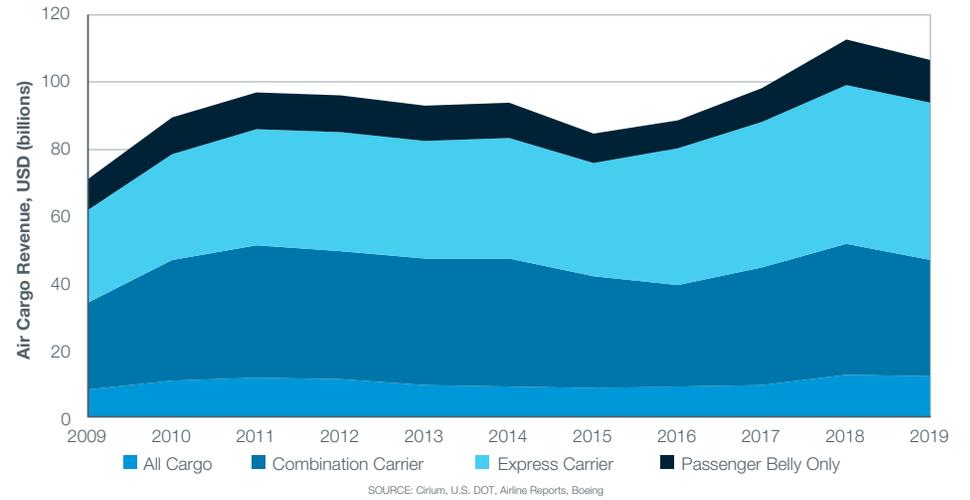


Airline air cargo business models

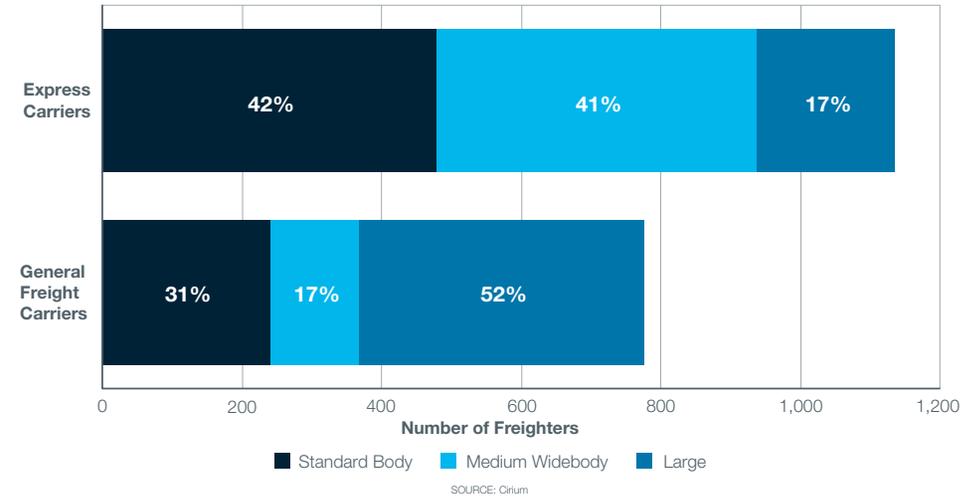
There are four main categories of air cargo operators:

- Belly-only operators provide air cargo capability within existing passenger networks.
- Cargo specialists provide dedicated main-deck freighter capability for general freight, charter operations, and specialized loading and carriage capabilities.
- Combination carriers leverage both dedicated main-deck freighters and the belly capacity of extensive passenger networks to provide reliable air connections particularly to and from home markets and hubs.
- Express carriers operate main-deck freighter fleets of all sizes to provide time-definite services as well as general air cargo capability. Express carriers typically utilize standard-body and medium widebody freighters to support their hub operations.

Express Carriers Have Generated the Majority of Cargo Revenues Over the Past Decade



Express Carriers Rely on Standard-Body and Medium Widebody Freighters to Support Hub Networks



Freighters are critical to compete in air cargo markets

While nearly half of global air cargo is carried in the bellies of passenger airplanes, freighters are a key component of the customized scheduling and operations flexibility

needed for many air cargo customers. As a result, airlines with main-deck freighters in their fleets earn nearly 90% of air cargo industry revenue.

Air cargo yields are volatile because of cyclical influences

Since the dawn of the jet age, air cargo yields have been driven lower by productivity gains, technical improvements and competition between carriers. While declining yields have created pricing pressure on all industry segments, they have also helped stimulate growth for the industry by enabling lower shipping costs for the consumer.

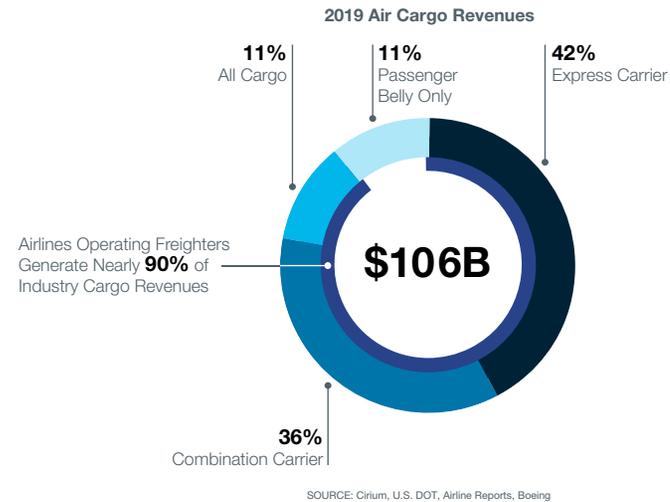
Fuel is a significant cost element for air cargo carriers and affects their yields by adding to unpredictability. Fuel-cost volatility is a challenge in operating air cargo businesses profitably. Operators typically shift rising fuel costs to their customers through the addition of fuel surcharges, which can drive large pricing and yield swings over time, contributing to market uncertainty that can discourage shippers from using air transport. Large pricing swings also obscure efficiencies that airlines and shippers realize over time, which can conceal business operational improvements.

After cost-driven yield increases from 2003 to 2008 as jet fuel prices rose almost fivefold, yields fell in 2009 because of the Global Financial Crisis. The crisis resulted in newfound consumer caution, and businesses strove to minimize inventory holdings. At the same time, excess capacity remained in the market, increasing air cargo price competition.

Yield growth came back strong in 2010 as demand grew faster than capacity. However, subpar economic and trade growth, and then falling oil prices in late 2014, again put downward pressure on yields for much of the last decade.

More recently, surging demand in 2017 and the first half of 2018 led to rising yields. However, a weakening manufacturing sector — particularly in automobile production — plus increasing trade tariffs led to weakened yields in the second half of 2018 through 2019.

Freighters Are Critical to Compete in Air Cargo Markets



International Air Freight Yields Declined in 2019 After 2018 Rebound



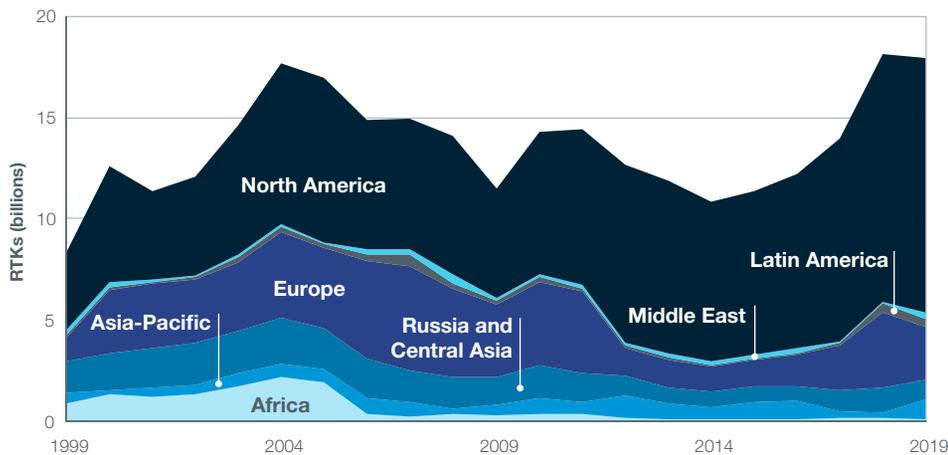
Air cargo growth and dynamics vary by region

Regional air cargo market shares have changed significantly during the past two decades. Airlines based in the Asia-Pacific region, Europe and North America have accounted for over 80% of the world's air cargo traffic for that entire period. In 1999, airlines based in the Asia-Pacific region had the largest share at 34%, while airlines based in North America had a 31% share of the world's air cargo traffic.

Since 2000, however, carriers based in the Middle East have leveraged

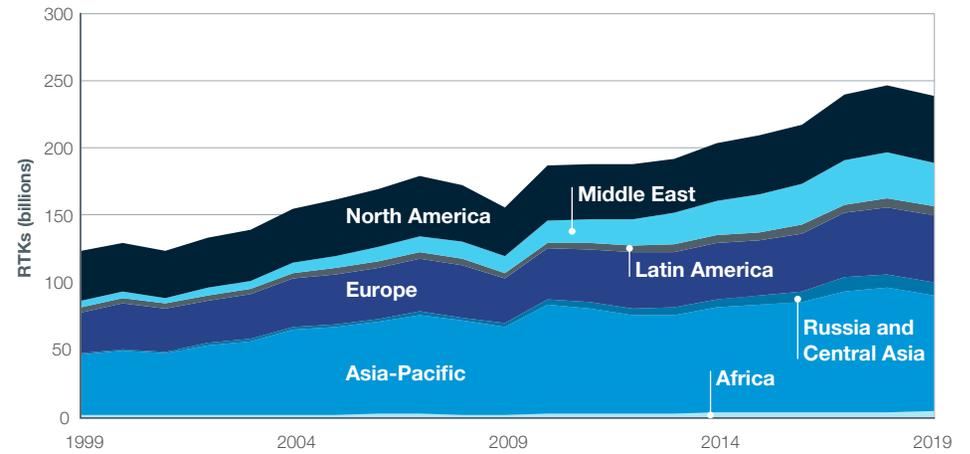
their geographic position at the crossroad between Africa, the Asia-Pacific region and Europe. Middle East carriers quickly expanded their widebody passenger and freighter fleets, which allowed them to increase their share of world air cargo traffic from 4% in 1999 to 13% in 2019. In 2019, airlines based in the Asia-Pacific region, Europe, North America and the Middle East accounted for over 90% of all world air cargo traffic. North American airlines are the leading providers of charter traffic.

North America-Domiciled Airlines Are the Leading Providers for Charter Air Freight



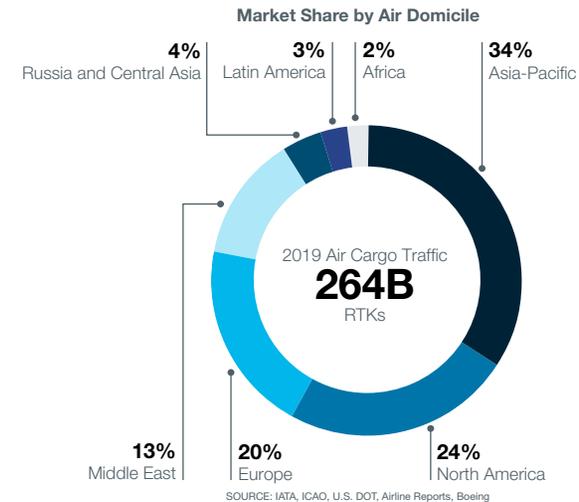
SOURCE: IATA, ICAO, U.S. DOT, Airline Reports, Boeing

Asia-Domiciled Airlines Are the Leading Providers for Scheduled Air Freight



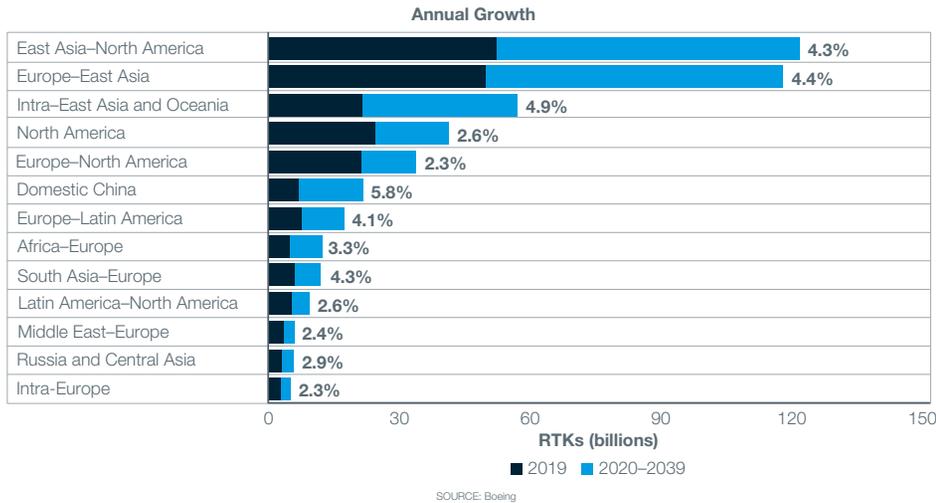
SOURCE: IATA, ICAO, U.S. DOT, Airline Reports, Boeing

Global Air Cargo Traffic Is Regionally Diversified



SOURCE: IATA, ICAO, U.S. DOT, Airline Reports, Boeing

East Asia Markets Will Continue to Lead Industry Growth



Air cargo markets linked to Asia, especially the Pacific Rim countries, will lead all other international markets in average annual growth between 2020 and 2039. Intra-East Asia and Oceania is currently the fifth-largest air cargo market, but because it is forecast to grow 4.9% per year in the next 20 years, it will be the third-largest air cargo market by 2039.

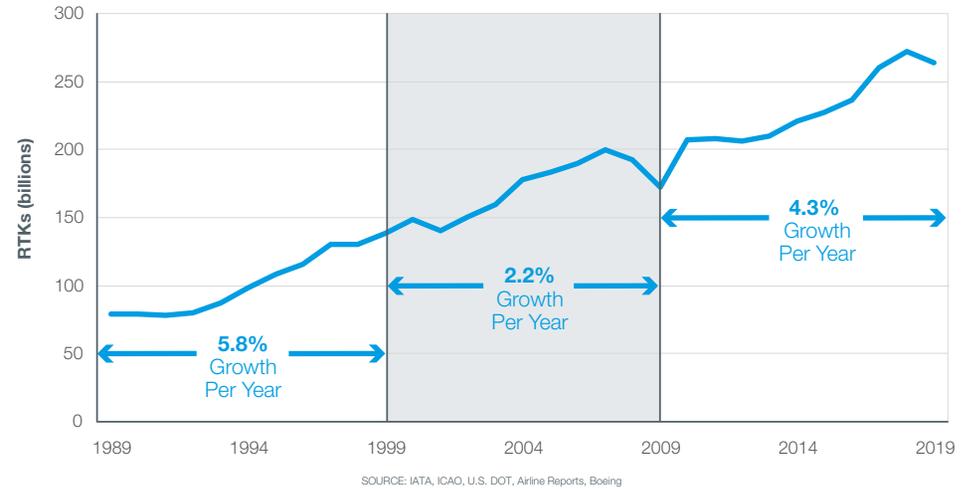
The share of world air cargo traffic associated with East Asia, including the domestic markets of China and Japan and all connected international markets, will increase from 56% in 2019 to 62% in 2039. Increasingly affluent consumers in East Asia continue to drive higher inbound air cargo share from other regions.

World air cargo forecast to grow 4.0%

Air cargo growth slowed early in the last decade as a result of the economic fallout left by the 2008-2009 Global Financial Crisis. However, over the

past 30 years world air cargo traffic proved resilient, growing an average of 4.1% per year despite wars, terrorism, economic disruptions and pandemics.

World Air Cargo Traffic Has Averaged 4.1% Per Year Since 1989



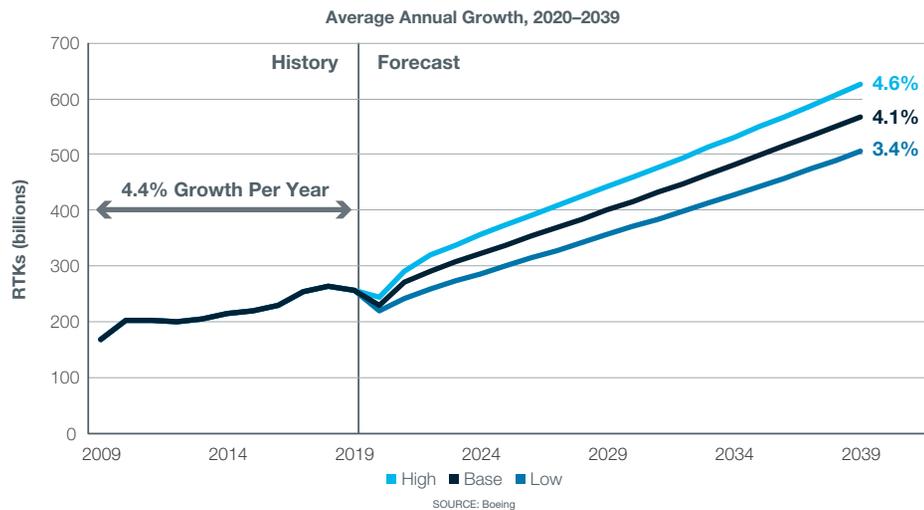
World air cargo is the sum of freight and mail, and air cargo traffic is strongly related to GDP, industrial production and average yield. World air cargo traffic, measured in RTKs, is projected to grow an average of 4.0% per year over the next 20 years.

World air freight traffic is forecast to grow 4.1% per year through 2039. High and low forecast scenarios correspond to higher and lower economic and industrial production scenarios versus the baseline. The baseline growth scenario is based upon world trade and economic recovery and the positive impact to air cargo from e-commerce. Worldwide air freight is expected to more than double in the next 20 years, increasing from 257 billion RTKs in 2019 to 568 billion RTKs by 2039. The majority of express and e-commerce

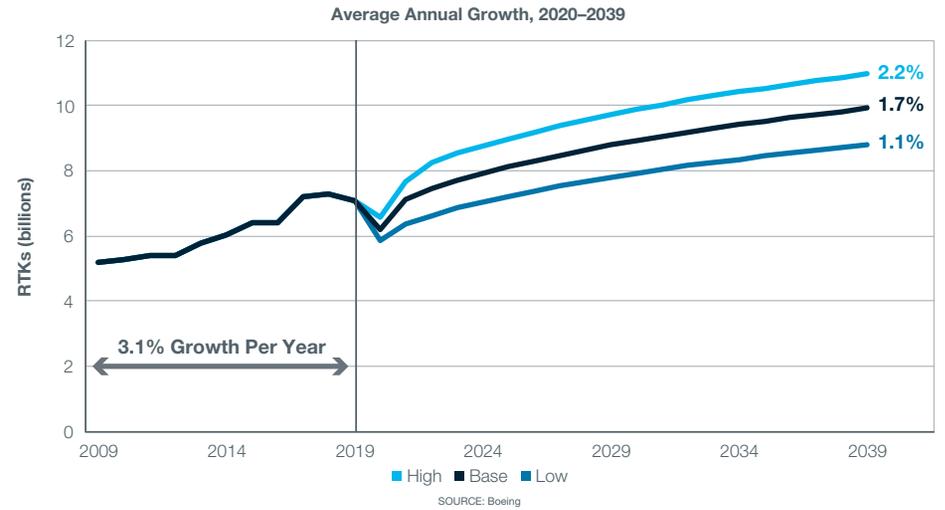
traffic is captured in air freight statistics rather than airmail statistics.

World airmail is forecast to grow 1.7% per year. Risks that could affect future airmail growth include increasing reliance on internet communication and more-stringent security requirements. Conversely, forces that could drive faster airmail growth include the proliferation of national and cross-border e-commerce services, particularly where national postal authorities work closely with e-commerce firms to provide “last-mile” delivery services. Anecdotal evidence suggests that airlines are combining their freight and mail traffic statistics, which may blur the distinction between these two forms of air cargo. This reporting trend affects the airmail forecast.

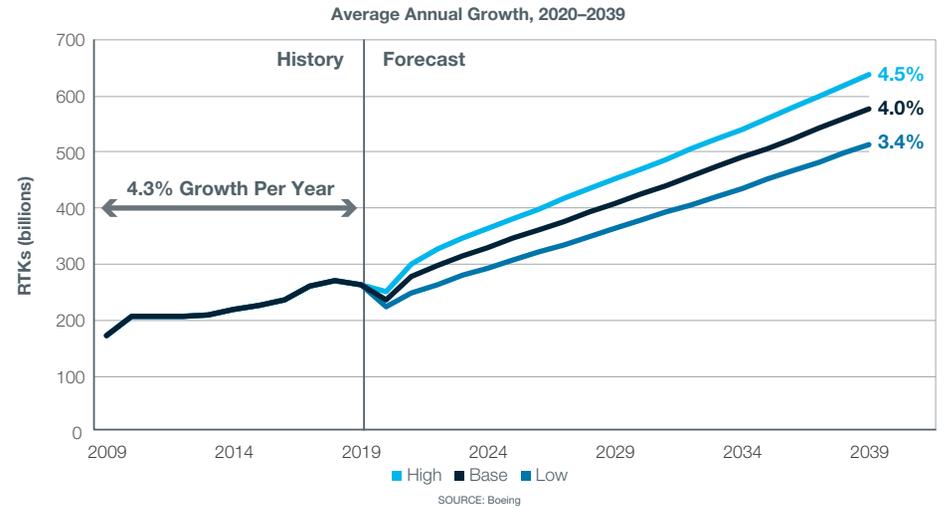
World Air Freight Traffic Will Grow 4.1% Per Year Over the Next 20 Years



World Airmail Traffic Will Grow 1.7% Per Year Over the Next 20 Years



World Air Cargo Traffic Will Grow 4.0% Per Year Over the Next 20 Years



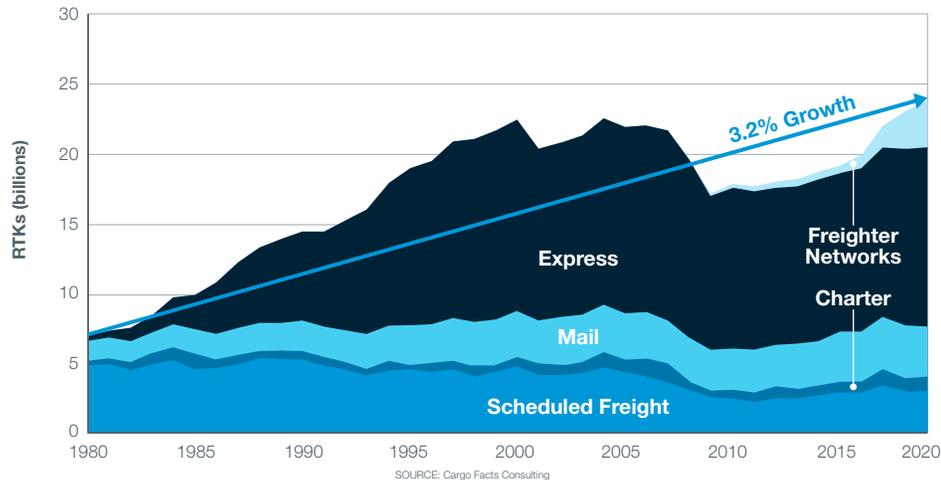
NORTH AMERICA REGIONAL FORECAST

For the purposes of this forecast, we define North America as the United States and Canada.

Air cargo traffic grew strongly in 2018, cooled in 2019

Air cargo moving to, from and within the United States and Canada accounts for 9.8% of the world's air cargo traffic in tonne-kilometers and 14.5% in tonnage alone.

U.S. Domestic Air Cargo Market Has Grown 3.2% Per Year Since 1980



Overall, North America air cargo traffic grew 6.0% in 2018 and 3.2% in 2019. U.S. domestic air cargo, which accounts for 95.8% of the North America market, grew 5.6% in 2018 and 3.0% in 2019, while Canada domestic air cargo, 2.8%

of the market, grew 23.7% and 10.8%, respectively. For 2019, transborder traffic from the United States to Canada comprised 1.2% of the North America market; traffic in the opposite direction comprised 0.2%.

U.S. domestic air cargo market

The U.S. domestic market grew 4.3% from 2018 through 2019.

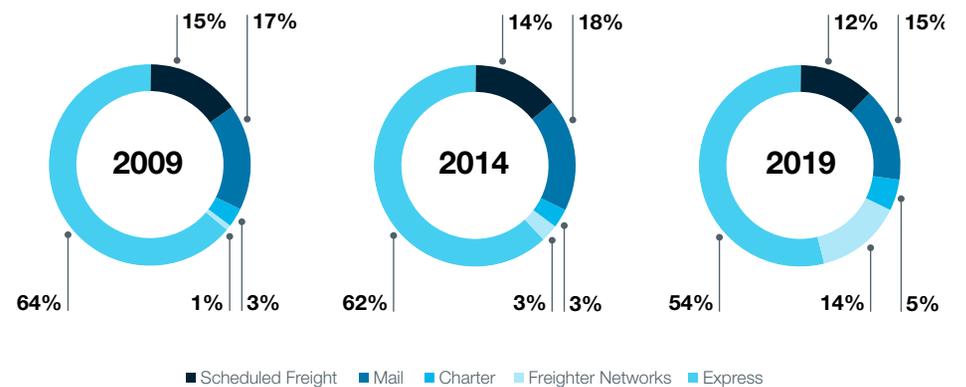
The U.S. domestic market is mature and, after the bounce back from the Global Financial Crisis, growth was relatively flat in the period through mid-2016, surging in 2017 because of a strong U.S. economy that reflected a strong global economy, consumer confidence and U.S. government tax incentives. The market still experienced above-trend growth of 5.6% in 2018, but growth cooled relative to 2017 as a result of tariffs and weakening global economic conditions. Growth in 2019 slowed even further to 3.0%.

In the United States, very little shift in the air cargo market share by carrier

category has occurred during the past 10 years. The rise of e-commerce has increased the mail category somewhat, resulting from the role the U.S. Postal Service has in this segment. However, express carriers and freighter network carriers remain the dominant sector, comprising 68% of the market, which has held relatively constant over the past 10 years.

After increasing consistently during the 1980s and 1990s, express carrier cargo traffic flattened between 2001 and 2007 as the market matured. Traffic remained flat through 2016 following the Global Financial Crisis of

Changing Dynamics of U.S. Domestic Retail Market With E-Commerce Rise Are Shown in Share Increase of Freight Network Carriers



2008 and 2009; however, traffic began to recover in 2017 with strong growth. In 2019, express traffic — at nearly 12.9 billion revenue tonne-kilometers (RTK) — finally surpassed levels not seen since 2008. Much of the recent growth can be attributed to renewed interest and activity in expanding U.S. domestic express networks to expedite movement of e-commerce goods. While express traffic still has yet to match its pre-2008 peak, the combined traffic of express carriers and freighter network carriers did surpass that peak in 2017. This traffic has continued to climb in recent years, reaching nearly 16.2 billion RTKs in 2019, which is 17% higher than the highest annual express traffic ever recorded. The freighter network growth in recent years has largely been driven by Amazon as it continues to build out its network and fleet to insource more of its deliveries.

Canada domestic air cargo market

Canada saw record growth; 17% from 2018 through 2019.

The Canada domestic market accounts for a small proportion of the total North America air cargo market, but traffic grew significantly in 2018 and 2019, at 23.7% and 10.8%, respectively. This growth was largely driven by e-commerce, with express operators comprising nearly 70% of the Canada domestic market and showing well over double-digit growth from 2018 through 2019 as they continued to build out their networks.

U.S.-Canada transborder air cargo grew above trend, from 324 million RTKs in 2017 to 349 million RTKs in 2019. Traffic in both directions grew in both 2018 and 2019 as economic growth in the United States in 2018

was the strongest it had been in the last decade (2010–2019), and 2019 also experienced positive, albeit lower, economic growth.

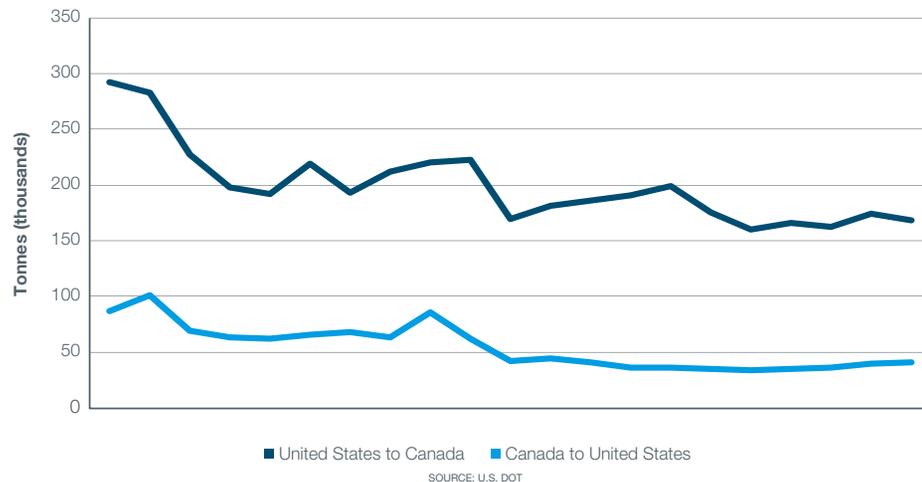
Trucking transport congestion and ELD law impact

At the end of 2017, the United States implemented a new law requiring truckers operating in the United States to install electronic logging devices (ELD) in their fleets. And while congestion is a watch item in terms of impact to air cargo growth, the effect of the ELD law has not been significant.

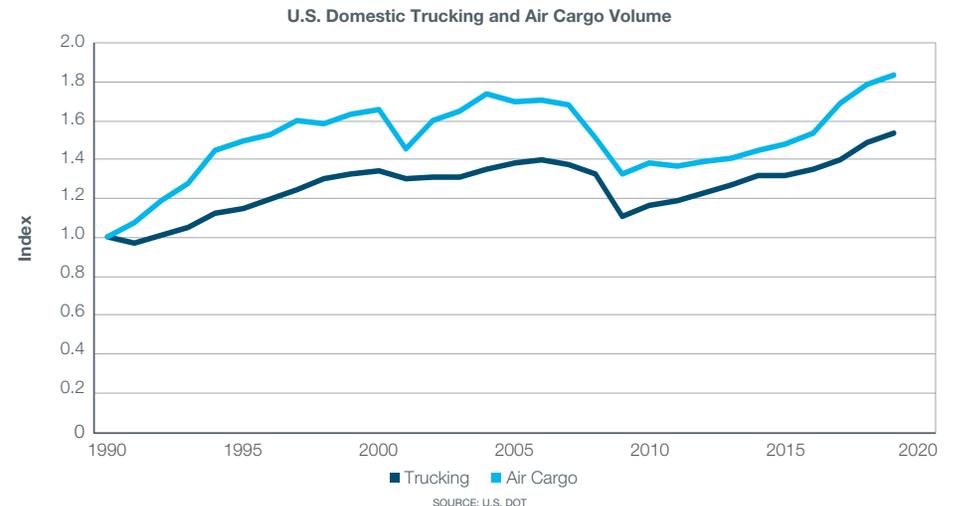
Most of the large fleets have complied with the ELD law, but reportedly many small fleets have not. The sentiment expressed by some is that this new law may stimulate air cargo traffic, as some truck drivers will be forced, through electronic monitoring, to stay within the driving time constraints specified by law.

However, the overall impact of this regulation is likely to have minimal — and possibly negligible — impact on overall long-haul trucking capacity, so the likelihood of any major shift from trucking to air transport as a result of the law is expected to be minor. In fact, ELDs have actually served to highlight inefficient wait times at shipping and receiving centers, leading shippers to drive improvements to wait times throughout their systems. The increased capacity from these wait-time reductions has mitigated some of the lost capacity resulting from drivers now staying within the mandatory driving time limits.

Northbound Continues to Exceed Southbound Tonnage



Trucking and Air Cargo Tonnage Continues to Grow



United States-Mexico-Canada Agreement

The United States-Mexico-Canada Agreement (USMCA), signed on Nov. 30, 2018, entered into force on July 1, 2020, and is not expected to materially impact the growth of, or allocation between, North America air cargo and trucking volumes.

The major changes of the USMCA from NAFTA mainly apply to labor laws, auto parts manufacturing, biologic drug exclusivity periods, environmental regulations, dairy and poultry market access between the United States and Canada, and updates related to trade in the digital age. These changes are not expected to materially change the North America air cargo growth forecast or contribute to significant modal shifts.

COVID-19 and e-commerce surge

The North America air cargo market has seen above-trend growth thus far in 2020, despite — and to some degree as a result of — the COVID-19 pandemic.

While the pandemic has caused a worldwide economic recession, e-commerce has uniquely thrived in this economic downturn because

consumers were less able or willing to visit brick-and-mortar stores because of social distancing, and thus have turned to online shopping, accelerating e-commerce market penetration. Even considering the reduction in available belly cargo space on commercial passenger flights, North America air cargo is expected to see moderate growth in 2020 as express carriers and freighter network carriers pick up this demand in addition to meeting growth in overall demand. This growth is expected to continue into 2021 as e-commerce market share continues to grow and as COVID-19 vaccines are distributed.

North America economic outlook

The GDP growth rate is projected to average 1.9% per year between 2020 and 2039 after dropping in 2020 because of the COVID-19 pandemic and resultant recession.

The U.S. economy grew 2.6% and the Canadian economy grew 1.8% in 2018 through 2019. GDPs for the United States and Canada are forecast to shrink 6.1% and 7.0%, respectively, in 2020 because of COVID-19, rebounding in 2021 with positive growth, and ultimately achieving respective long-term growth rates of 1.9% and 1.7%.

Industrial production, a bellwether of air cargo growth, began a steep increase

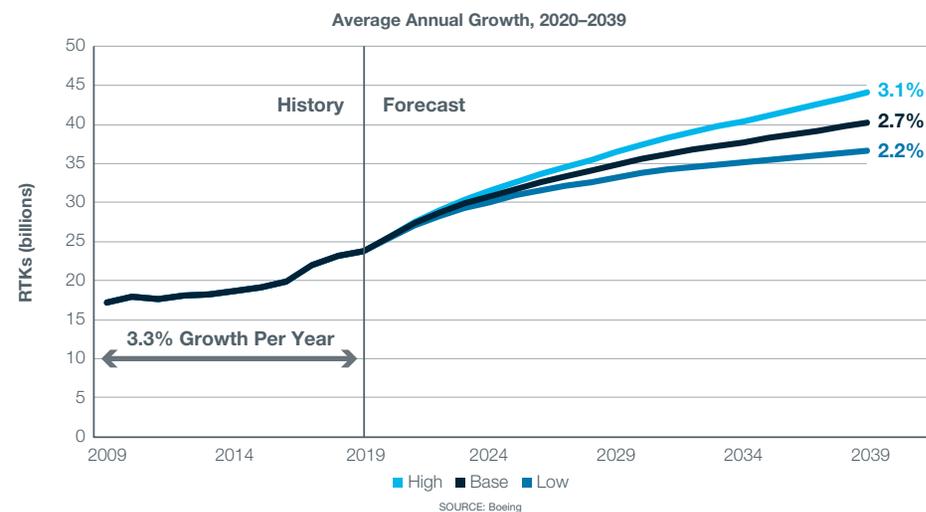
in 2017, with positive but lessening growth continuing through 2019. Industrial production is forecast to shrink substantially in 2020, although not quite as severely as during the 2009 Global Financial Crisis, and then to rebound in 2021, recovering over the next five years and returning to stable growth beyond that. U.S. retail, a proxy for e-commerce, has seen relatively stable growth over the past few years but is also expected to drop sharply in 2020, with declines similar to those of the 2009 Global Financial Crisis. Retail will recover over a time frame similar to industrial production, experiencing stable growth levels between 2030 and 2039. While 2020 e-commerce will not fully mitigate the losses in overall U.S. retail resulting from brick-and-mortar store sales declines, it is expected that e-commerce will mitigate near-term declines in air cargo, contributing to positive growth for the North America air cargo market in the near term.

North America forecast

Air cargo traffic in North America is expected to average 3.8% growth over the next 10 years and 2.6% growth over the full 20-year period, reflecting the continued rise of e-commerce.

The U.S. domestic market will maintain the dominant share of the total North America market, with about 96% of total RTKs. The U.S. domestic market is projected to grow at an average annual rate of 3.9% during the first 10 years as e-commerce market share grows and providers continue to build networks and fleets, with growth leveling out in the second 10 years, for 20-year growth of 2.7% over the period from 2020 to 2039.

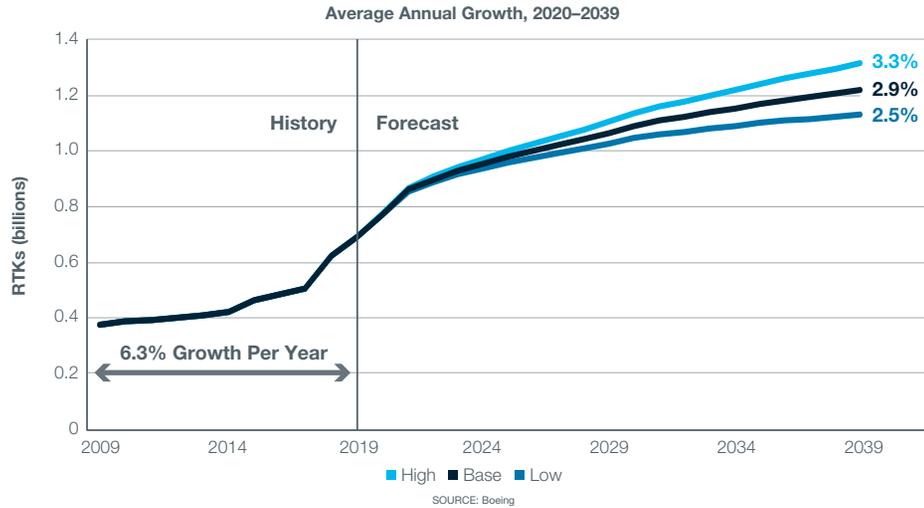
U.S. Domestic Air Cargo Traffic Will Grow 2.7% Per Year



The Canada domestic market is similarly forecast to grow at a higher rate in the first 10 years because of e-commerce and then level out to a lower long-term growth rate for the

second 10 years. The Canada domestic market will average 4.4% growth for the first 10 years and 2.9% over the 20-year period from 2020 to 2039.

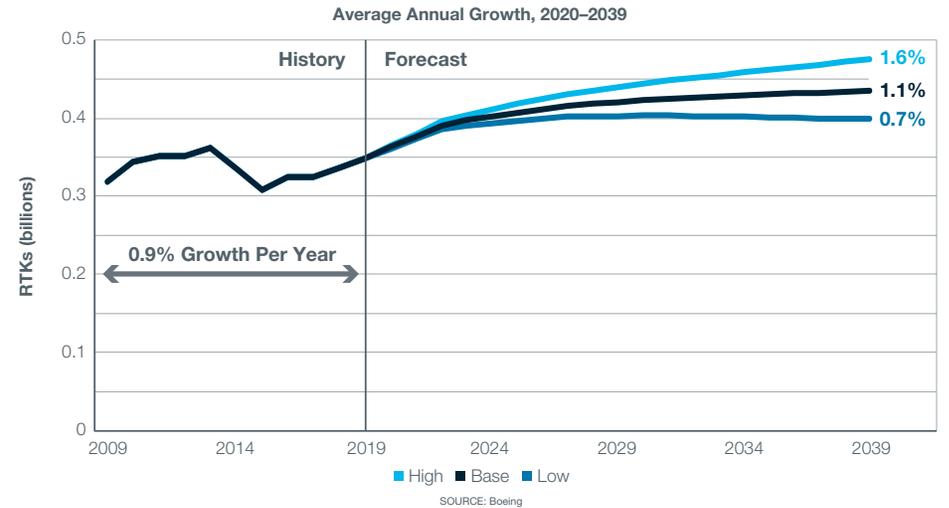
Canada Domestic Air Cargo Traffic Will Grow 2.9% Per Year



Transborder air cargo traffic is expected to grow at 1.1% over the 20-year period, which is slightly higher than its growth over the past 10 years (0.9%). This forecast is expected

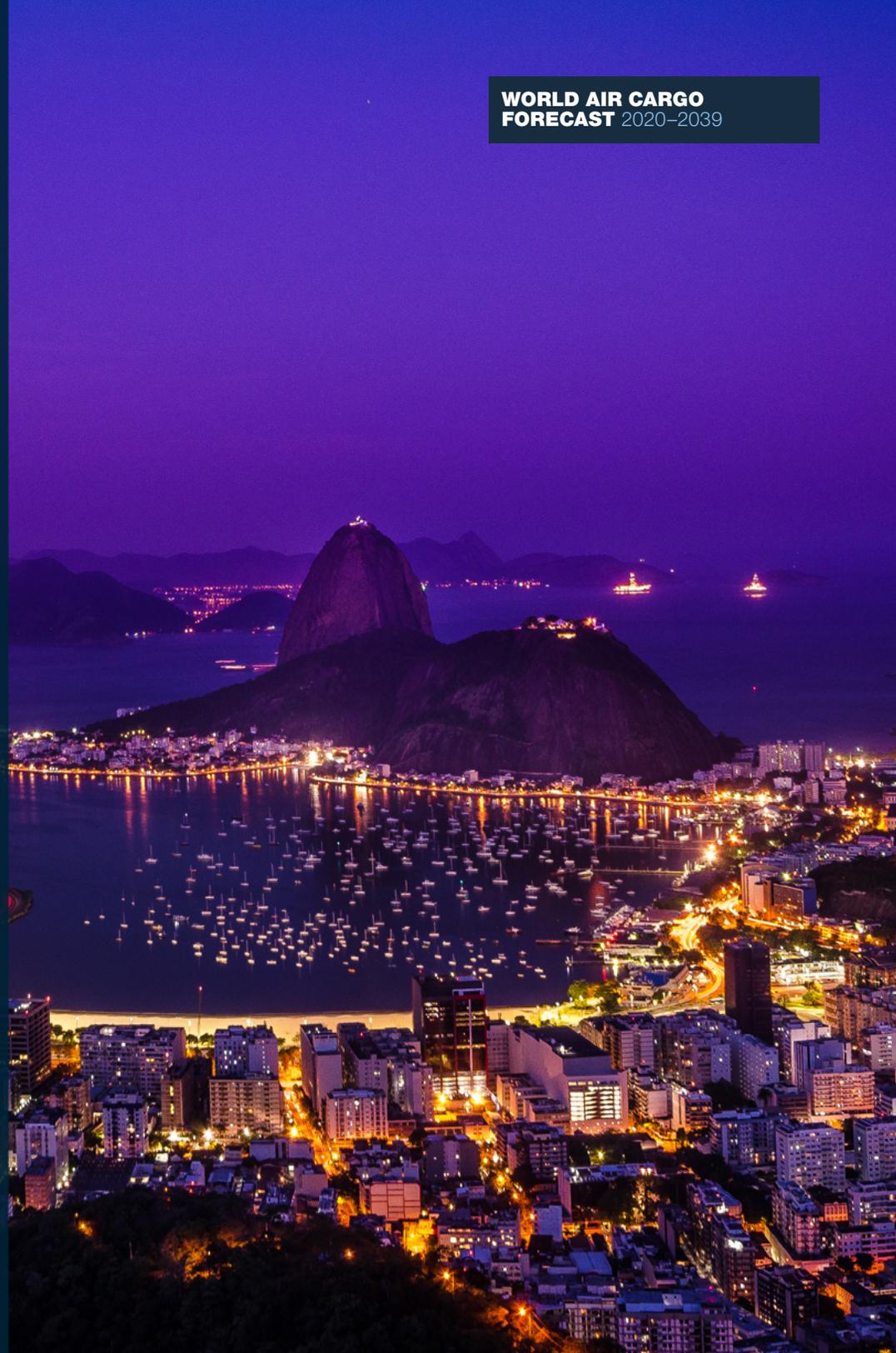
to be more in line with transborder traffic trends over the past 20 years. Northbound traffic is still expected to exceed southbound traffic.

U.S.–Canada Transborder Air Cargo Traffic Will Grow 1.1% Per Year



LATIN AMERICA AND NORTH AMERICA REGIONAL FORECAST

For the purposes of this forecast, we define Latin America as South America; Central America, including Mexico; and the Caribbean Basin. We define North America as Canada and the United States. Puerto Rico and the U.S. Virgin Islands are not included in the United States GDP assumptions.



Air cargo shrank 3.6% in 2019

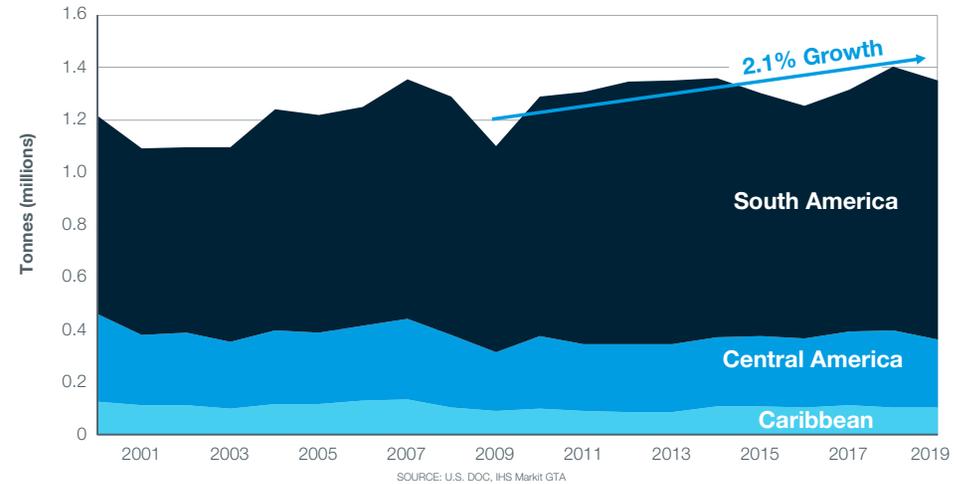
The Latin America–North America market, which represents 2.2% of the world’s air cargo traffic measured in tonnes-kilometers and 2.5% measured in tonnes, shrank 3.6% in 2019, following two years of gains. From 2015 to 2019, the market grew an average of 0.2% annually.

In recent years, changes to the overall Latin America–North America market have been driven primarily by improvement in the northbound market, as the southbound market has remained volatile yet relatively flat overall. Air cargo traffic from North America to Latin America grew by 7.0% in 2017 followed by growth of only 1.0% in 2018 and a decrease of 5.0% in 2019. Air cargo traffic from Latin America to North America grew steadily from 2016 through 2018, but decreased by just a bit in 2019.

The decrease in the southbound market in 2016 was led by sharp drops in Latin America imports, particularly

in Brazil, Colombia, Venezuela and Mexico. However, in part because of the end of recessions in Brazil, Argentina and Ecuador in 2017, the southbound market recovered slowly that year while the northbound market has grown more rapidly. Other contributing factors are higher commodity prices, improvements in the labor market, inflation control and the benefits of global growth. This should help lead to continued moderate medium- and long-term growth. However, there still remain some pockets of uncertainty with respect to the long-term sustainability of economic reforms.

Latin America–North America Market Driven by South America Trade



Latin America–U.S. air cargo market

The United States is Latin America’s major North America trading partner, accounting for 90% of bilateral airborne cargo traffic.

Monthly Latin America–U.S. trade, therefore, serves as a good approximation of month-to-month activity in the overall Latin America–North America air cargo market.

For the purposes of analyzing air traffic growth rates, Latin America is divided into three subregions: South America, Central America and the Caribbean Basin. During 2019, South America accounted for 73% of the total 1.4 million-tonne Latin America–North America air cargo market. Central America accounted for 19% and the Caribbean Basin accounted for 8%. Although traffic between the different subregions fluctuates at different rates, the Latin America–North America market generally moves in the same direction as South America, as it represents the large majority of the market.

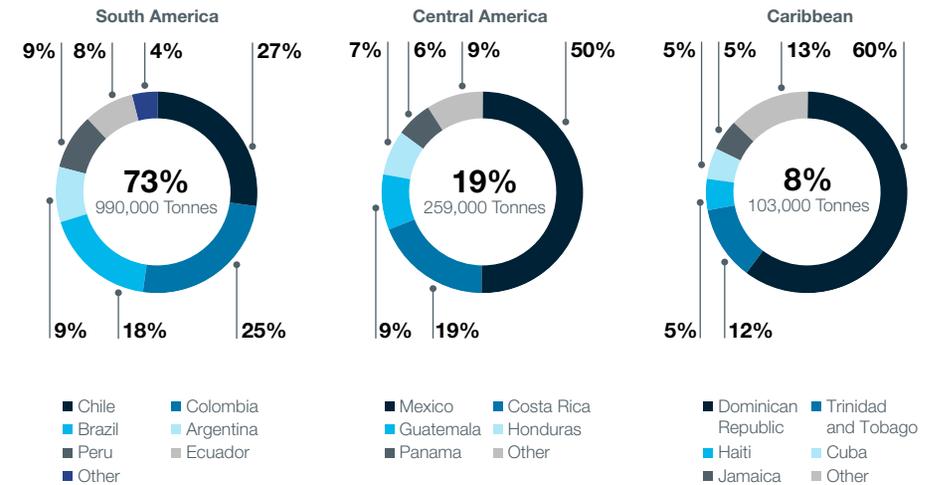
South America–North America air trade declined 1.6% in 2019, in part because of a global slowdown in manufacturing, in particular within the auto sector, as well as slowed economic growth in Brazil, Chile and Ecuador. Yet this contraction is notably less than that observed in the global traffic figures. The factors affecting the South America economy were most evident in imports, which declined

3.2% in 2019 after growing 2.6% in 2018. Chile maintains the largest share of South America trade, while Brazil’s share fell in 2019, but remains the third largest. The majority of Chile’s and Colombia’s air trade consists of goods going to North America. The majority of Brazil’s air trade consists of goods coming from North America.

Central America–North America air trade declined 11% in 2019, by far the most severe traffic contraction of the subregions. Trade between Mexico and North America accounted for 50% of the Central America market in 2019, down from 54% in 2018. Both air imports and exports to and from Mexico saw significant decline year over year, driven by a contracting Mexico economy and slowdowns in the manufacturing sector. Costa Rica, Central America’s next largest trade partner, saw an increase to 19% of cargo traffic in 2019, up 3 percentage points.

Caribbean–North America air trade declined less than 1.0% in 2019 following a larger 6.8% decline in 2018. Decline in imports and exports with the Dominican Republic, which has 60% of the market share, have contributed to the recent contraction of the market.

South America Makes Up Nearly 75% of Traffic With North America



SOURCE: U.S. DOC, IHS Markit GTA

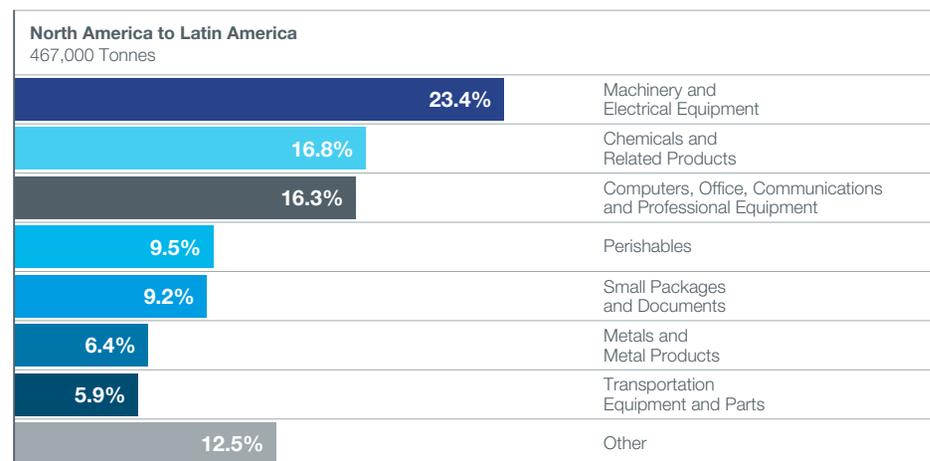
Air trade commodities

Commodities data from 2019 show similar cargo flows from previous years.

Northbound movement of goods from Latin America were primarily made up of perishables. Fresh-cut flowers and seafood each accounted for 26% of exports, while fruits and vegetables accounted for another 14%.

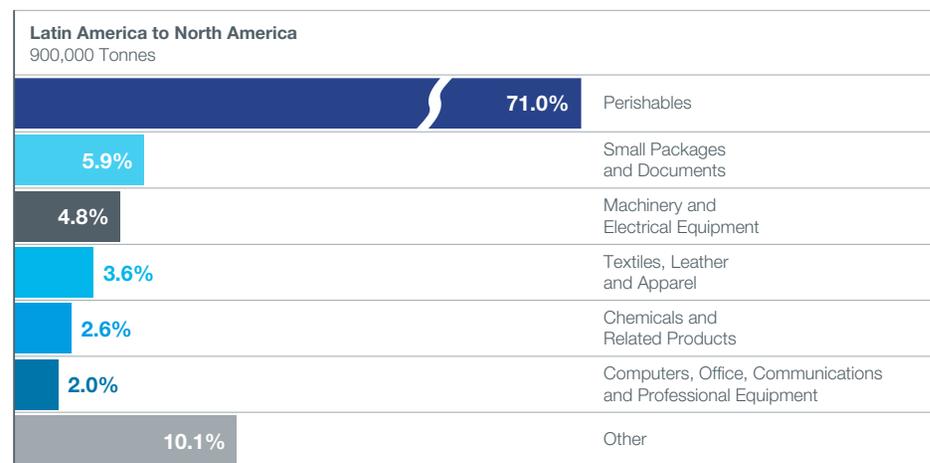
Flows coming from North America to Latin America consisted of higher-value manufactured goods, such as industrial and specialized machinery, computers, telephones, transportation goods and chemicals.

Industrial Goods Drive North America-to-Latin America Trade



SOURCE: IHS Markit GTA

Perishables Drive Latin America-to-North America Trade



SOURCE: IHS Markit GTA

Latin America–North America forecast

The total Latin America–North America market for air cargo services is forecast to grow 2.6% per year from 2019 to 2039.

Both North America and Latin America have dealt with the recession created by COVID-19 and, while it seems to be recovering slightly in the third and fourth quarters of 2020, the cargo market will drop for the year. These two regions specifically were hit later in the pandemic than other areas (such as Asia or Europe), and both depend heavily on manufacturing and production, which was put on hold. In the years following, we are projecting a quick market recovery, then steady growth at the forecast rate.

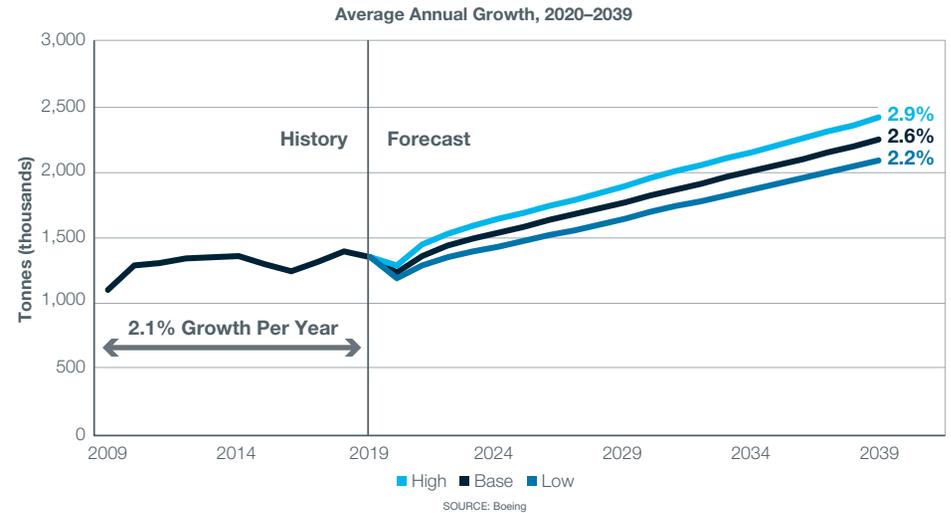
Prior to the pandemic, the combined effects of overall global growth and partial recovery of commodity prices have helped support the Latin America countries that rely on commodities exports. More importantly, many countries in Latin America have also made efforts to improve economic management by implementing policies to help stabilize exchange rates, reduce fiscal deficits and control inflation. In many countries, there have been signs of improved labor markets, which have increased private consumption. Also, Mexico, Central America and parts of the Caribbean have benefited from stronger U.S. growth, via trade and increases in remittances. With the signing of the United States-Mexico-Canada Agreement (USMCA), trade risks have decreased for the long term. However,

the agreement has made trade more difficult. For instance, in the automotive industry, tariffs are levied if 40%–75% (increases over time) of the vehicle isn't made of materials and labor in the United States. This will make it more difficult for original equipment manufacturers to have supplied parts, which could be flown across the borders, built in Mexico.

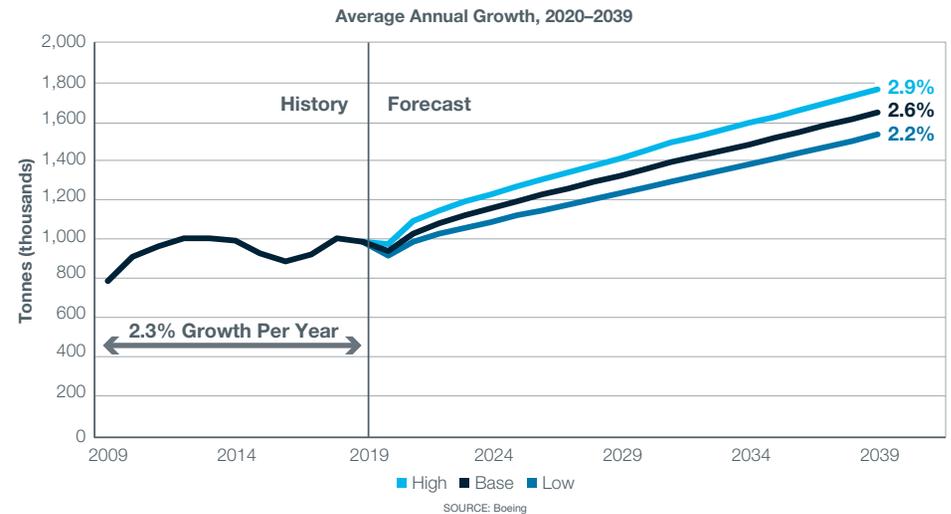
Over the next 20 years, South America GDP is forecast to grow 2.2% per year, while Central America and the Caribbean Basin are forecast to grow 2.1% and 2.6% per year, respectively, through 2039. This is a decrease of about 0.8% annually in each region relative to the previous World Air Cargo Forecast. North America GDP is forecast to grow at an average annual rate of 1.9% over the next 20 years. These numbers, along with variables such as retail, industrial production and foreign exchange, affect the forecast growth in the region. For the Latin America–North America air trade market, this is expected to result in 2.9% growth per year from Latin America to North America, while air trade from North America to Latin America will grow 1.9%.

The South America–North America air trade market is forecast to grow 2.6% per year over the next 20 years. Traffic

Latin America–North America Air Cargo Traffic Will Grow 2.6% Per Year



South America–North America Air Cargo Traffic Will Grow 2.6% Per Year



from South America to North America will grow 2.9% per year, while growth for traffic from North America to South America is projected at 1.9%. This takes into account the generally positive outlooks in the South America economy, while considering its potential risks. The South America-to-North America market will continue moderate growth given the lowered pace of GDP growth in both regions — although 2020 is expected to be a year of decreased trade as a result of the pandemic.

In Central America, the results of the USMCA deal have led to slightly lower projections than in previous years, resulting in an air trade forecast of 2.9% growth per year over the next 20 years. Most at risk, traffic from Central America to North America will grow at a rate of 3.3% per year. Because a large percentage of the commodities traded to Mexico includes production-related items (machinery, chemicals, etc.), this trade deal will also affect this

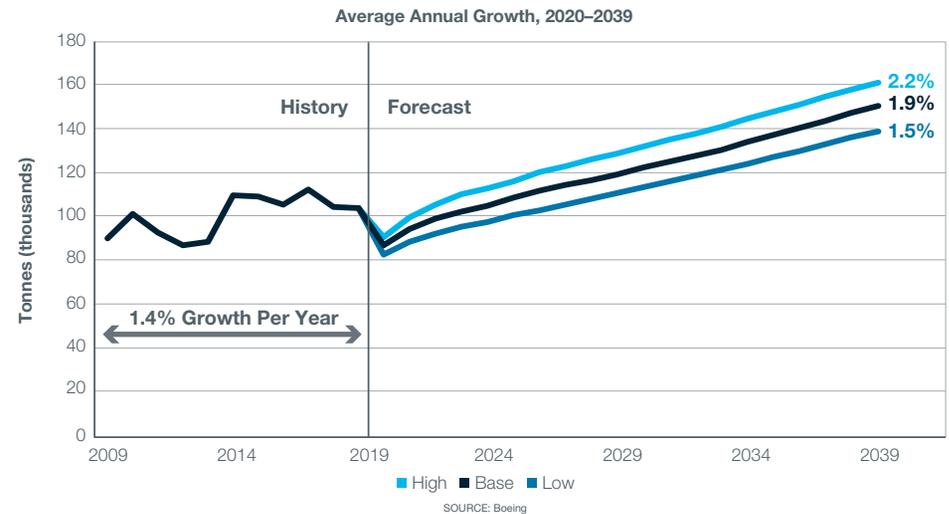
direction, which drops to a growth of 2.2% over the next 20 years. These uncertainties, along with potential changes in U.S. immigration policies, are affecting business sentiment and investments, but overall, Central America's outlook still remains positive given the benefit the economy experiences as a result of growth in the United States.

The Caribbean–North America air trade market is expected to grow 1.9% per year during the next 20 years. Northbound traffic will grow 2.0% per year, while the opposite direction, North America to Caribbean, will grow at about 1.7%. A slight increase to the growth projections for traffic from the Caribbean to North America is attributable to strong growth over the past five years, in particular because of recent sustained growth in the Dominican Republic, buoyed by targeted government efforts on exports.

Central America–North America Air Cargo Traffic Will Grow 2.9% Per Year



Caribbean–North America Air Cargo Traffic Will Grow 1.9% Per Year



LATIN AMERICA AND EUROPE REGIONAL FORECAST

For the purposes of this forecast, we define Latin America as South America; Central America, including Mexico; and the Caribbean Basin. We define Europe as all 27 member countries of the European Union plus Albania, Gibraltar, Iceland, Norway, Switzerland, Turkey, the United Kingdom and other countries comprising the former Yugoslavia.



Latin America–Europe market growth shows continued signs of improvement

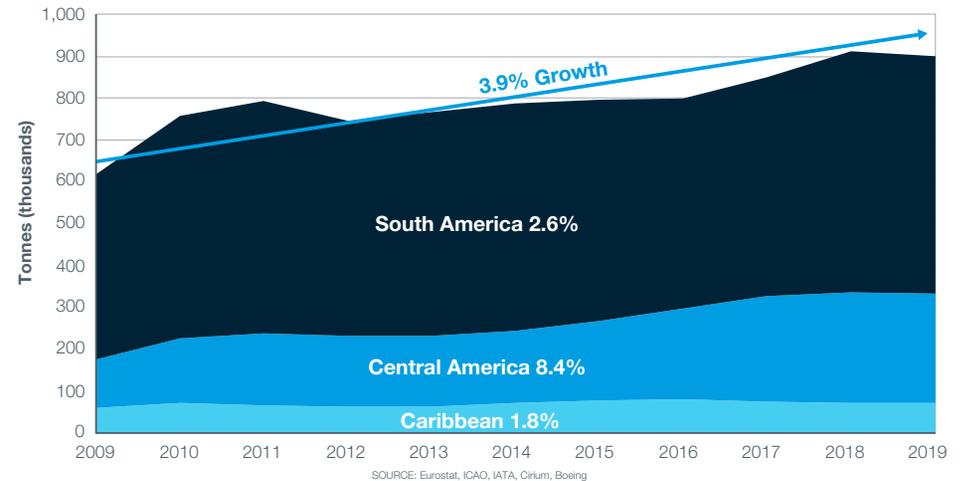
In the Latin America–Europe market, which represents approximately 3.1% of world air cargo traffic in terms of tonne-kilometers and 1.7% in trade tonnage, air cargo grew 7.2% in 2018, but contracted 1.2% in 2019.

Even with a slow economic recovery, Latin America air trade continues to show a historic positive 10-year growth trajectory, up to 3.9% from 3.0% in the previous period study. Two important factors in this significant increase are the continued recovery of Brazil's economy and increased trade between Mexico and Europe. Brazil accounted for 32% and Mexico for 25% of Latin America–Europe air trade in 2019. Air trade growth in Central America, one of three Latin America subregions, remains strong with a 10-year growth rate through 2019 of 8.4%. Air trade in the Caribbean subregion grew modestly at 1.8% per year for the 10-year period through 2019, while the

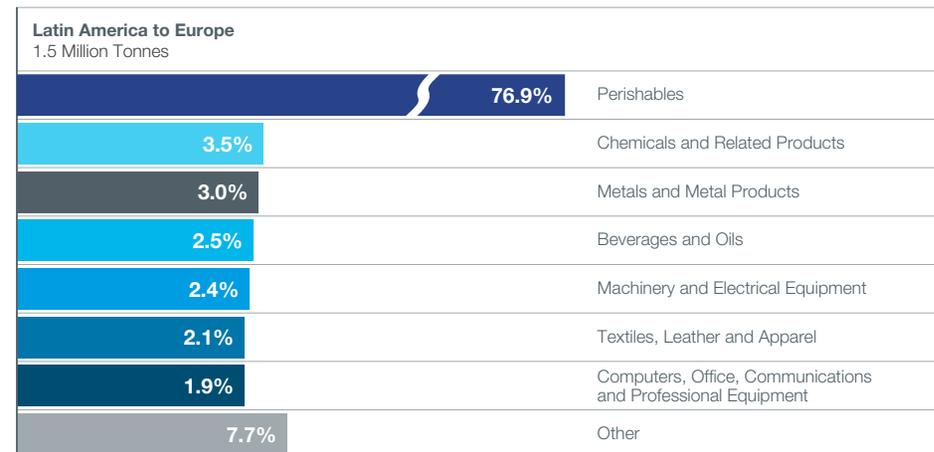
growth rate over the same period for Latin America's largest subregion, South America, was 2.6%.

In 2019, 77% of imports shipped by air to Europe from Latin America were perishable products. South America accounted for 91% of those imports, of which 84% were fruits, vegetables, seafood and flowers. In the opposite direction, commodities traded are more diverse, consisting of finished goods, machinery and equipment, perishables and pharmaceuticals, among others. The European Union remains an important trading partner for Latin America, second only to the United States.

Latin America–Europe Traffic Grew 3.9% Per Year Since 2009



Perishables Make Up the Majority of Trade From Latin America to Europe



SOURCE: IHS Markit GTA

Europe-to-Latin America Trade Is Spread Across a Wide Variety of Goods



SOURCE: IHS Markit GTA

Latin America–Europe air trade

Of the more than 902,000 tonnes of air cargo transported between Latin America and Europe in 2019, South America accounted for over 63% of the market, followed by Central America at 29% and the Caribbean with the remaining 8%.

Brazil and Mexico remain the overall largest air cargo trade countries at 32% and 25%, respectively.

After a brief period of decline in 2015 and 2016, South America–Europe air trade grew in 2017 and 2018 while contracting less than the global market in 2019. Brazil's economic recovery has allowed the country to maintain its majority share of that market, with 51% of South America air trade originating or ending there. Colombia remained the second-largest trading country at 12%. Argentina's air trade share increased

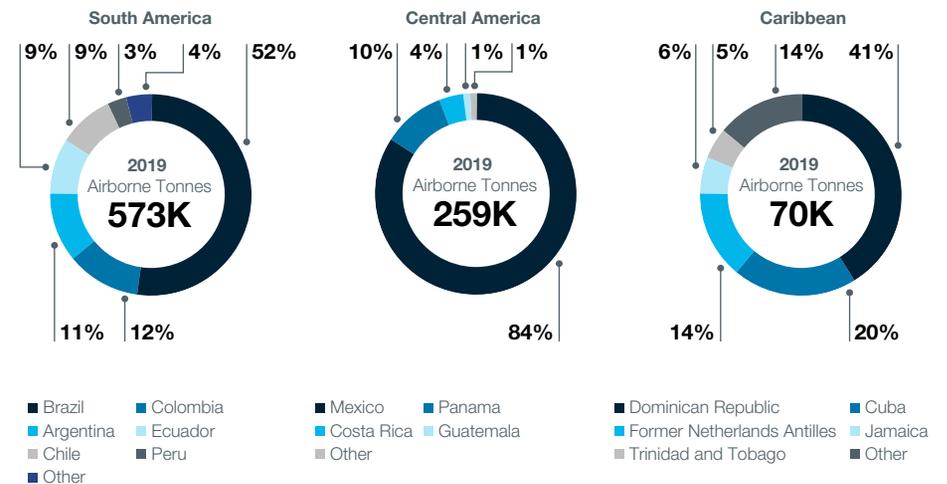
slightly over last reporting period from 10.0% to 10.9% while Ecuador and Chile remained relatively flat.

Central America air trade contracted less than 1% in 2019, supporting the strong growth seen over the last 10 years. Mexico continues to be a major trading partner with Europe, which is reflected in its 84% share of the market. Panama increased its share of the Central America market by 3.0% in 2019, while Costa Rica and Panama remained mostly stagnant in line with 2017 growth rates.

On a year-over-year basis, Air trade between the Caribbean and Europe has remained volatile, with the last three years contracting, while the 10-year growth through 2019 remains low. The Dominican Republic, Cuba, the former Netherlands Antilles and Jamaica account for 82% of subregion traffic with Europe. While this market is not expected to grow significantly in the next few years, it is likely that the rate will remain positive.

Directional traffic from Latin America to Europe grew 3.5% over the last 10 years to 2019. The larger Europe-to-Latin America flow grew 4.1% over the same period. However, in a more recent five-year history, Latin America to Europe has outpaced the opposite flow. As Brazil's economy continues its slow recovery and trade with Mexico grows, Europe-to-Latin America trade is expected to recover as well.

Air Cargo Between Europe and a Dominant Country Drives Subregion Trade



SOURCE: Eurostat, Boeing

Latin America–Europe economic outlook

Latin America economies, measured in GDP, declined in 2019.

Central America and the Caribbean have shown overall positive economies since 2010 year over year.

Economies in the region are forecast to grow 2.2% per year between 2020 and 2039. Continued growth in the middle class (which increased from 21% of the population in 2001 to 35% in 2015) and improved political stability will drive sustained economic growth in Latin America.

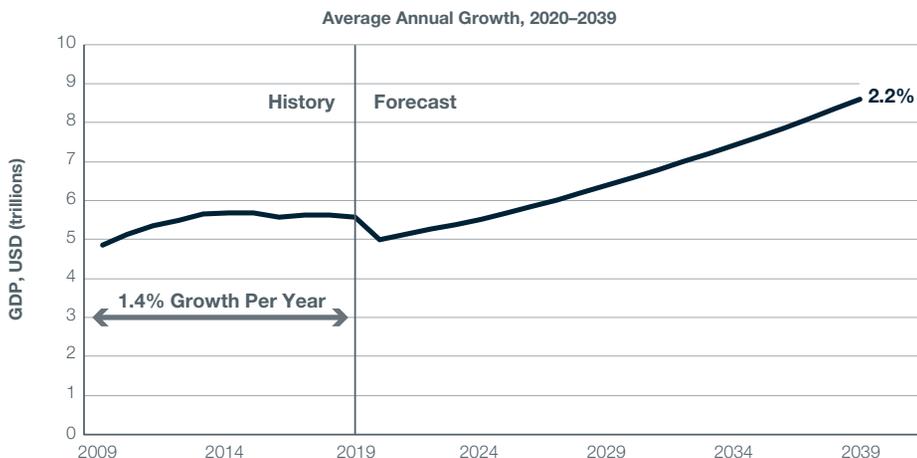
As Brazil continues its economic recovery, it will account for 51% of South America's total GDP by 2039 and Argentina will represent 15%. The overall South America economy is expected to grow 2.2% annually

over the forecast period. The Central America economy is expected to grow at an average rate of 2.1% per year during the 20-year forecast period, while the Caribbean economy, led by Cuba, is projected to grow at a rate of 2.2% over the same period.

While modest economic growth will continue, it is important to note that the share of Latin America trade (world exports) has stagnated since 1970. This inhibits better gains in economic growth over the forecast period.

Europe's economy is forecast to grow at an average annual rate of 1.3%, reflecting modest-yet-consistent growth in the region.

Latin America's Economy Is Expected to Grow 2.2% Per Year



SOURCE: IHS Markit GTA

Latin America–Europe forecast

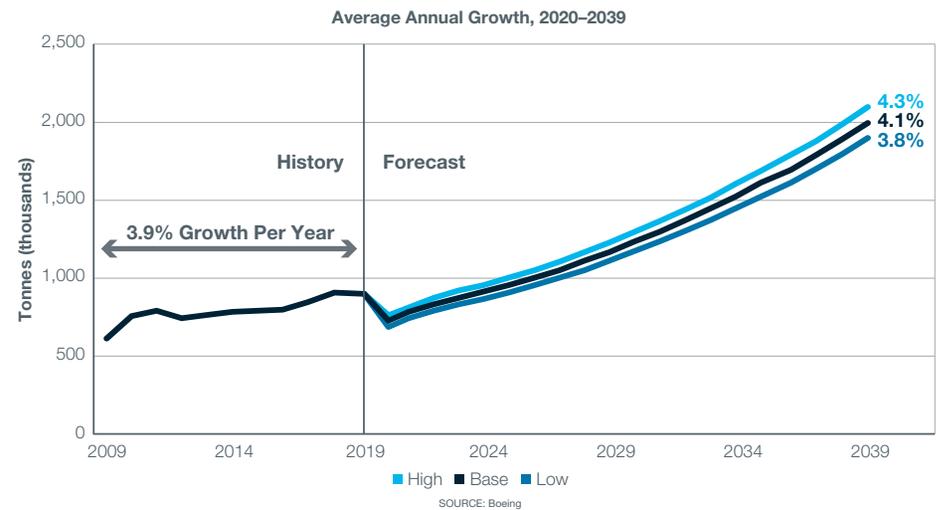
Latin America and Europe continue to work toward maintaining increased trade liberalization.

Relations between Latin America and Europe have been maintained through regular summit meetings between heads of state since 1999. Air trade has seen some benefit from several trade and association agreements put in place over the last few years. Continued success of these agreements could support increased air cargo demand between the two regions.

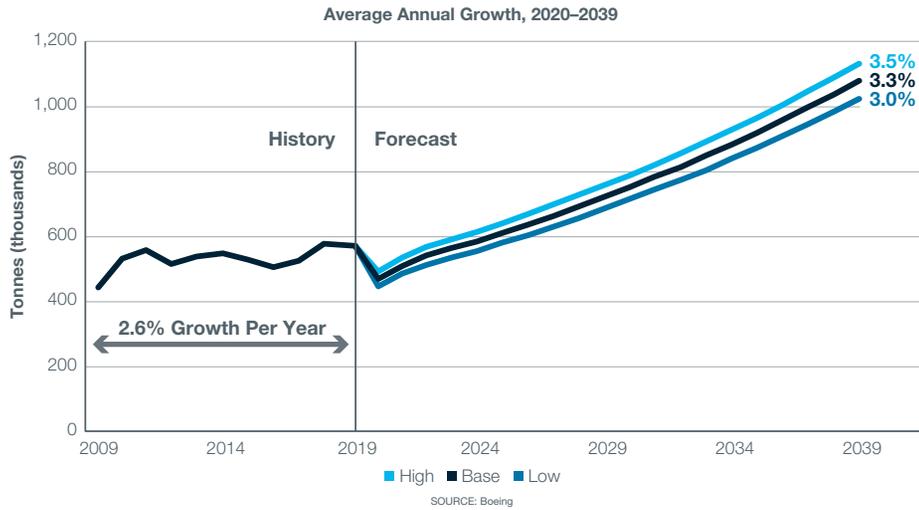
After growing at an annual rate of 3.9% over the past 10 years, the Latin America–Europe air cargo market is projected to grow 4.1% per year over the next 20 years.

The long-term air cargo growth outlook through 2039 is 4.4% in the Europe-to-Latin America direction and 3.6% in the opposite direction.

Latin America–Europe Air Cargo Traffic Will Grow 4.1% Per Year



South America–Europe Air Cargo Traffic Will Grow 3.3% Per Year



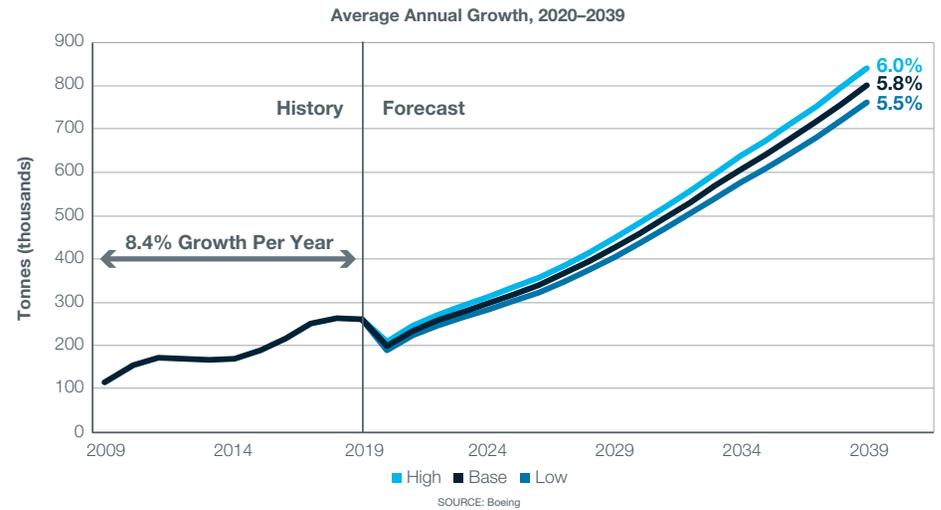
Air trade between South America and Europe is projected to grow an average of 3.3% over the next 20 years. Europe-to-South America air cargo traffic is forecast to grow 3.4% on average, while South America-to-Europe traffic is forecast to grow 3.1%, driven by the economic recovery in Brazil. Additionally, these rates assume that the short- to medium-term ramifications of economic instability in South America will affect air trade but will improve and dissipate over time.

The Central America–Europe market is projected to grow 5.8% on average over the next 20 years. Europe-to-Central America traffic is forecast to grow at a rate of 6.1%, while Central America-to-Europe traffic is forecast to grow 5.1% per year through 2039.

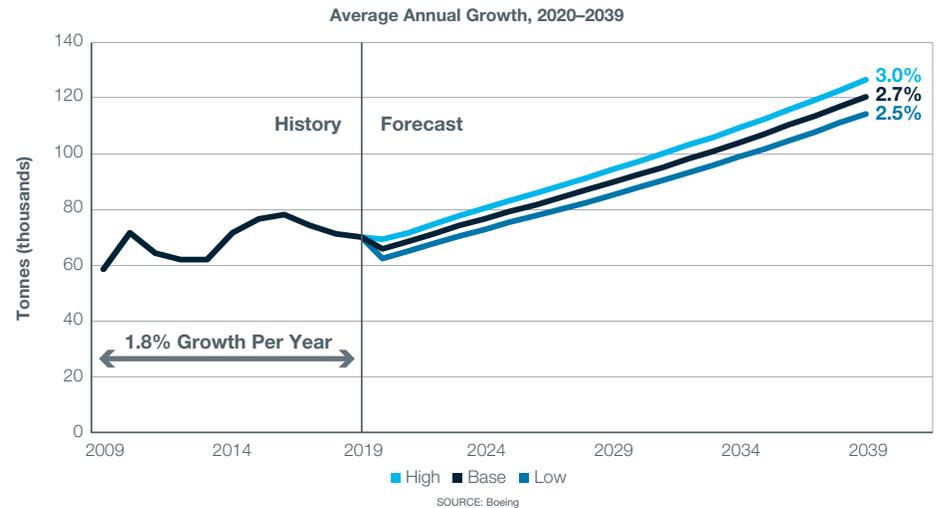
Led by a growing trade relationship between Mexico and the European Union, European manufacturing within Mexico borders is expected to support higher cargo traffic growth.

Levels of air cargo traffic between Europe and the Caribbean are projected to be similar in both directions, with total air trade forecast to grow at 2.7% over the next 20 years. Air cargo traffic from Europe to the Caribbean is forecast to grow at an average annual rate of 2.5%; air cargo traffic from the Caribbean to Europe is forecast to grow 3.0% per year over the forecast period. Air cargo traffic growth rates for the Caribbean subregion will depend on continued political reform and integration.

Central America–Europe Air Cargo Traffic Will Grow 5.8% Per Year



Caribbean–Europe Air Cargo Traffic Will Grow 2.7% Per Year



EUROPE AND NORTH AMERICA REGIONAL FORECAST

For the purposes of this forecast, we define Europe as all 27 member countries of the European Union plus Albania, Gibraltar, Iceland, Norway, Switzerland, Turkey, the United Kingdom and other countries comprising the former Yugoslavia. We define North America as Canada and the United States.



Weak manufacturing curbed Europe–North America air trade in 2019

Air trade between Europe and North America, approximately 6.4% of world air cargo tonnage and 8.5% of tonne-kilometers, grew 7.2% in 2018, only to contract 4.7% in 2019 to 3.4 million tonnes.

After growing 10.4% in 2017, strong monthly year-over-year growth continued during the first half of 2018, but growth began to weaken during third quarter 2018 and throughout 2019, partially resulting from a slowdown in automobile production on both continents. Trans-Atlantic air trade was notably weak during 2019 because of weakness in the commodity groupings of transportation equipment, capital equipment, animal products, beverages and oils, and glass products.

In January and February 2020, the weakness of Europe–North America air trade appeared to be abating. With the onset of the COVID-19 pandemic, however, air trade in this bloc contracted in excess of 25% from March through June 2020, as airlines ceased trans-Atlantic passenger service, industrial activity slowed, and considerable freighter capacity was diverted

to East Asia to transport urgent shipments of personal protective equipment (PPE). Traffic volumes began to improve in June 2020.

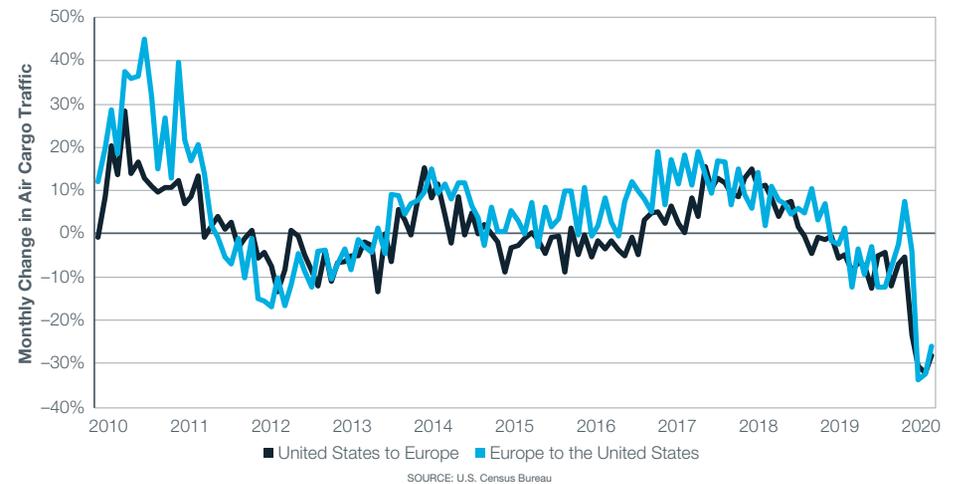
The United States accounted for 90.4% of North American air exports to Europe and 91.4% of the region’s air imports from Europe in 2019; consequently, monthly Europe–U.S. air trade closely approximates the overall transatlantic air cargo market.

Total air cargo tonnage between Europe and the United States grew 7.5% in 2018. The following year saw a 5.4% decrease in total tonnage, the steepest drop since 2013.

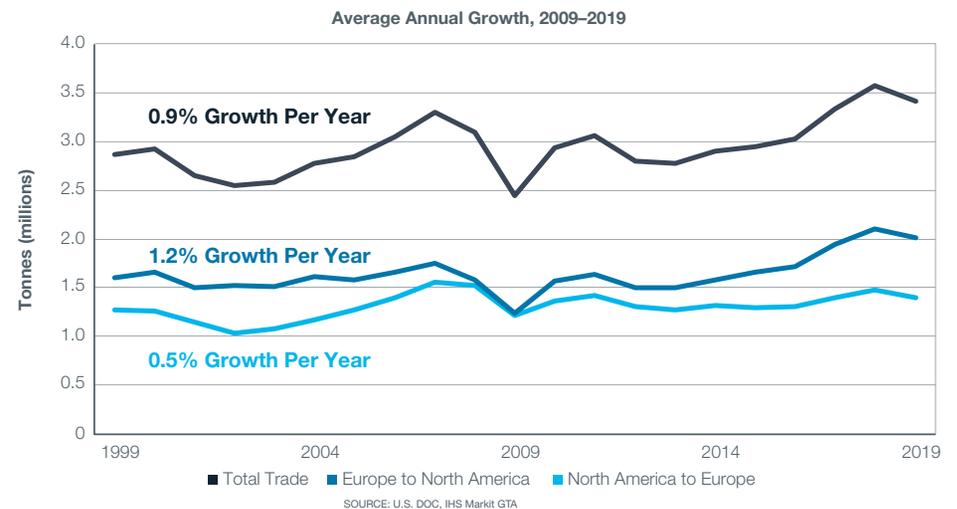
In the U.S.-to-Europe direction, air trade grew 6.7% in 2018, but fell 5.8% in 2019.

In the Europe-to-U.S. direction, annual air trade expanded 8.1% in 2018, but contracted 5.1% in 2019.

Europe–U.S. Air Trade Contracted 17.8% in the First Six Months of 2020



Europe–North America Air Trade Has Grown 0.9% Per Year Since 1999



Total air trade between Canada and Europe grew 4.0% in 2018 and 2.1% in 2019. Canada-to-Europe air trade fell 0.1% in 2018 and 0.5% in 2019. In the Europe-to-Canada direction, air trade expanded 7.5% in 2018 and 4.3% in 2019.

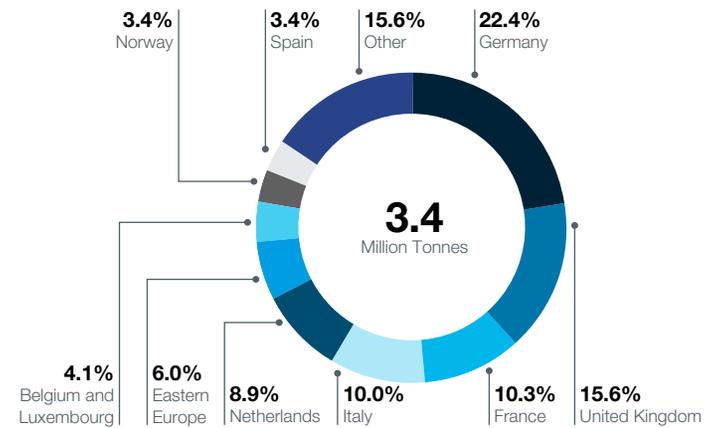
Total air trade between Europe and North America grew 7.2% in 2018 and fell 4.7% in 2019. North America-to-Europe flows grew 6.0% in 2018, but fell 5.3% in 2019. Europe-to-North America flows increased 8.0% in 2018 and dropped 4.3% in 2019.

Since 1980, five European countries — Germany, the United Kingdom, Italy, France and the Netherlands — have comprised nearly 70% of all European

air trade with North America. While trans-Atlantic air trade for these five leading economies has declined slightly to 67% in recent years, trade on the periphery of Europe, particularly with Eastern Europe and Turkey, has gained share in the overall regional air trade bloc.

Outsize cargo, shipment requirements and the unique demands of shippers continue to prove that dedicated freighters are vital to the market, reflected by 43% of trans-Atlantic air cargo still carried on cargo aircraft and despite the increasing frequency of trans-Atlantic passenger flights and the enhanced capabilities of the lower holds of aircraft on these routes.

Five Countries Account for 67% of Europe–North America Air Trade



SOURCE: U.S. DOC, IHS Markit GTA

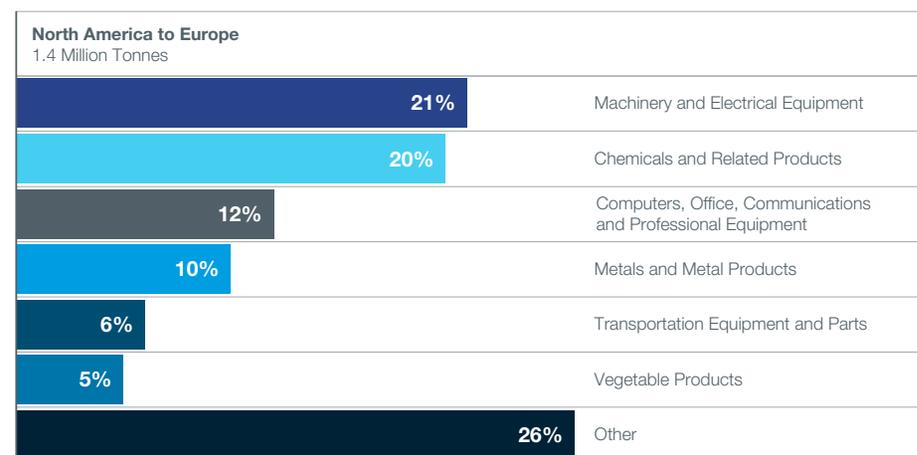
Air trade commodities

Six commodity groups make up approximately 75% of air cargo flows between Europe and North America. Among them, industrial products and manufactured goods, including components and goods in process, are key elements of both eastbound and westbound flows.

Chemicals, capital equipment (machinery and electrical equipment), and computing and telecommunication equipment made up about 53% of all air trade commodities shipped from North America to Europe in 2019. Air commodities in this eastbound direction that are forecast to grow at or faster than predicted trends include chemicals, glass and nonmetallic products, and miscellaneous manufactured products.

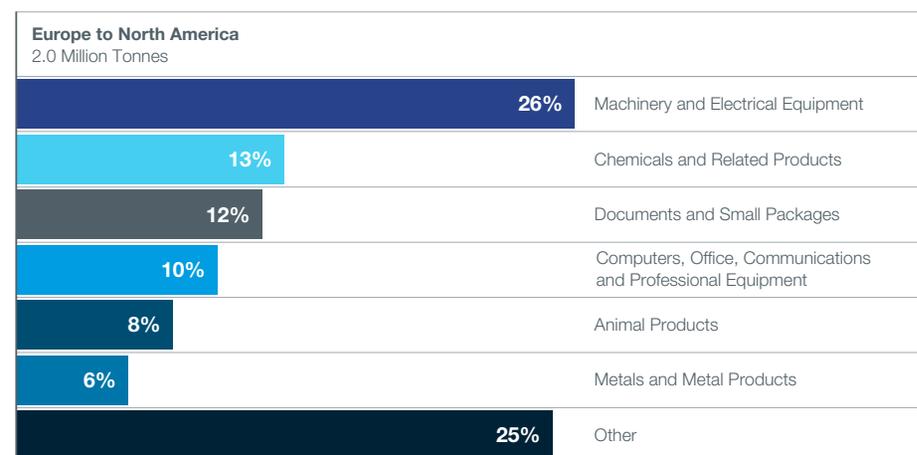
In the Europe-to-North America direction, capital equipment, express shipments and chemicals made up nearly 51% of all air trade volumes in 2019. Air commodities in this westbound lane that are forecast to grow faster than predicted trends include capital equipment, beverages and oils, and chemicals.

Top Three Commodities Account for About 53% of North America-to-Europe Trade



SOURCE: IHS Markit GTA

Top Three Commodities Account for 51% of Europe-to-North America Trade



SOURCE: IHS Markit GTA

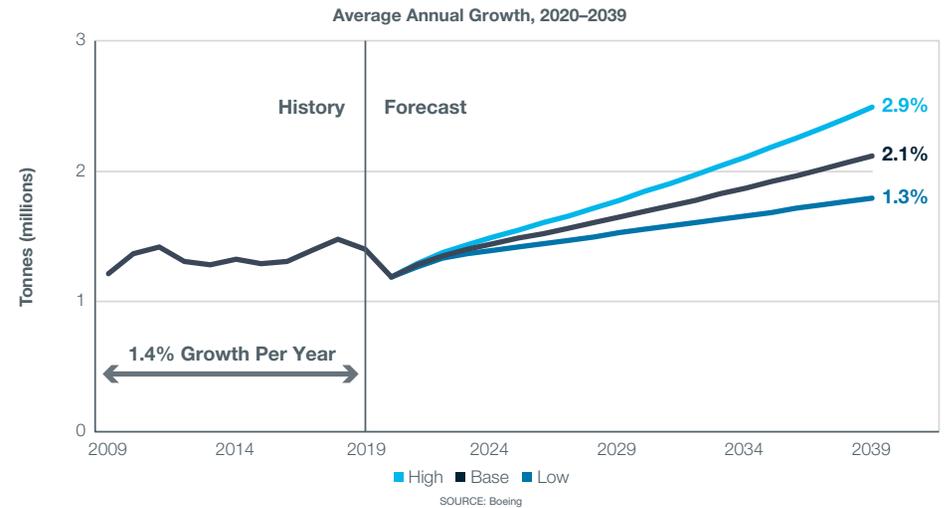
Europe–North America forecast

GDP growth in Europe and North America will continue to be the broadest-based indicator of trade between these regions. The baseline GDP projections for Europe and North America through 2039 anticipate an average annual growth of 1.2% and 1.9%, respectively. Low- and high-growth scenarios are based on projections of 0.5% below and above baseline GDP growth rates.

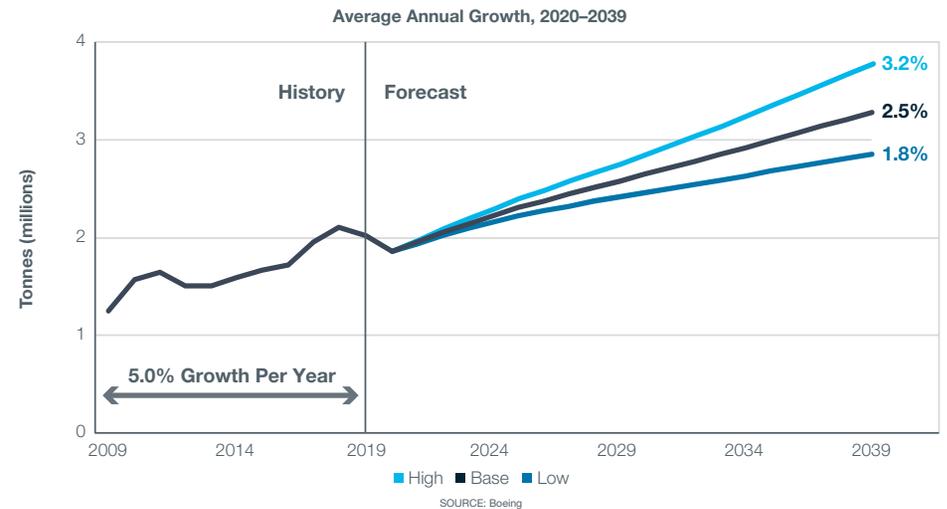
Baseline growth of total air trade in this market in the next 20 years is projected to be 2.3% annually, compared to the 0.9% annual average of the previous two decades. Air trade in the North America-to-Europe direction will average 2.1% growth per year and will grow slightly faster in the Europe-to-North America direction at an average of 2.5% per year.

By way of comparison, according to the IHS Markit Global Trade Atlas, the containership sector between Europe and North America will expand 2.0% annually through 2035. Container trade will average 1.9% growth per year in the North America-to-Europe direction and 2.1% growth per year in the Europe-to-North America direction.

North America-to-Europe Air Trade Will Grow 2.1% Per Year

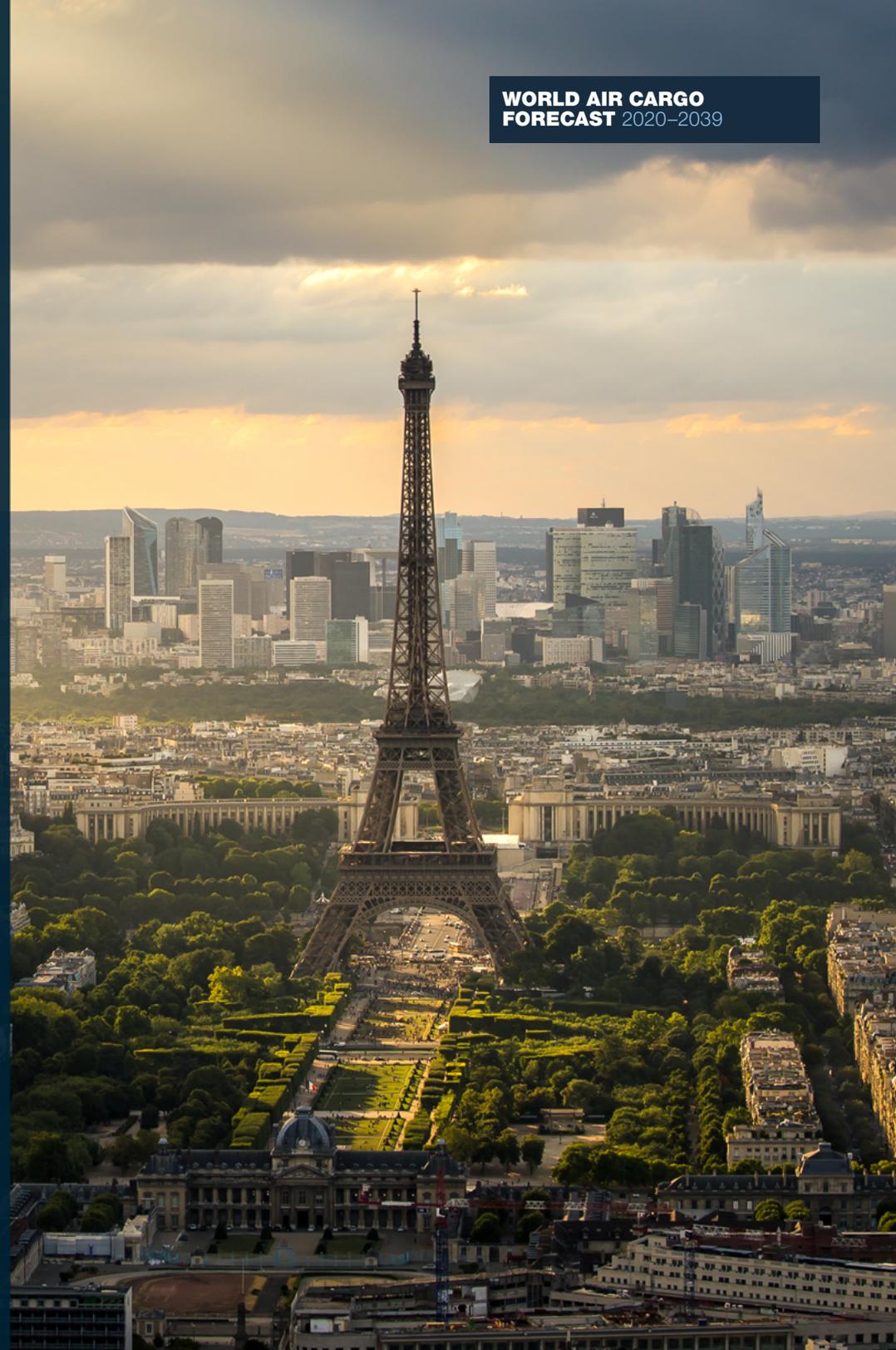


Europe-to-North America Air Trade Will Grow 2.5% Per Year



INTRA-EUROPE REGIONAL FORECAST

For the purposes of this forecast, we define Europe as all 27 member countries of the European Union plus Albania, Gibraltar, Iceland, Norway, Switzerland, Turkey, the United Kingdom and other countries comprising the former Yugoslavia.



Intra-Europe air cargo market has grown despite manufacturing weakness

The intra-Europe air cargo market comprises approximately 4.9% of the world's air cargo tonnage but, because the region is geographically compact, only 1.3% of the world's tonne-kilometers.

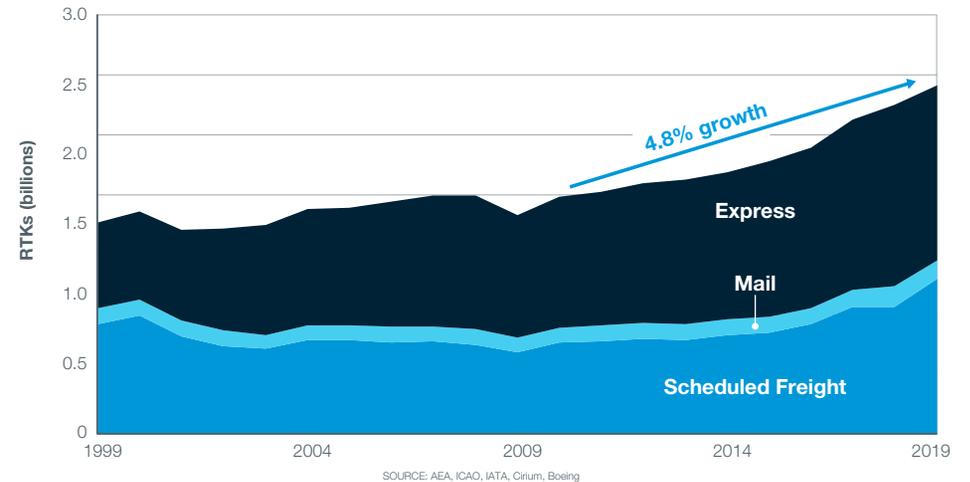
Approximately 68% of all air cargo moving into, within and out of Europe passes through one or more of the Northern European countries Germany, France, the United Kingdom, the Netherlands, Belgium and Luxembourg, decreasing the share from 70% in 2017. The compact geography of air cargo markets within Europe generally limits routes to relatively short hauls, typically between 900 and 1,200 kilometers. It should be noted that this analysis surveys domestic and transborder intra-Europe air cargo traffic, regardless of its true origin or destination.

The intra-Europe air cargo market has expanded above long-term trends since 2014. Growth peaked in 2017, jumping nearly 10% over 2016 levels, only to slow starting mid-year 2018 because of an overall slowdown in

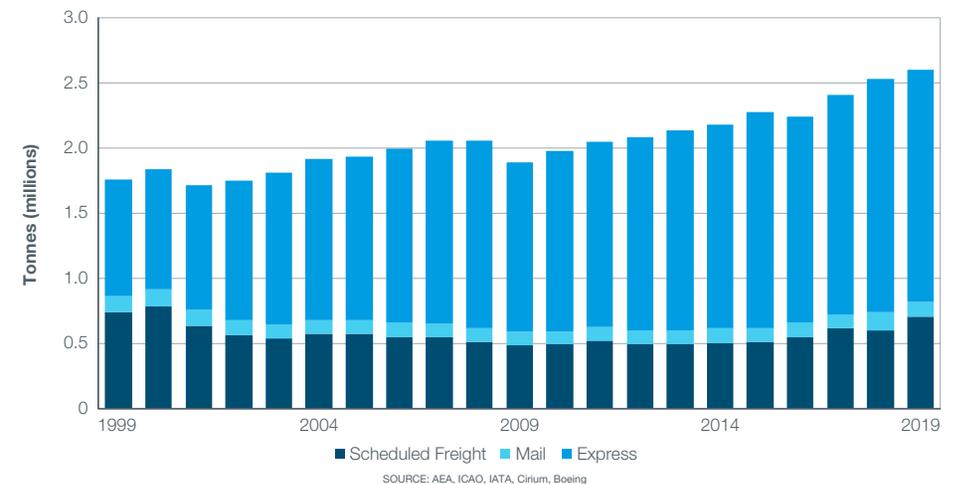
European industrial activity, particularly in the automotive sector. Nevertheless, intra-Europe traffic grew about 5% in 2018 and then slightly faster in 2019 at 6.0%. The scheduled freight sector saw substantial growth in excess of 20% in 2019, largely resulting from the network expansion of a small number of airlines domiciled in Northern and Southeastern Europe. Furthermore, continued growth in the business-to-consumer (B2C) or e-commerce sector has helped to bolster overall intra-Europe traffic in the 2018-2019 time frame.

Intra-Europe air cargo tonnage has also expanded above long-term trends in recent years, reaching 2.6 million tonnes in 2019. The express sector held less than 10% of overall intra-Europe air trade in the late 1980s, but now commands nearly 70% of this market.

The Intra-Europe Air Cargo Market Has Grown 4.8% Per Year Since 2009



Express Traffic Comprises 70% of Intra-Europe Tonnage



Intra-Europe air cargo market

The three primary components of air cargo traffic within Europe — scheduled freight, mail and express — grow at differing rates. Express traffic averaged 3.6% growth per year during the past 20 years. Scheduled freight and mail traffic grew much slower during the same period, at 1.8% and 0.3% per year, respectively.

The intra-Europe air cargo market has expanded at nearly 5% per year since 2009, a marked improvement over the nearly stagnant period of 1999 to 2009. Scheduled freight and mail traffic were stagnant from 2000 to 2015, while the express segment alone accounted for nearly all growth in the intra-Europe air cargo market. Since 2014, however, scheduled freight and mail have recovered, with 9.4% and 2.2% average annual growth, respectively. Much of this growth emanates from the network expansion of a small number of passenger airlines located on the periphery of Europe.

Except during the Global Financial Crisis of 2008 and 2009 and again in 2019, express traffic has grown at a steady pace for the past two decades. While express traffic grew 6.4% in 2017 and 6.7% in 2018, this segment of intra-Europe air cargo traffic is estimated to have contracted 3.5% in 2019, largely resulting from industrial traffic weakness and network consolidation among the major express carriers.

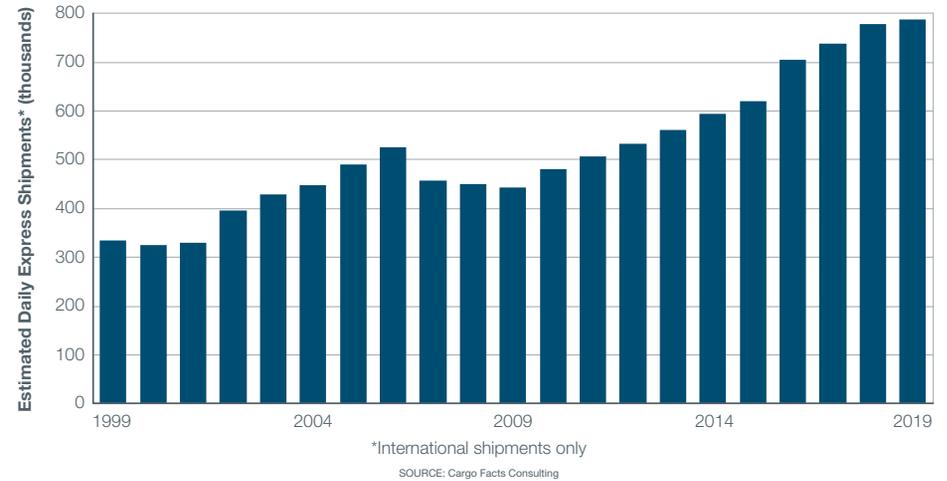
Integrated express carrier traffic has made up more than half of all

intra-Europe air cargo tonnage since 2003, reflecting the declining market share of scheduled freight and mail. It is important to note that express network traffic within Europe includes significant general freight to fill out freighter loads when traffic is light in the small parcels and documents that traditionally make up express cargo.

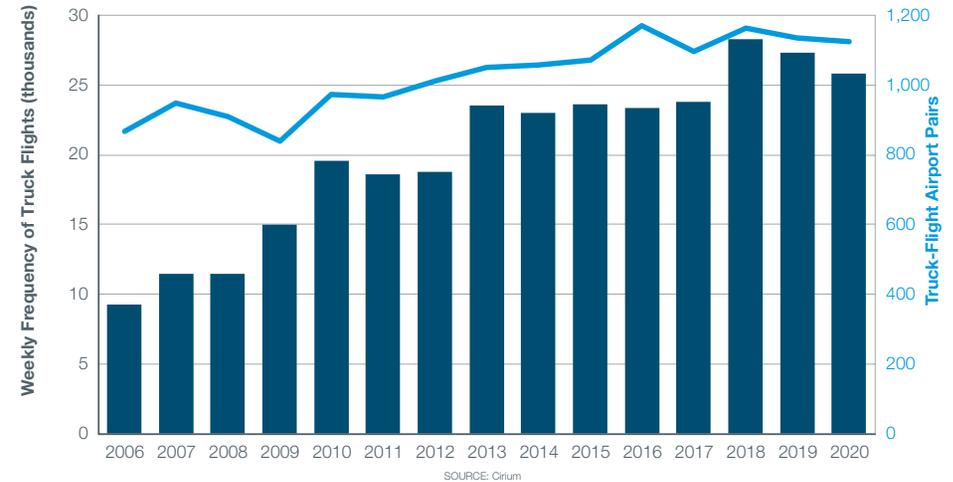
Nearly all air cargo growth since the late 1990s is a result of the expansion of integrated air express carrier services. In addition to geographical ease of surface transport within Europe, the Schengen Agreement of June 1990, which removed customs inspection on goods moving between several countries in Northern Europe (and later within most of the European Union), facilitated intra-Europe truck transport and reduced the need for expedited scheduled air freight service. Consequently, trucking has become the preferred mode of transport for most freight and mail, even for small-parcel express shipments in short-haul markets.

After growing an average of 2.8% per year during the 10 years between

Intra-Europe Air Express Shipments Have More Than Doubled Since 1999



Airline Scheduled Truck-Flight Frequency Fell 5.5% in 2020



1999 and 2009, the estimated number of daily international air express shipments rebounded after the Global Financial Crisis of 2008 and 2009. Daily shipment count growth reaccelerated and has grown at a 6.0%

average annual growth rate per year since 2009. Daily intra-Europe express shipment counts have expanded from 442,600 shipments per day in 2009 to 789,000 shipments per day in 2019.

Trucking and scheduled air freight services

Air cargo has never been solely an airport-to-airport service. Rather, air cargo is a single component of a transportation infrastructure that links the shipper and the consignee. Trucking offers door-to-door and factory-to-distribution center service, which air transport alone cannot provide.

Scheduled airlines that serve the intra-Europe market have used truck flights, trucking services registered with their own flight number, to extend their networks and add scheduling flexibility.

Long-haul truck-flight operations in Europe supplement overall air logistics systems. Their dramatic rise over the past 20 years has clearly contributed to a decline in growth of scheduled air freight. Truck-flight operations provide regularly scheduled freight service for high-value or work-in-progress goods between manufacturing facilities, especially to and from Central and Eastern Europe. Scheduled truck operations are often used where demand is too low or infrequent to warrant dedicated air freight service.

Most of the intra-Europe truck-flight growth has historically occurred in the major hub airports of the carriers,

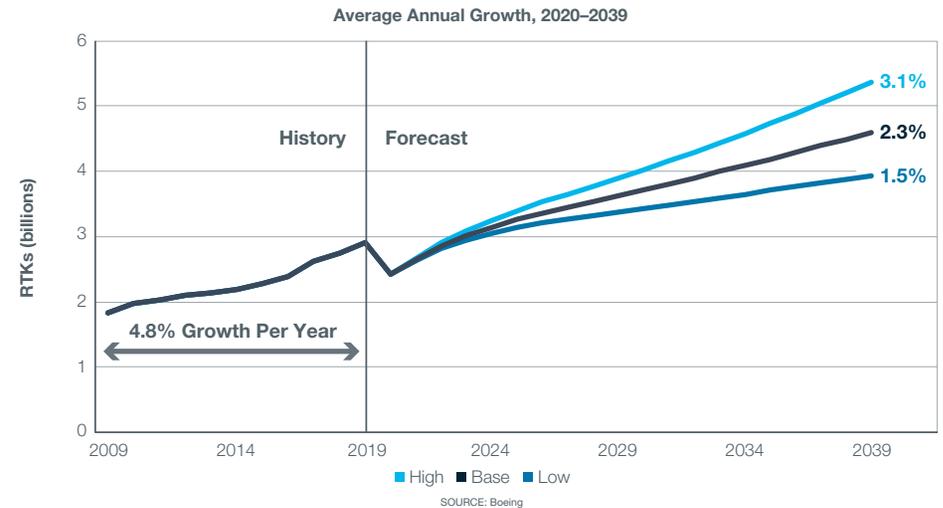
strengthening their air cargo networks. Weekly frequencies of truck flights grew 6.6% on average per year between 2008 and 2018. However, according to the truck-flight schedules published by airlines, airport pairs of truck flights fell 3.6% in 2019 and then fell another 5.5% in 2020. The scheduled truck-flight reductions occurred mostly in the domestic markets of Germany, the United Kingdom, France and Italy, plus a drawdown of certain mainland Europe markets connected to the United Kingdom, possibly because of overall industrial production weakness and uncertainty over Brexit.

Intra-Europe forecast

Led predominantly by express shipments and longer scheduled-freight sectors to Eastern and Southern Europe, intra-Europe air cargo traffic is forecast to expand at an average annual rate of 2.3% per year through 2039. The 20-year forecast growth in air cargo traffic is lower than the 2.5% growth trend recorded during the previous 20-year period from 1999 to 2019.

Economic activity, as measured by GDP, and industrial activity will remain the primary drivers for traffic growth in this market. In the long term, the baseline GDP for Europe will average

Intra-Europe Air Cargo Traffic Will Grow 2.3% Per Year



1.2% growth per year through 2039. GDP projections of 0.5% below and above the baseline were assessed, and the results of these growth rates are reflected in the low- and high-growth scenarios. Intra-Europe air cargo traffic growth is forecast to range between 1.5% and 3.1%.

Inflexible labor markets, an aging population, expensive pension systems and slow economic reforms will limit long-term economic growth, especially in the countries of Northern Europe. Tight fiscal and monetary policies, which may emerge following the downturn induced by COVID-19 in 2020, will continue to curb economic growth and entrepreneurial activity in some European countries, thereby restraining air cargo growth. The effects of the U.K. secession from the European Union in early 2020 are not fully known at this time, but increased trade barriers are generally not conducive to air cargo traffic growth.

On a positive note, the longer trucking times to distant eastern and southern markets may be unacceptable for some shippers, offering air cargo traffic growth prospects for the next two decades.

MIDDLE EAST REGIONAL FORECAST

For the purposes of this forecast, we define the Middle East as Bahrain, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syria, the United Arab Emirates and Yemen.



Air cargo trade growth has stabilized; the region continues to be a key transit point for global cargo flows

Air cargo moving into, within and out of the Middle East accounted for an estimated 11.2% of the world’s tonnage in 2019.

The Middle East continues to be a dynamic region, both for import and export flows as well as transit cargo. It remains an important crossroad for air trade in the Eastern Hemisphere. Geopolitical disruptions, oil price fluctuations and the impact those realities have on economic activity make it uniquely challenging in projecting air cargo growth prospects.

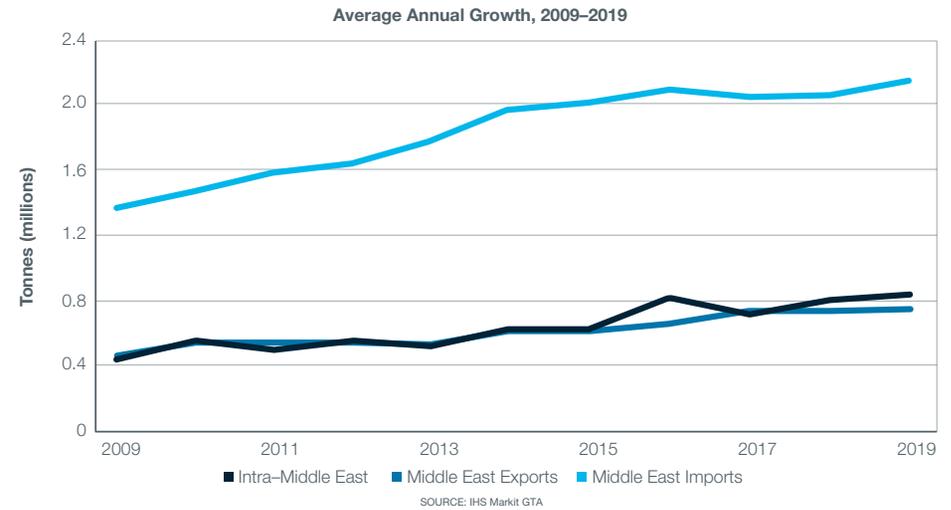
The COVID-19 pandemic has created a temporary but unique situation for air cargo supply and demand. Border closures and almost nonexistent passenger flights in the Middle East significantly reduced the amount of belly cargo capacity aboard the region’s large widebody fleet during the second and third quarters of 2020. Not only has critical demand for protective equipment increased the utilization for carriers with dedicated freighter fleets, but many passenger airplanes also flew with only cargo on board, referred to as “freighters.” Those airlines with

dedicated freighter fleets were able to offset passenger operation losses with high cargo yields and frequencies.

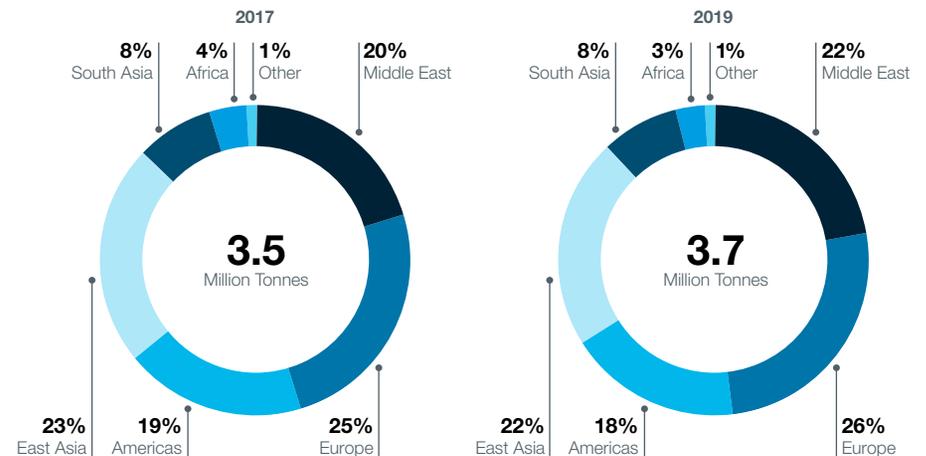
Air cargo trade from, to and within the Middle East grew 3.3% from 2009 to 2019, a reduction of 0.8 percentage points from the prior 10-year growth rate analyzed in 2018. Trade grew from 3.5 million metric tonnes in 2017 to 3.7 million metric tonnes in 2019, a compound annual growth rate of 2.7%.

Oil and natural gas are the major revenue-producing commodities in the Middle East. Market prices for these commodities began to fall in mid-2014, as prices decreased by about 30% off their 2014 highs. By early 2016, oil prices began to rebound. This recovery extended mostly unabated into 2018 but slightly declined in 2019 before the COVID-19 pandemic affected global demand.

Middle East Air Trade Grew 5.0% Per Year



Europe Maintains Its Dominant Trading Partner Position



In mid-2017, the Qatar diplomatic crisis brought on disruption to the region that affected both passenger and air cargo. Although this resulted in the necessity to redirect airplane traffic around the airspace of conflicting countries, impressive air cargo growth continued for Qatar, albeit at a slower rate.

Recent geopolitical and economic moves affecting Iran's economy will significantly affect the growth potential of that market until there is resolution that stabilizes the economy. The overall impact to the Middle East growth will be muted as less than 10% of the region's air cargo tonnage flows through Iran.

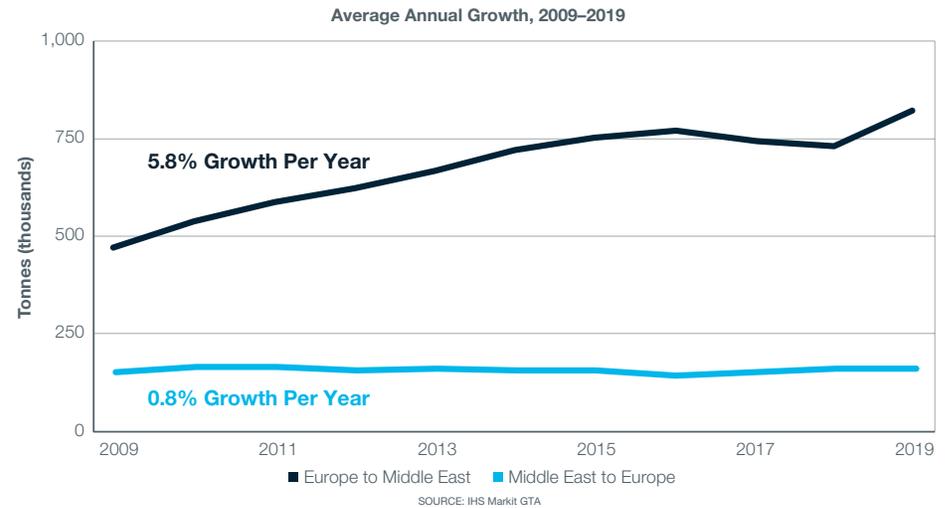
The strategic geographic location of the Middle East makes it well-positioned to continue as a transit point for air cargo moving between Europe, Asia and Africa. Just one-third of the total air cargo tonnage originates or terminates in Middle East countries, with two-thirds of the air cargo transferring through Middle East airports to other regions. This is also reflective of the impressive rise in the past 10 years of the sixth freedom global superconnectors among the top air cargo carriers worldwide.

New infrastructure will continue to reinforce the region's role as an air cargo hub. All three of the largest cargo centers in the region — Dubai and Abu Dhabi in the United Arab Emirates and Doha in Qatar — are expanding their cargo-handling capacity to meet growing air cargo demand. Dubai's Al Maktoum International Airport, also known as Dubai World Central, is in the process of being transformed to be the world's largest cargo hub, with the ability to handle 12 million tonnes of freight. The airport will be home to an integrated operation, combining different transportation modes, logistics, manufacturing and assembly in a single free-trade zone.

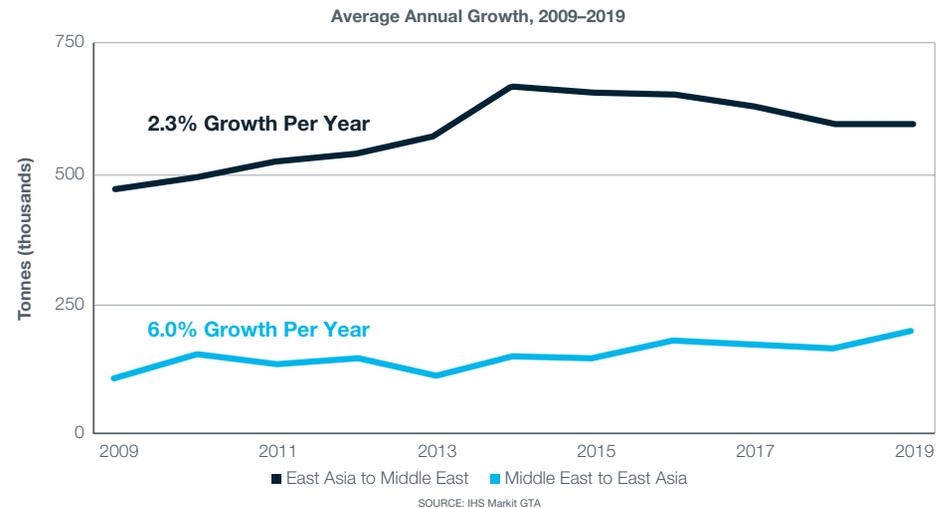
The Middle East region also has a significant sea-air market in which goods from South Asia arrive on ships and continue to other regions by air.

The 777 — with its unmatched lower-hold cargo capability — is a major part of Middle East fleets and networks. Middle East carriers operated 335 777s (passenger and freighters) as of year-end 2019, which has contributed to the notable air cargo growth of the global superconnectors.

Middle East–Europe Air Trade Grew 4.8% Per Year



Middle East–East Asia Air Trade Grew 3.2% Per Year



Middle East–Europe traffic growth

Air cargo traffic between the Middle East and Europe has grown moderately since 2009. Imports from Europe, much larger than exports from the Middle East, have grown 5.8% per year, while exports to Europe have grown 0.8%.

Accounting for 970,000 tonnes of air cargo in 2019, trade with Europe represented 26% of the Middle East's international air cargo market. The primary commodities shipped to Europe are garments and perishables.

Leading commodities shipped from Europe include meats and seafood, agricultural products, chemicals and machinery. Overall air cargo traffic in both directions has averaged 4.8% annual growth since 2009.

Middle East–East Asia traffic growth

In 2019, East Asia traffic accounted for 21% of the air cargo market in the Middle East, at 802,000 tonnes.

Air cargo shipments arriving from the East Asia region consisted predominantly of textiles, machinery and electrical equipment, and computer equipment. Imports from the East Asia region have increased

at a robust annual rate of 2.3% since 2009. The air cargo export flow to the East Asia region is relatively small (one-quarter of total trade with the region) but grew at a strong 6.0% per year over the past decade.

Middle East–Europe forecast

Overall air cargo between the Middle East and Europe will grow at an average annual rate of 2.4% between 2020 and 2039.

Direct flights connecting production centers in Asia and Europe will continue to pose some risk to air cargo traffic growth prospects between the Middle East and Europe. Nevertheless, increasing local exports, coupled with the continued European market

for goods transshipped from Asia and Africa, will keep growth in the Middle East air cargo market healthy. In addition, a growing middle class will act to stimulate modest air cargo growth in the future.

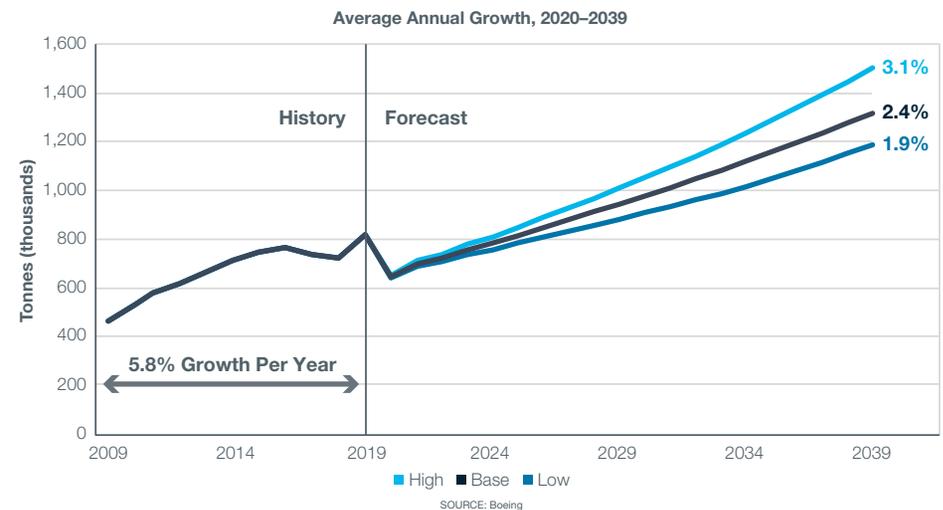
The price of oil will have a significant effect on Middle East demand for products from Europe. The rate and extent of diversification from oil-related industries will affect the long-term growth prospects for air trade to and from the region. In particular, the

competitiveness of local products, including perishables, fish, textiles and the products of emerging light industries, will determine whether the long-term growth trend tends more to the high or low projection.

Middle East-to-Europe Air Trade Will Grow 2.0% Per Year



Europe-to-Middle East Air Trade Will Grow 2.4% Per Year



AFRICA REGIONAL FORECAST

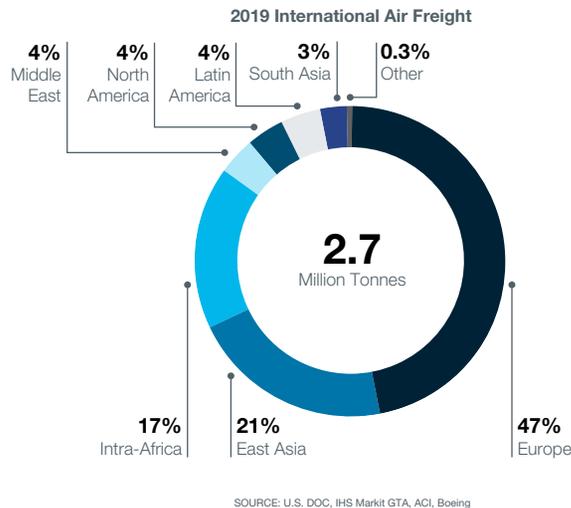
For the purposes of this forecast, we define Africa as the entire continent of Africa plus the nations of Cape Verde, Madagascar, Réunion, the Seychelles, Mayotte, Mauritius, the Comoros Islands, and São Tomé and Príncipe.



Africa air trade patterns changing

The Africa–Europe market accounts for approximately 2.4% of global air cargo tonnage and 2.5% of global air cargo traffic in tonne-kilometers.

Europe Remains Africa’s Largest Trade Partner, but East Asia Has Grown the Most Since 2009



Based on regional air trade and airport statistics, overall African air trade was estimated at 2.7 million tonnes in 2019. While East Asia and North America are critical market partners for the region, Europe accounts for 47% of Africa’s international air trade, largely because of its proximity and long-standing historical and investment ties.

East Asia’s share of Africa’s international air trade grew to 21% in 2019. Growing Chinese investment and commercial ties to Africa are the principal drivers of growth in this market. Rich in natural resources, Africa continues to draw Chinese enterprises seeking out new raw materials to fuel the country’s industrial expansion. Growth of China’s foreign

direct investment in Africa grew at a rate of 12% per year between 2008 and 2018.

In 2019, North America accounted for 4.0% of Africa’s international air trade, down slightly from the previous year. Africa–North America air trade increased significantly in 2019, reversing a trend of decline observed in the prior decade. Renewed attention to trade relations between the United States and Africa likely drove the gains in 2019. The Africa Strategy, also known as Prosper Africa, is a U.S. proposal intended to counter China’s growing investment and geopolitical influence in the Africa region. Its implementation may result in continued

near-term growth as China-U.S. trade tension lingers. However, it should be noted that Africa–North America air trade growth over the last decade has been stagnate at a rate of less than 1% since 2009.

Trade among African nations was estimated at 295,000 tonnes for 2019, which accounts for 11% of the total Africa cargo market. When including domestic traffic, intra-Africa accounts for 17% of the total market. Africa is moving forward to implement new free trade agreements and air service agreements, such as the African Continental Free Trade Area agreement and Single African Air Transport Market (SAATM). These agreements

Chinese Foreign Direct Investment Has Grown Beyond U.S. Levels



encourage operators to develop new intra-Africa air cargo lanes. With 34 states having signed the SAATM in 2018, implementation is key to stimulate more economic growth within the continent. Also, current ground infrastructure limitations will continue to drive a special need for air cargo within Africa because development projects are limited by the difficulty of securing substantial financial investments.

International air trade in African subregions

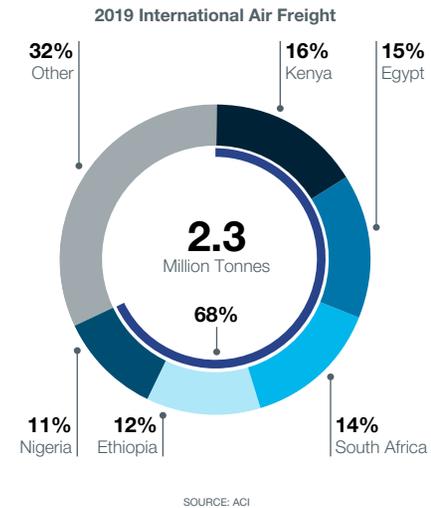
Relatively few economies conduct the majority of Africa's international air trade.

Africa can be divided into five distinct economic subregions: North Africa, Southern Africa, East Africa, West

Africa and Central Africa. The East Africa subregion has the largest share of outbound air cargo traffic, while more import traffic comes into the North Africa subregion; however, imports are more widely spread across all subregions. Central Africa represents the smallest share of traffic in both directions and is heavily dependent on imports.

As of 2019, leading international air cargo markets on the Africa continent included Kenya (16%), Egypt (15%), South Africa (14%), Ethiopia (12%) and Nigeria (11%). Of these, only South Africa contracted in 2019, falling 18% in international air freight. Overall, Africa was one of the few regions to see air cargo traffic increase in 2019. The economy of the Africa region improved in 2019, with GDP growth of about 3.0% and goods imported up nearly 11%, which boosted air cargo in that year.

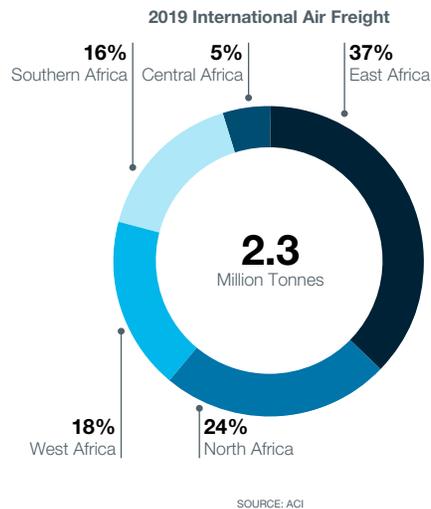
Kenya, Egypt, South Africa, Ethiopia and Nigeria Lead Africa's International Air Trade



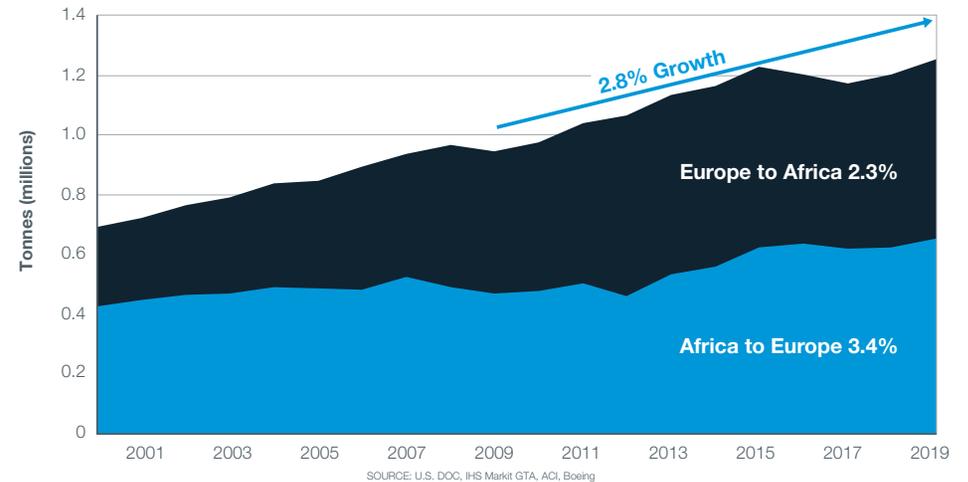
Africa-Europe traffic

Air cargo flows between Africa and Europe experienced growth over the past decade.

Airport Data Indicates East Africa Moved the Most International Freight in 2019



Traffic Between Africa and Europe Has Seen Steady Growth Since 2009

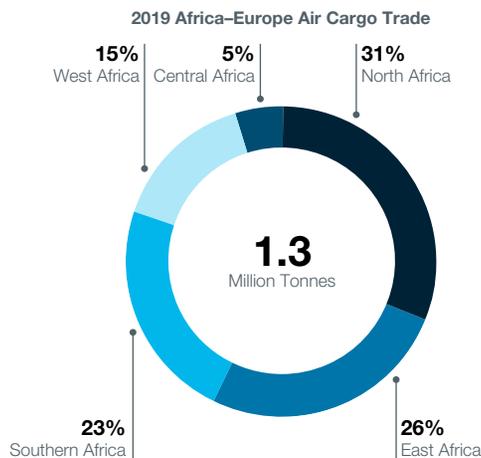


Traffic from Africa to Europe experienced volatile growth over the last decade, averaging 3.4% per year since 2009, growing 5.1% most recently in 2019. Europe-to-Africa flows showed similar volatility, yet averaged a lower growth rate of 2.3% per year since 2009. Air cargo imports from Europe saw growth in both 2018 and 2019. The directional imbalance between Africa to Europe and Europe to Africa is relatively small.

Traffic between Africa and Europe is heavily dependent on the strong perishables trade. In the northbound direction, Africa to Europe, perishable traffic is largely driven by fresh-cut

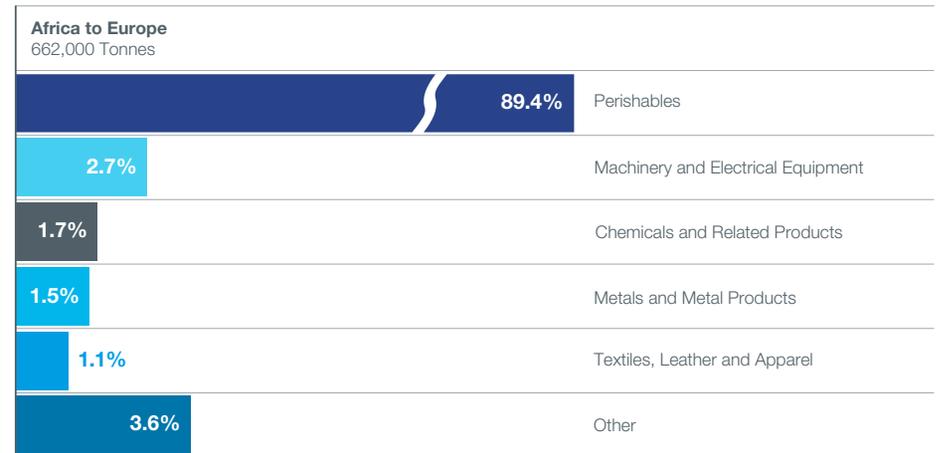
flowers (45%), most of which are produced within the East Africa subregion. Seafood (26%) makes up the next largest share of perishables shipped to Europe, originating mostly from the Southern Africa and East Africa subregions. In the opposite direction, Europe to Africa, perishables are again the largest segment of goods, mostly consisting of seafood, meat and dairy products primarily imported into the North Africa subregion. However, other industrial goods play a large role in air cargo traffic, in particular chemicals and related goods, of which pharmaceutical goods make up 32%.

North Africa and East Africa Make Up Over Half of Africa–Europe Traffic



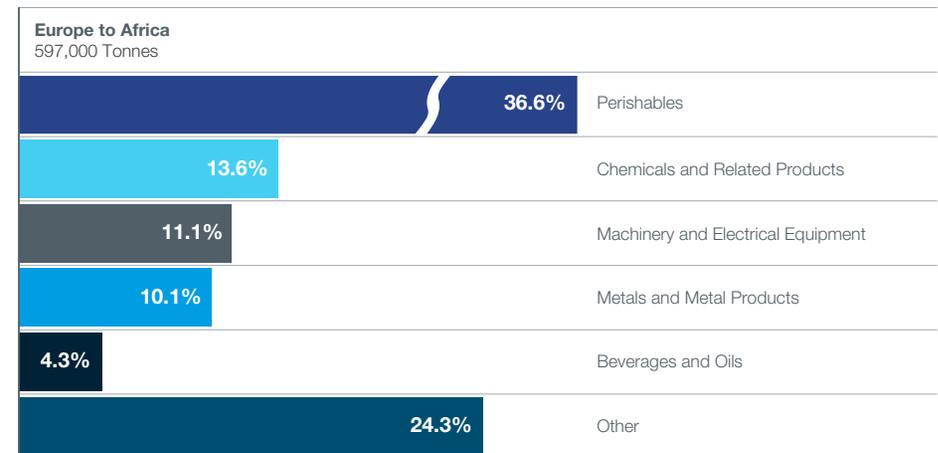
SOURCE: U.S. DOC, IHS Markit GTA, ACI, Boeing

Perishables Market Drives Africa-to-Europe Trade



SOURCE: IHS Markit GTA

Europe-to-Africa Trade Is Made Up of a More Diverse Range of Goods



SOURCE: IHS Markit GTA

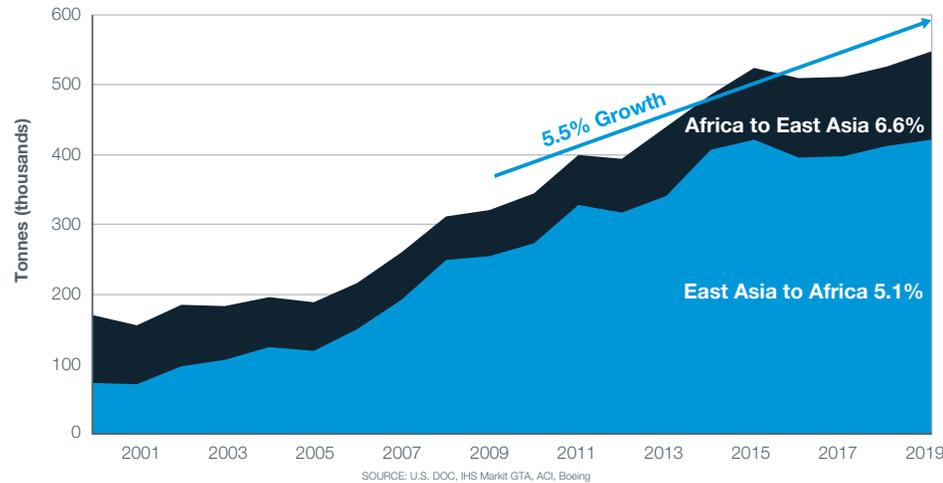
Africa–East Asia traffic

Continued East Asian investment and African consumer demand drives Africa–East Asia air cargo trade.

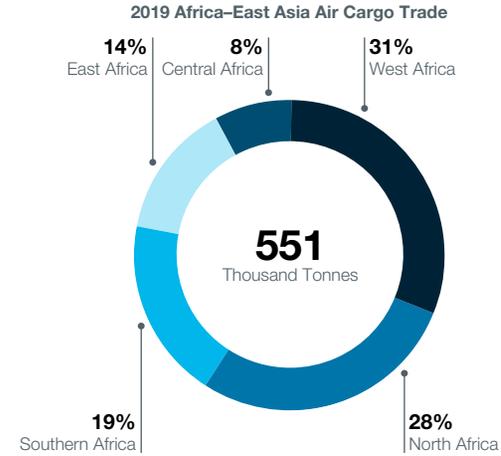
The developing Africa–East Asia air cargo market has increased 5.5% per year on average in the past decade. Capital investments in African extractive industries (e.g., oil from Sudan and copper from Zambia) and growing African economies that

demand more consumer goods — especially from China — will continue to drive these markets. Air cargo flows are significantly imbalanced, with nearly four times as much Asian air cargo entering as leaving Africa.

Africa and East Asia Traffic Continues to Grow Above the Average Rate



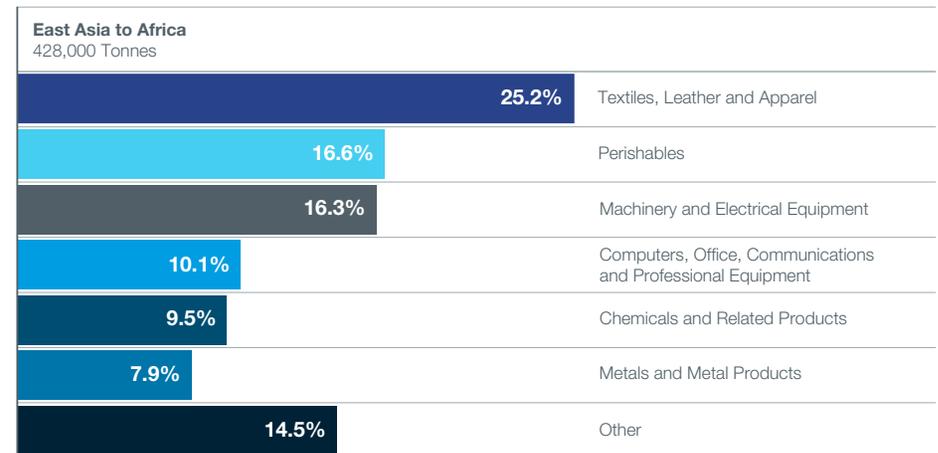
The Majority of Africa–East Asia Air Cargo Traffic Involves the West Africa and North Africa Subregions



Traffic moving from East Asia into Africa consists of a wide variety of commodities, mostly finished and industrial goods. Textiles, leather and apparel represents the largest share

of imported traffic (25%), most of which is brought into the West Africa subregion, the bulk being apparel. Machinery and electrical equipment as well as computers and professional

Various Goods Make Up Trade From East Asia to Africa

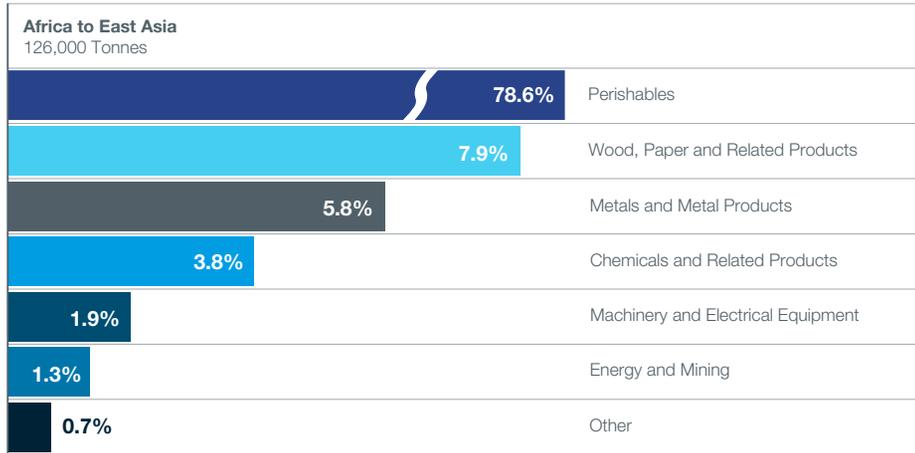


Source: IHS Markit GTA

equipment make up a large portion of imported goods, evidence of East Asia's, primarily China's, industrial and commercial investment into the

continent. Of the chemicals and related products category imported from East Asia, 44% is pharmaceutical goods.

Africa-to-East Asia Trade Consists Mostly of Seafood and Other Perishables



SOURCE: IHS Markit GTA

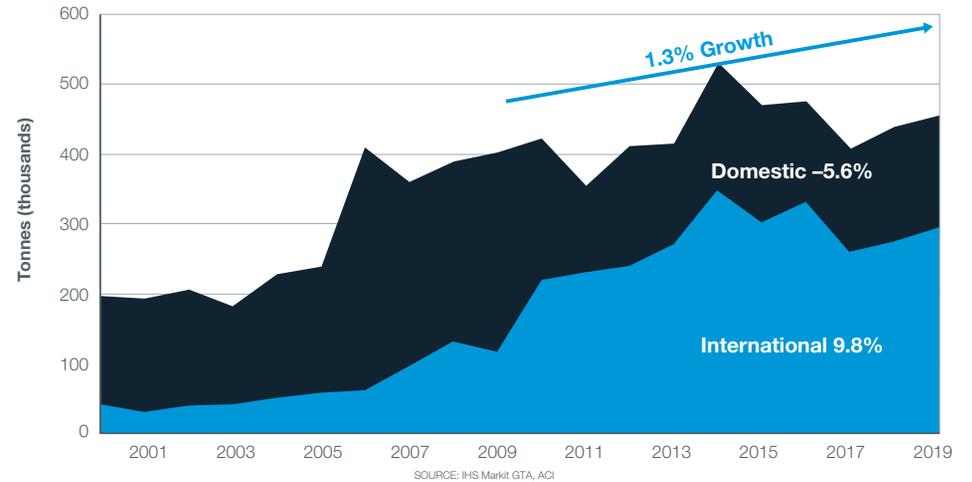
Intra-Africa traffic

Trade between African nations continues to grow as regional trade agreements are implemented.

Intra-Africa traffic has grown only 1.3% per year since 2009. However, that rate is inclusive of domestic Africa traffic, which has declined over the same period. Focusing on international traffic between African nations, traffic grew 9.8% over the past decade. A large majority of the international traffic is generated by

the Southern Africa region, primarily the result of the longtime standing of South Africa as one of the largest economies on the continent, with many established global trade relations and a large portion of cargo capacity. Yet, strong growth observed in both the economy and cargo capacity in Ethiopia, Kenya and Egypt

Intra-Africa Traffic Has Grown 1.3% Per Year Since 2009

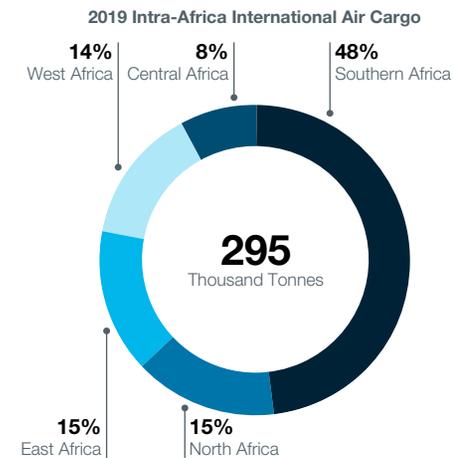


may challenge the current balance of international traffic going forward.

is strongest in South Africa and the Democratic Republic of the Congo, which together had 83% of domestic Africa air cargo traffic in 2019.

Domestic air cargo in Africa is estimated to total 161,000 tonnes and

Southern Africa Holds the Highest Share of Intra-Africa Traffic

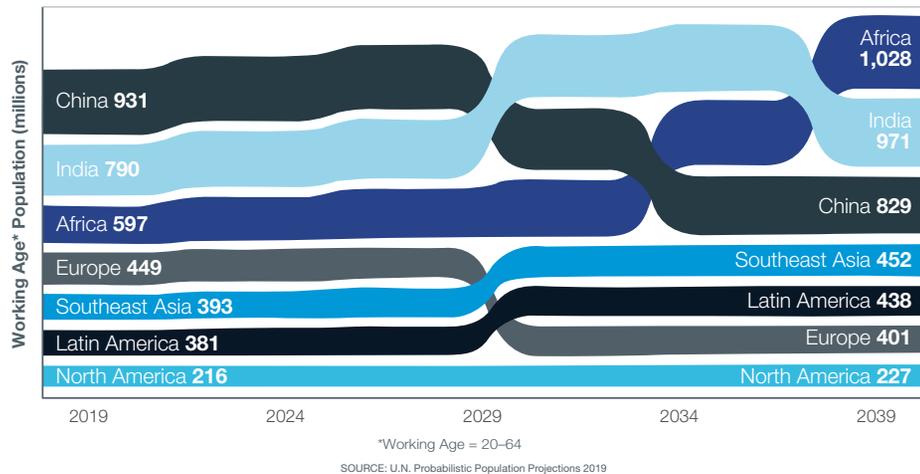


SOURCE: IHS Markit GTA, ACI

Africa forecast

Driven by developing economies and a rapidly growing working-age population, Africa represents an opportune market for industrialization and air cargo growth. Overall, air cargo trade between Africa and Europe will grow 3.3% per year, while Africa–East Asia air cargo trade will expand at an average annual growth rate of 5.6%. While intra-Africa air cargo trade will grow 4.1% per year.

Africa's Working Age Population Will Be Greater Than China and India's by 2039

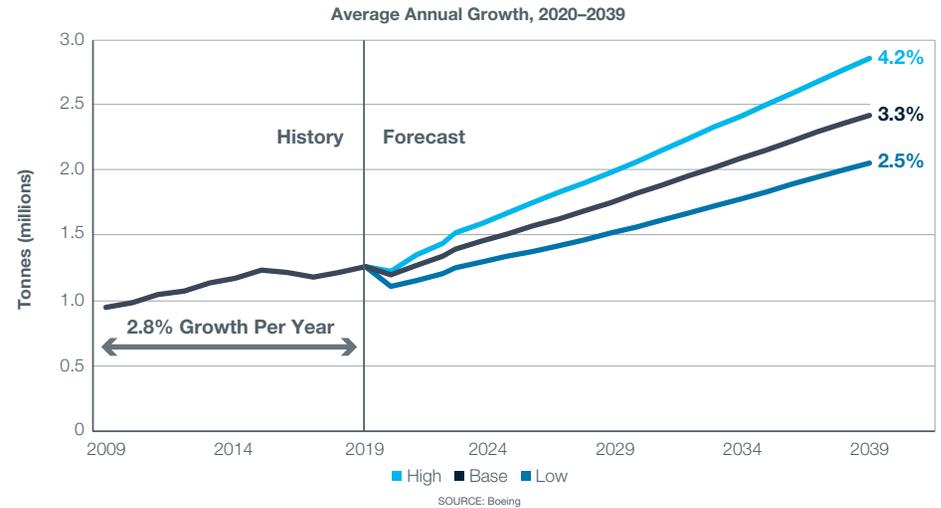


Both directions in the Africa–Europe market will grow at relatively similar rates. The Africa-to-Europe market is expected to average 3.2% growth per year. European economic growth, African economic diversification into manufactured products and continuation of moderate growth in African perishables are assumed in the baseline forecast for this air trade flow.

A slightly higher level of growth is forecast for the Europe-to-Africa

market, reflecting the higher economic growth rates expected for Africa. At 3.5%, the base growth rate forecast reflects both Africa's consumer buying power for goods that arrive by air and increased investment in industries that depend on air cargo for time-critical shipments. As the manufacturing base in Africa continues to develop, the diversity of inbound air cargo should increase and reduce its vulnerability to swings in commodity prices.

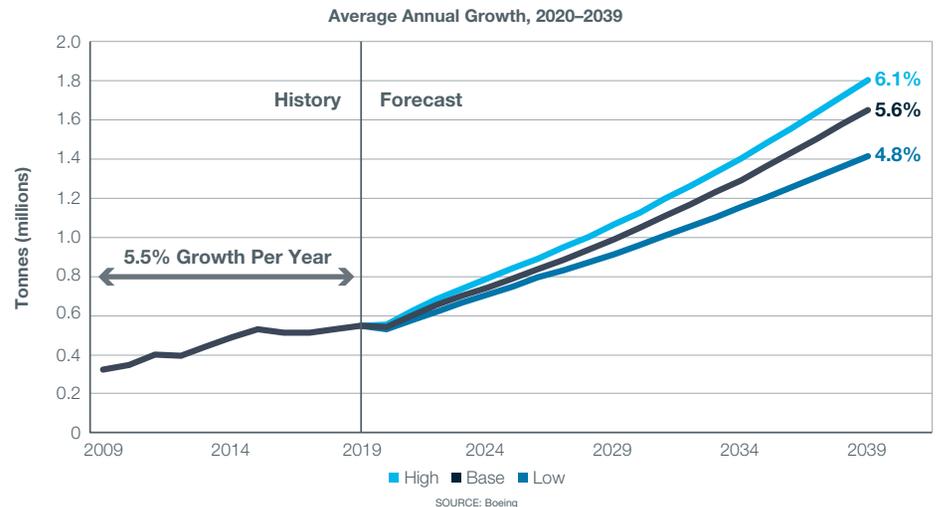
The Africa–Europe Market Will Grow 3.3% Per Year



Growth in Africa's air trade with East Asia will be driven principally by East Asian imports into the continent. Follow-on investment by China in extractive industries in Africa and — equally important — continuing urbanization and rising demand for

consumer goods in Africa will propel East Asia-to-Africa air trade growth at a rate of 6.0% per year for the forecast period. Conversely, Africa-to-East Asia air cargo trade will expand at a slower rate of 4.1% per year, with higher growth

The Africa–East Asia Market Will Grow 5.6% Per Year

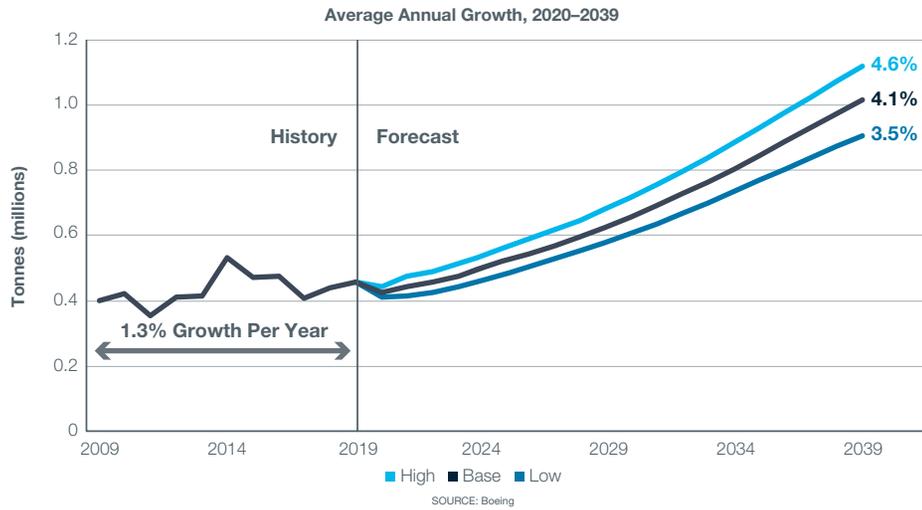


expected later in the forecast period as Africa slowly develops industrial ties with East Asia.

Development of intra-Africa air cargo traffic will be driven by the international market between African nations.

The intra-Africa flow is expected to grow 4.1% per year through 2039, as further liberalization of markets and implementation of trade and Open Skies agreements among a growing number of countries progresses.

The Intra-Africa Market Will Grow 4.1% Per Year



EAST ASIA AND NORTH AMERICA REGIONAL FORECAST

For the purposes of this forecast, we define East Asia as the eastern Pacific Rim, including Australia, Brunei, Cambodia, China, Hong Kong, Indonesia, Japan, Laos, Macau, Malaysia, Myanmar, New Zealand, the Philippines, Singapore, South Korea, Taiwan, Thailand and Vietnam. We define North America as Canada and the United States.

East Asia–North America market contracted 7.5% in 2019

The East Asia–North America market represents 20.7% of the world’s air cargo in tonne-kilometers and 8.2% in tonnage.

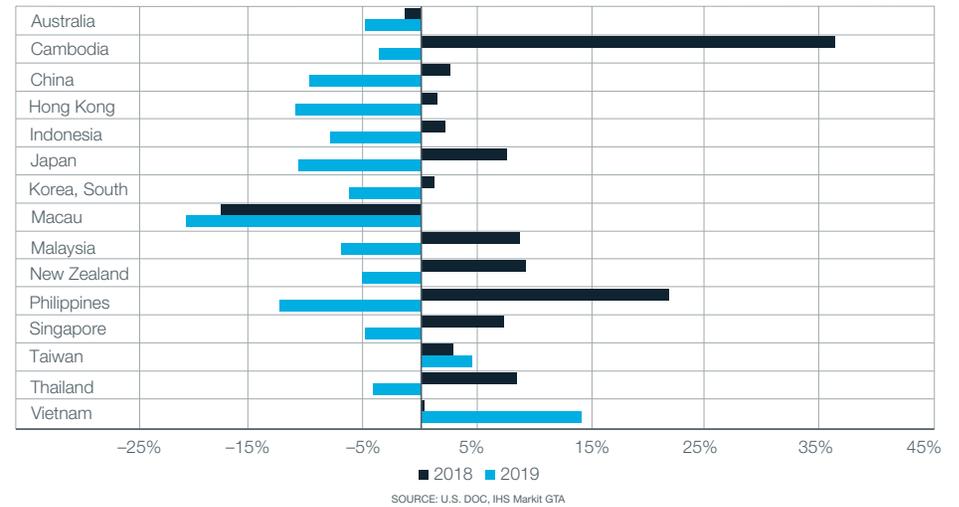
The overall East Asia–North America market grew 3.7% in 2018 but declined 7.5% in 2019. Air freight in the East Asia-to-North America direction decreased from 2.9 million tonnes in 2018 to 2.7 million tonnes in 2019. Similarly, air freight from North America to East Asia decreased from 1.8 million tonnes in 2018 to 1.7 million tonnes in 2019.

The United States accounts for nearly 90% of the overall air trade market between East Asia and North America. U.S. monthly market activity can therefore be taken to approximate the overall trans-Pacific market. During the first six months of 2020, overall East Asia–U.S. air cargo traffic contracted 1.2% compared with the first six months of 2019. Traffic contracted 9.8% in the U.S.-to-East Asia direction but grew 4.6% in the East Asia-to-U.S. direction. U.S. imports growth

can be attributed to high demand for transportation of personal protective equipment (PPE) because of the COVID-19 pandemic. The first two months saw the traffic contracting 10.6%. For March through June, traffic grew 10.9%, with the strongest growth in May when traffic grew 20.5% in comparison to the previous year.

China continues to represent the largest air cargo market in the East Asia–North America market; its market share rose from 16% in 1999 to 42% in 2009, and now stands at 47% in 2019. This increased Chinese dominance led to a decline in Japan’s share, from 27% in 1999 to 17% in 2009 and 14% in 2019. South Korea holds the third-largest share, 7.0%, as of 2019. The recent trend of rapid middle-class growth in China will likely ensure continued growth for China’s air cargo market.

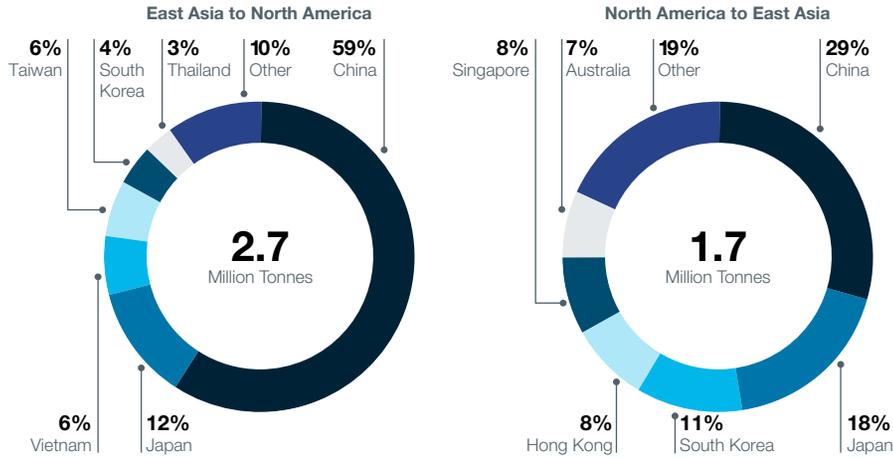
The Air Freight Market Contracted 7.5% in 2019



East Asia–North America Air Freight Contracted 1.2% for the First Half of 2020

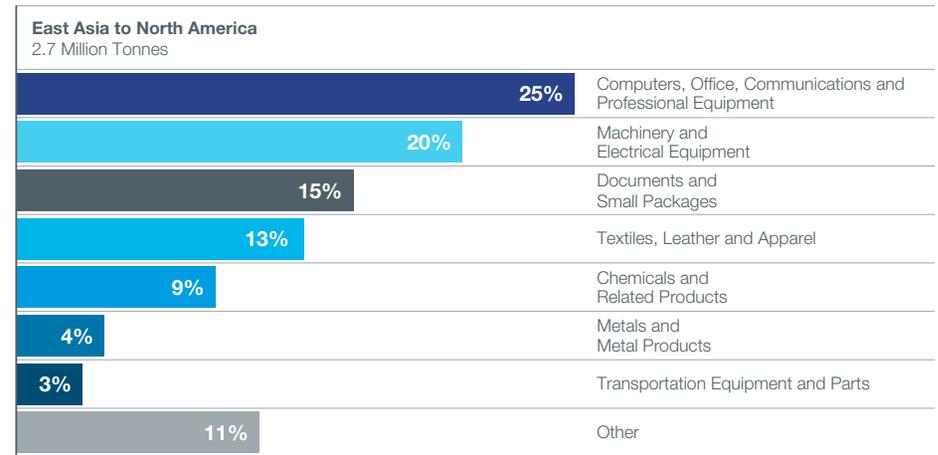


China Accounts for 47% of Trans-Pacific Air Cargo Market



SOURCE: U.S. DOC, IHS Markit GTA

Consumer Goods Drive Eastbound Flow



SOURCE: U.S. DOC, IHS Markit GTA

East Asia–North America air trade commodities

Four commodity categories account for 73% of East Asia-to-North America air cargo traffic: apparel, office and communication equipment, machinery and electrical equipment, and documents and small packages.

In the opposite direction, 62% of traffic falls within seven categories: office and communication equipment, documents and small packages, machinery and electrical equipment, metal products, vegetable products, animal products and chemical materials.

East Asia exports to North America contracted in 2019. Office and communication equipment, machinery and electrical equipment as well as the apparel category

declined 7.4%, 13.3% and 8.8%, respectively. Vegetable product exports, however, grew 3.5% but only account for 1.7% of the tonnage.

In the opposite direction, exports also fell for office and communication equipment (5.6%); chemical materials (6.6%), machinery and electrical equipment (14.2%), and documents and small packages (8.4%). Vegetable products and animal products contracted 4.0% and 7.7%, respectively.

Manufacturing Materials Drive Westbound Trans-Pacific Flow



SOURCE: U.S. DOC, IHS Markit GTA

East Asia–North America forecast

Air trade in both directions across the Pacific is forecast to grow an average of 4.3% per year in the next 20 years.

Directionally, the flow from East Asia to North America is forecast to grow at an average rate of 4.2% per year; the opposite flow is projected to grow at a higher rate of 4.4%.

Total air tonnage on the trans-Pacific route is determined by the combined economic activities of the countries in North America and East Asia, international trade patterns and the different types of trade commodities. Economic growth in the importing region primarily determines directionality of tonnage flow, but flow is also influenced by exchange rates, which affect the cost of imported goods in national currencies.

The forecast assumes that rapid economic growth in East Asia will continue. In particular, it assumes that China's middle class will continue to grow rapidly. Since 2010, service and consumption sectors now contributes more than 52% of China's GDP. Consumption per capita has more than doubled. As China shift toward a consumer economy, this will further accelerate air traffic and air cargo demand.

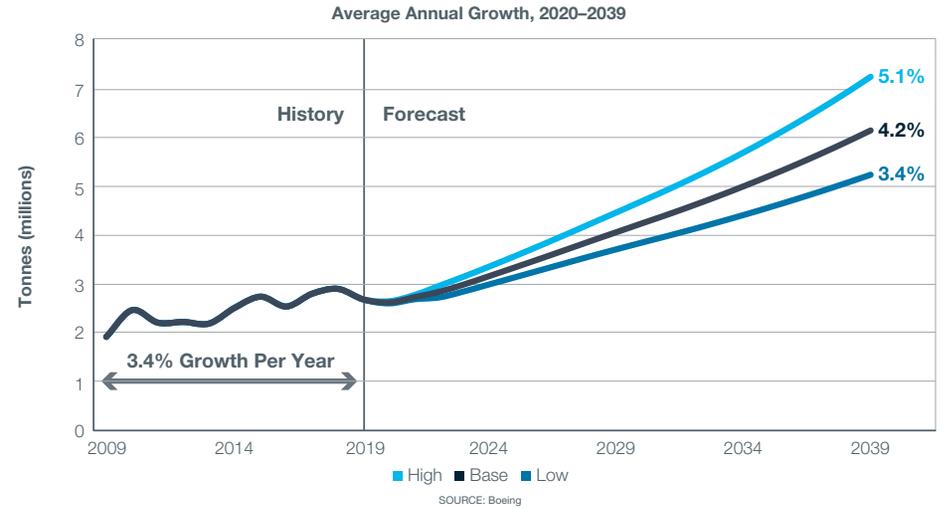
Future growth of the East Asia-to-North America air cargo market will also be

affected by additional factors, such as Vietnam's economy. During the past five years, the country's air cargo exports to North America grew an average of 12.6%, bolstered by Vietnam's lower manufacturing costs compared to China. Nike and Adidas now produce twice as many shoes in Vietnam as in China. Vietnam is also attracting high-tech manufacturing companies such as Microsoft, Intel and Samsung. The latter now produces more than half its smartphones in Vietnam, making it the second largest smartphone exporter after China.

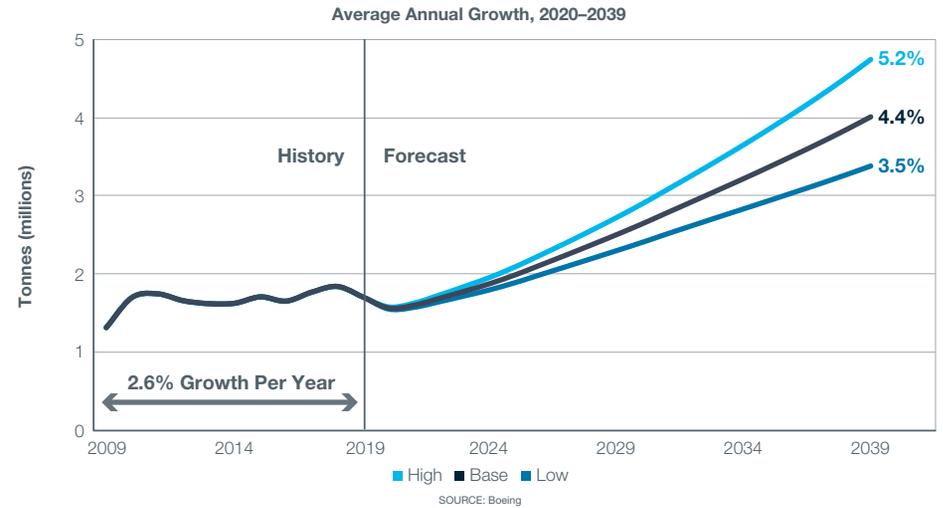
Vietnam continues to attract record foreign direct investment (FDI). The Foreign Direct Agency reports that FDI in Vietnam increased 7.2% in 2019, reaching US\$38.2 billion. Of the 19 sectors receiving capital, manufacturing and processing came on top at US\$24.6 billion, accounting for 64% of total registered investment capital.

In 2019, South Korea invested US\$7.9 billion in Vietnam, making it the top investor. Hong Kong followed at US\$7.8 billion. China has also been increasing its investment in Vietnam over the years. China is now the fourth-largest investor in Vietnam.

East Asia-to-North America Air Cargo Traffic Will Grow 4.2% Per Year



North America-to-East Asia Air Cargo Traffic Will Grow 4.4% Per Year



EUROPE AND EAST ASIA REGIONAL FORECAST

For the purposes of this forecast, we define Europe as all 27 member countries of the European Union plus Albania, Gibraltar, Iceland, Norway, Switzerland, Turkey, the United Kingdom and other countries comprising the former Yugoslavia. We define East Asia as the eastern Pacific Rim, including Australia, Brunei, Cambodia, China, Hong Kong, Indonesia, Japan, Laos, Macau, Malaysia, Myanmar, New Zealand, the Philippines, Singapore, South Korea, Taiwan, Thailand and Vietnam.



Europe–East Asia market contracted 3.2% in 2019

The Europe–East Asia market represents 19.7% of the world’s air cargo in tonne-kilometers and 9.6% in tonnage.

Europe–East Asia air cargo traffic has averaged 4.6% growth per year from 2004 through 2019. After the Global Financial Crisis in 2008, the market quickly recovered with growth at an average annual rate of 5.7% between 2009 and 2017.

After strong growth, the market slowed growing 0.4% in 2018, but then contracted 3.2% in 2019. The Europe-to-East Asia flow contracted 1.1% in 2018 and 3.5% in 2019, while in the East Asia-to-Europe direction, traffic grew 2.0% in 2018, but then contracted 2.9% in 2019.

The Europe–East Asia annual growth chart shows overall air traffic flows between Europe and East Asia that also contain some sixth freedom traffic that flows into or out of other regions. The chart does not represent the actual trade flows by direction. Therefore, comparisons should not be made between the chart and the following air trade flow analysis.

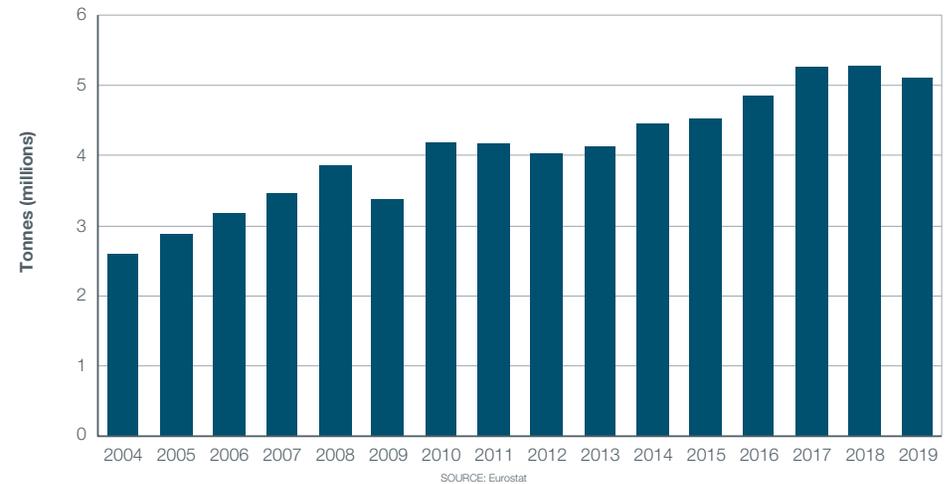
Between 2004 and 2008, Europe’s imports from East Asia grew at an average annual rate of 12% while

its exports to Asia grew at 8.4%. By 2008, Europe was importing 2.3 million tonnes from East Asia and exporting 1.6 million tonnes to East Asia. The gap between Europe’s imports and exports narrowed, reaching parity in 2011 as a result of the 2008–2009 Global Financial Crisis and attendant aggressive financial stimulus in Asia. China led the way with a stimulus package equivalent to 3.2% of its GDP in 2009, exceeding the 2.0% GDP stimulus recommended by the International Monetary Fund.

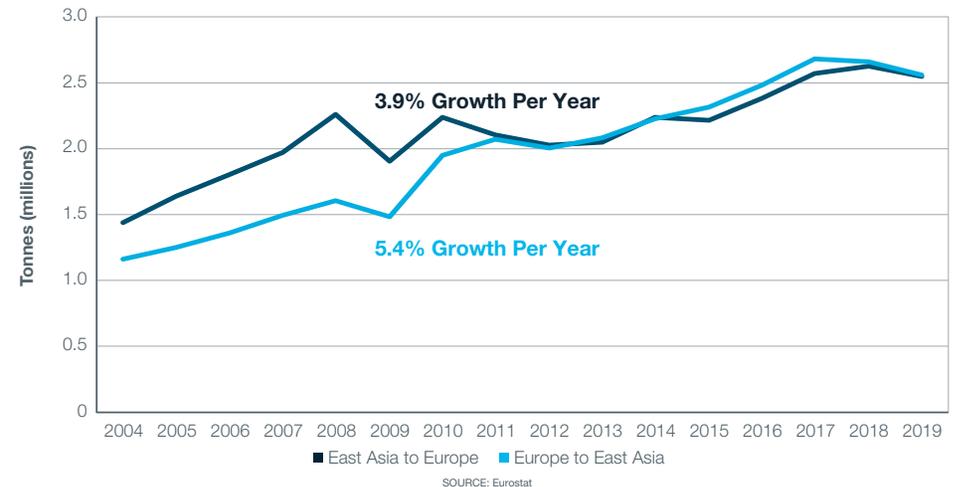
Since 2011, Europe-to-East Asia and East Asia-to-Europe volume grew 2.7% and 2.4%, respectively, as East Asia’s growing middle-class, with more disposable income, accelerated a shift to a consumption economy, which furthered the demand for European goods.

U.S.–China trade negotiations may affect Europe’s exports to China in the near term. Phase 1 of the U.S.–China trade deal of 2020 obligates China to buy U.S. goods worth US\$200 billion between 2020 and 2021. Germany, the largest European Union economy,

Europe–East Asia Air Cargo Market Has Grown 4.6% Per Year Since 2004



European Air Exports to East Asia Account for 50% of the Market



can be particularly affected by this deal, losing its exports of automotive, aerospace and industrial machinery products. After three decades of continuous growth in its economic relationships, China became the largest trading partner of Germany, surpassing the United States in 2016.

For January through August 2020, in comparison to January through August 2019, the Europe–East Asia air cargo volume contracted 17% because of the ongoing COVID-19 pandemic. The pandemic has significantly affected economic activities and international air travel between the two regions, affecting both air freight demand and capacity. Prior to the pandemic, passenger widebody belly capacity

accounted for 57% of the Europe–East Asia air cargo capacity. With the onset of the pandemic, nearly 40% of the Europe–East Asia air cargo capacity was removed from the market. As a result, freighter operators have increased the utilization and load factor of their fleet to an unprecedented level. However, it wasn't sufficient to compensate for the lost belly capacity of passenger aircraft, leading to cargo yield escalation by approximately 40% from January to August 2020. High cargo yield resulting from the loss of passenger belly capacity incentivized nearly 200 airlines to offer more than 2,400 passenger airplanes for cargo-only (“freighter”) flights, with European airlines accounting for 22% of the freighters offered.

Europe–East Asia air trade commodities

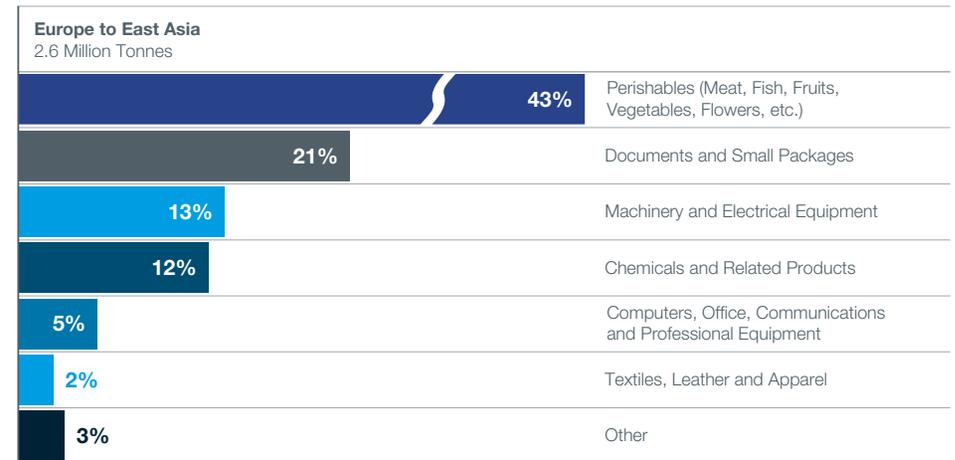
In the Europe-to-East Asia direction, the top three commodity categories account for 77% of air cargo traffic.

In descending order, the categories are perishables (such as meat, fish, fruits, vegetables and flowers), documents and small packages, and machinery and electrical equipment. In the East Asia-to-Europe direction, the top three commodity categories account for 66% of air trade. The categories are computers, office and communication equipment; machinery and electrical equipment; and perishables.

One particularly fast-growing market segment between Europe and East Asia has been documents and small

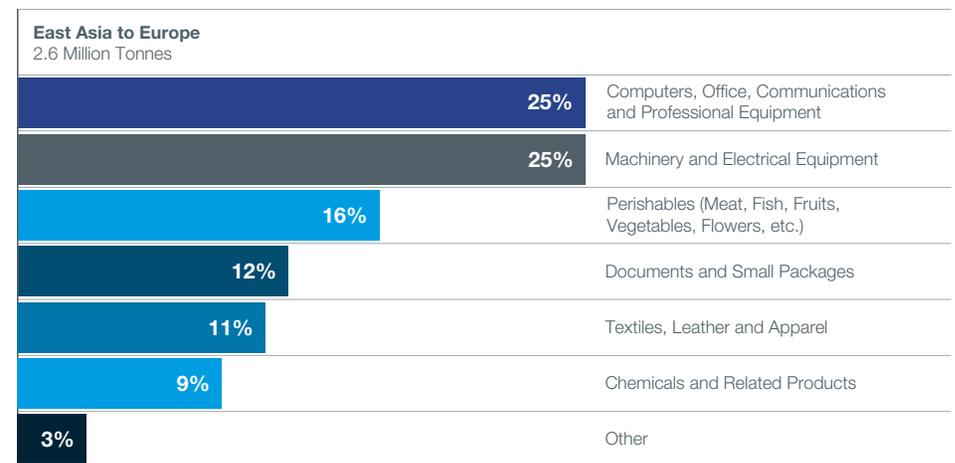
packages, sometimes referred to as “traditional express traffic.” This trade flow has an average of 5.2% annual growth in annual shipment count in both directions since 2009, as the movement of business samples, legal documents and other expedited small-batch items between Europe and East Asia has increased. The total bidirectional express market averaged 822 million shipments in 2019.

Top Three Commodity Categories Account for 77% of Europe-to-East Asia Air Cargo Traffic



SOURCE: IHS Markit GTA

Top Three Commodity Categories Account for 66% of East Asia-to-Europe Air Cargo Traffic



SOURCE: IHS Markit GTA

One Belt, One Road complementing air cargo

China's Belt Road Initiative (BRI), also known as "One Belt, One Road," was launched in 2013 and is one of the most ambitious infrastructure projects conceived. China plans to invest up to US\$8 trillion in 115 countries building roads, rails, maritime shipping lanes and airports to better connect China to Central Asia, Southeast Asia, Russia, Europe and Africa. The vast amount of investment will stimulate economic growth in the region, increasing trade volume. Europe–East Asia trade is expected to benefit from BRI because of improved connectivity and lower costs.

As the number of China-to-Europe trains increase, the effect on air freight should be minimal. The cost of rail is twice the cost of sea freight and one-quarter the cost of air freight. Transit time for rail takes 13–18 days compared to the 30 days for sea freight and five days for air freight (which includes customs clearance, warehousing, etc.). From a commodity level, the value per kilogram of products moved by rail is much closer to sea than to air. Thus, rail is more a competitor to sea freight than to air freight.

Europe–East Asia forecast

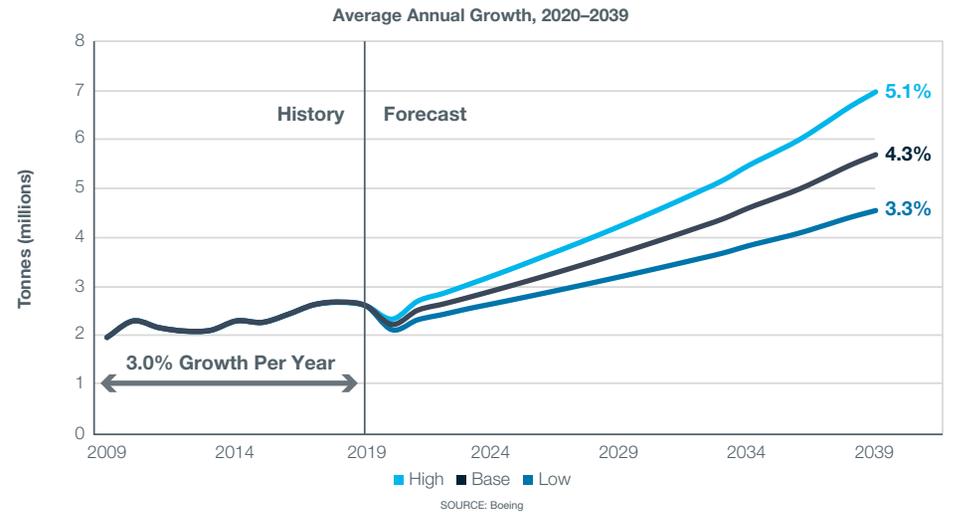
Air trade flowing in both directions for the Europe–East Asia air cargo market is forecast to grow an average of 4.3% per year during the next 20 years.

The flow from East Asia-to-Europe is forecast to grow at an average rate of 4.3% per year through 2039 and the flow from Europe-to-East Asia is forecast to grow 4.5% per year.

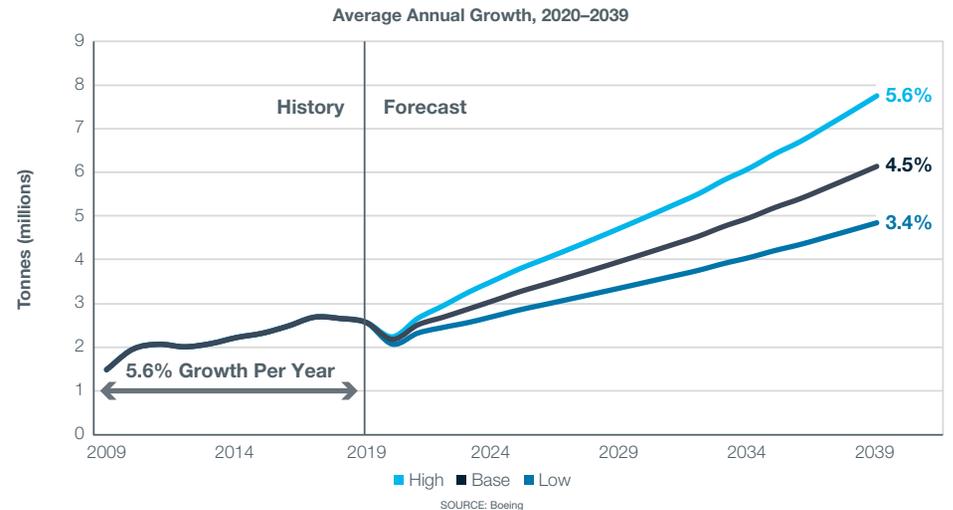
East Asia's GDP will grow 3.4% per year during the next 20 years. China

will continue to play a major role in East Asia, with the expected GDP growth of 4.3% per year during the next 20 years. China's economy currently accounts for 55% of East Asia's GDP and will increase to 65% by 2039. The established economies of Europe are expected to grow 1.2% per year.

East Asia-to-Europe Air Cargo Traffic Will Grow 4.3% Per Year



Europe-to-East Asia Air Cargo Traffic Will Grow 4.5% Per Year



INTRA-EAST ASIA AND OCEANIA REGIONAL FORECAST

For this forecast, we define East Asia and Oceania as the eastern Pacific Rim, including Australia, Brunei, Cambodia, China, Hong Kong, Indonesia, Japan, Laos, Macau, Malaysia, Myanmar, New Zealand, the Philippines, Singapore, South Korea, Taiwan, Thailand and Vietnam.

Note: This section does not examine domestic flows within the nations in Asia.



Synchronized global economic expansion and world trade contribute to strong growth in intra-East Asia and Oceania air cargo trade.

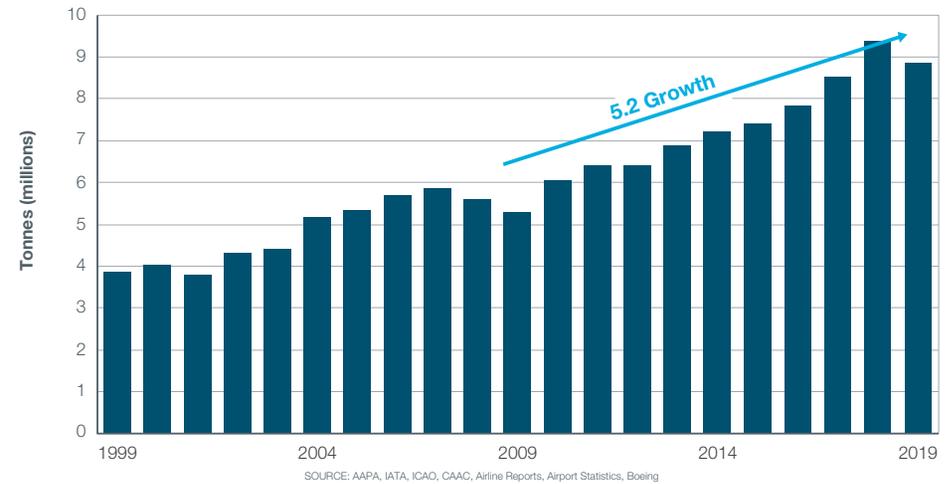
The intra-East Asia and Oceania market represents 8.7% of the world's air cargo in tonne-kilometers and 16.5% in tonnage.

The intra-East Asia and Oceania region has enjoyed GDP growth of 5.2% over the last 10 years, while that is expected to slow to 3.4% over the next 20 years. The intra-East Asia and Oceania market saw a 10% increase in regional air cargo traffic in 2018 and a 5.4% decrease in 2019. Most global air cargo markets saw a decrease in 2019 because of increasing economic uncertainties and trade disputes.

The intra-East Asia and Oceania market is expected to remain strong with an average annual growth of 4.9% per year. The main source of air cargo — China — is expected to outpace the region with a GDP growth of 4.8%. China continues to be an economic powerhouse in the region, accounting for almost 55% of the region's GDP in 2019. Meanwhile, economies

and trade in other Asian countries have also shown strong growth, which continues to drive positive momentum in the intra-East Asia and Oceania trade outlook. Many of Asia's manufacturing sectors transport critical parts and subassemblies through the supply chain to support the region's air cargo traffic. A large portion of those goods is moved within the region to various industrial locations prior to being completed and exported outside the region. The trend is expected to continue, if not accelerate, in the next decade as manufacturing hubs are diversified because of growing labor rates in China and geopolitical tensions between China and the United States. By 2039, China is projected to account for more than 65% of the region's economy.

Intra-East Asia and Oceania Air Cargo Market Has Grown 5.2% Per Year Since 2009



Unique market conditions

The region represents 30% of the world population, providing vast market potential internally and externally.

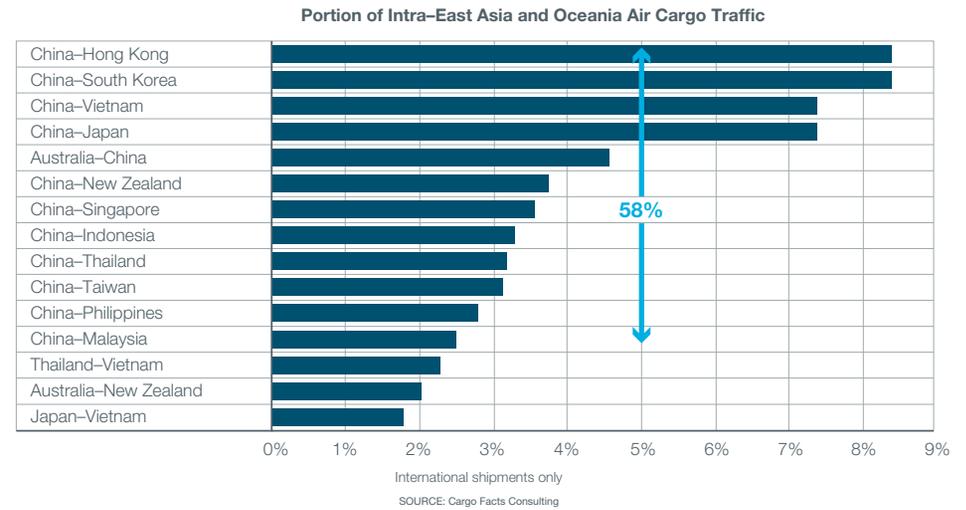
GDPs are growing and shifting because of increased consumption. Much of the world's consumer goods is manufactured in Asia, creating both a supply base and demand base within the region. Additionally, economic and political conflicts with economies outside the region continue to support an entirely intra-East Asia and Oceania supply chain.

Asia is the largest continent in the world, covering about 30% of the Earth. This massive-yet-distinct landmass consists of different terrains, including mountains, water, desert and plain steppes, some of which can be the limiting factors for ground transport options. The current state of ground infrastructure development varies by country and subregion. For example, countries such as Japan, South Korea and Taiwan contribute a significant share of the trade volume in Asia and have highly developed ground infrastructure systems relative to many other countries in the region. However, what ground infrastructure can provide in these countries is strictly limited to domestic markets

because of geographical and political challenges. On the other hand, despite rapid ground infrastructure development in recent years in China and Southeast Asia, these regions cover a large area of land with challenging terrains. As a result, the region has continued to remain highly dependent on air transport options for regional trade activities. Since most of the region's manufacturing centers, such as China, Japan and South Korea, are separated by water, containerships have been used as an efficient alternative transport method to meet shipping needs. Yet, air cargo services will continue to be required in the region to support the development of national economies accompanied by strong growth in per capita incomes, as well as the need to transport high-value industrial goods and perishables, the core commodities of air cargo services.

Macro-economic dynamics in Asia often center on select countries with larger GDPs. Likewise, intra-East Asia and Oceania air trade has been highly concentrated among few high-volume

China Partners in 58% of Intra-East Asia and Oceania Air Cargo Trade



market segments, resulting from the close correlation between economic developments and trade activities. China continues to be the main growth engine in the region's air cargo commerce, with Hong Kong acting as a transitional hub for all of China. The intra-East Asia and Oceania region comprises 105 trading partner combinations, with trade between China and the other intraregional countries representing 58% of regional air cargo traffic by tonnage. By comparison, the next highest trade pairing — Vietnam and Thailand — represents only 2.3% of regional air cargo traffic by tonnage.

Optimistic prospects on region's economic performance and air cargo demand post-pandemic

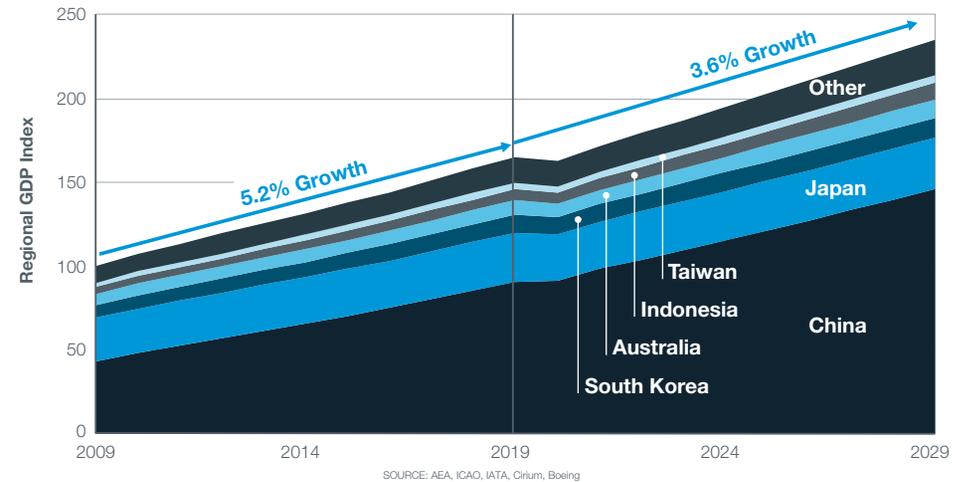
The region has a mix of mature and emerging markets, with established economic growth rates that are still among the highest globally.

Despite the negative effects of political and economic uncertainty, such as depreciating currency and rising oil prices, intra-East Asia and Oceania trade has continued to expand at well above the average world growth trend. The region experienced a decrease in air cargo volume in 2019 along with most of the world. The cargo volume in the intra-East Asia and Oceania region decreased by 5.4% in 2019 as a result of weakening manufacturing activities and soft consumer and business confidence. However, the region was showing signs of recovery in fourth quarter 2019 and into 2020 before the COVID-19 outbreak. While COVID-19 is expected to severely affect economic growth in the region, the impact is relatively modest compared to the rest of the world. Regional GDP is expected to contract 1.6% in 2020, while the world GDP is forecast to drop 5.5%. China's GDP is expected

to grow 0.5% in 2020, showing rapid recovery from COVID-19 economic effects in the first quarter. The region is projected to show a continuing increase in post-pandemic private consumption and market expansion.

In the longer term, intra-East Asia and Oceania economies are projected to grow at an average annual rate of 3.4%, nearly doubling overall GDP in the next 20 years. China will continue to improve the aggregate outlook as GDP is expected to increase at near 4.3% per year, accounting for 65% of the region's overall GDP by 2039. China's economic presence in the region is expected to become even greater as it shifts toward more consumption-driven economies and produces more higher-value manufacturing goods, increasing its region's GDP share from 55% today to 65% over the forecast period.

China Increases Its Contribution to Regional Economic Vitality



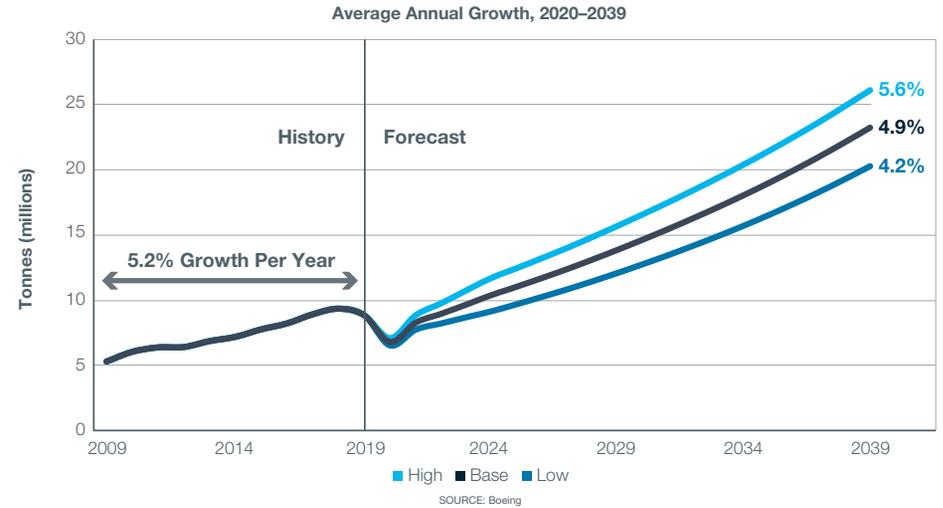
Intra-East Asia and Oceania forecast

Intra-East Asia and Oceania air cargo traffic has enjoyed average annual growth of 5.2% over the previous 10 years.

The region is projected to see a 23% decrease in air cargo volume in 2020 because of COVID-19 and its impact on air cargo capacity. The region heavily relies on the belly capacity of widebody passenger air traffic. While utilization of dedicated freighters rose to its highest historical level, it was not sufficient to completely compensate for the loss in internal passenger flights in the region. Though highly uncertain, internal passenger traffic is expected to recover slowly in this region until COVID-19 is under control. Future growth will be affected

initially by COVID-19, but is expected to recover, averaging 4.9% over the next 20 years. Robust GDP growth will lead to expansion of air trade in the region. Increased consumption in the region, combined with the demand for intercontinental export markets, supports the forecast of 4.9% average annual air cargo growth. The estimated rate would be an adjustment over the 5.2% annual growth in the previous 10-year period. Alternate GDP projections, increased and decreased, were assessed to provide low- and high-growth rate scenarios.

Intra-East Asia and Oceania Air Cargo Market Will Grow 4.9% Per Year



SOUTH ASIA REGIONAL FORECAST

For the purposes of this forecast, South Asia (sometimes referred to as the Indian subcontinent) is defined as Afghanistan, Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan and Sri Lanka.



South Asia air cargo flow exceeds 2.9 million tonnes per year

The South Asia air cargo market exceeded 2.9 million tonnes of cargo in 2019. The South Asia air cargo market constitutes approximately 6.8% of the world's air cargo traffic in tonnage and 5.9% in tonne-kilometers.

Over the last decade, the South Asia economy has continued to grow steadily. GDP in South Asia has grown 5.0% per year since 2009 and continues to exhibit growth as a center of the global population. As of 2019, South Asia contains nearly a quarter of the world's population, with over 1.8 billion people.

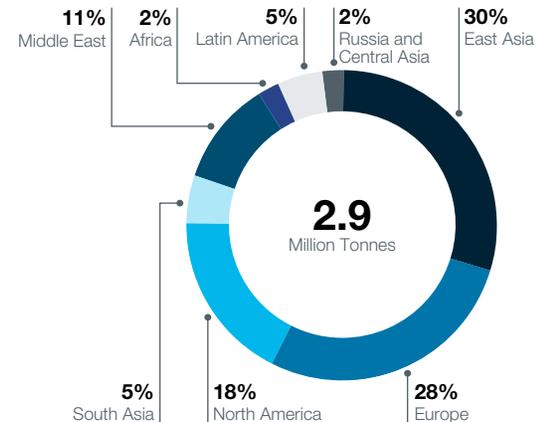
India has proven to be the center of most freight traffic in South Asia. In 2019, over 70% of South Asia cargo moved through India, and the top four airports by freight traffic were located within India. It is worth noting that the Indian government adopted a nationwide goods and service tax (GST), replacing complicated individual state taxation in July 2017. The new tax no longer requires checkpoints at state borders, easing the movement of goods across the country and boosting air freight demand.

South Asia has experienced a downtrend in traffic thus far in 2020

as a result of the COVID-19 pandemic. Forecast models were adjusted to account for the current and future impact of the virus. However, imports from East Asia have remained steady during the pandemic, despite a major downturn between other trade centers globally. India will experience a gradual recovery on a timeline dependent on vaccine availability and the rate of infection spread.

The East Asia region remains the most dominant trade partner for South Asia, with an increase in its share from 27% in 2009 to 30% in 2019. Meanwhile, Europe — South Asia's second-largest trade partner — lost some of its share, declining from 35% in 2009 to 28% in 2019. The majority of South Asia's international air trade is conducted by India, with an over 70% share, followed by Pakistan and Bangladesh.

East Asia Is the Largest South Asia Trade Partner



SOURCE: IHS Markit GTA, ACI

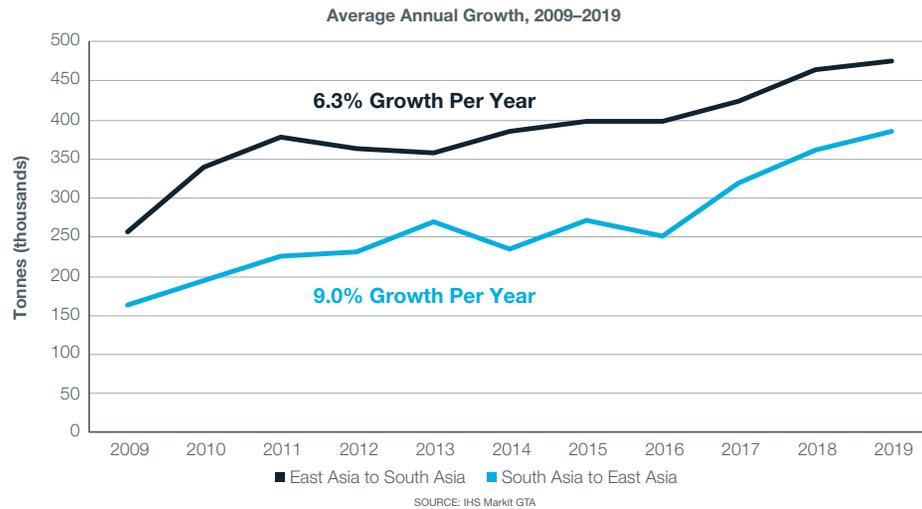
South Asia–East Asia traffic

South Asia’s air trade with East Asia has grown 7.4% annually since 2009.

Trade with East Asia continues to grow steadily for South Asia at 7.4% over the last decade. Trade between South Asia and East Asia favors air imports,

following historical trend. Traffic has recovered from the 2016 recession. Almost 70% of exports from South Asia into East Asia are animal products.

South Asia–East Asia Air Trade Has Grown 7.4% Per Year Since 2009



South Asia–Europe traffic

Over the past decade, air cargo tonnage between South Asia and Europe expanded 4.1% per year.

Unlike trade between South Asia and East Asia, trade between South Asia and Europe favors air exports, following historical trend. While

the export market to Europe sees heavy trade of chemical products and textiles, leather and apparel, the leading air export is animal products.

South Asia–Europe Air Trade Has Grown 4.1% Per Year Since 2009



Domestic India forecast

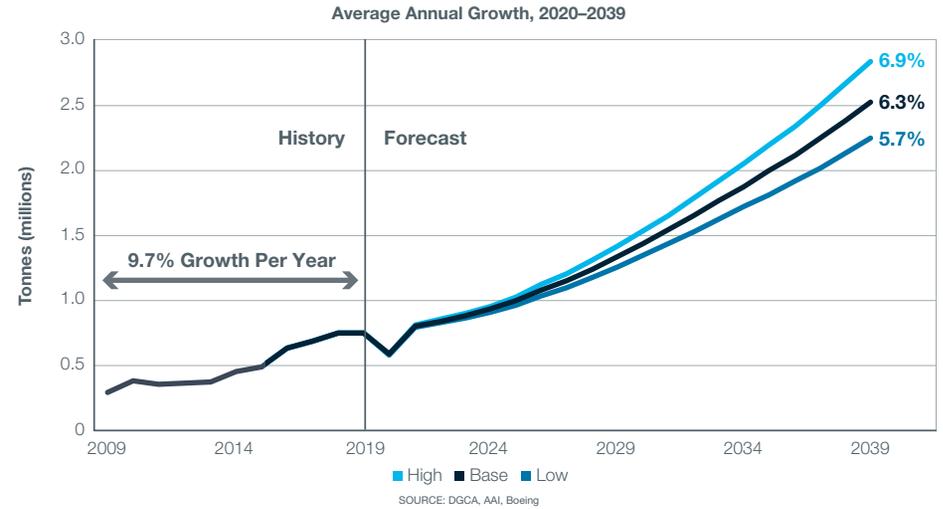
India's domestic air cargo trade will continue to see rapid growth of 6.3% per year over the next two decades.

Base, low and high models were developed to forecast the South Asia–East Asia air cargo market. GDP projections of 0.5% below and above the baseline were assessed and the results of these growth rates are reflected in the low- and high-growth scenarios.

Domestic India has seen significant growth of 9.7% over the last decade

and will continue to grow despite the impact from the COVID-19 novel coronavirus. An analysis of data compiled by the Airport Authority of India was used to adjust year 2020 in the forecast because of ongoing COVID-19 effects. This historical trade growth has been driven by India's expanding economy, which experienced growth of 6.6% per year in real GDP over the past decade.

Domestic India Air Trade Will Grow 6.3% Per Year



South Asia–East Asia forecast

South Asia’s air trade with its largest trade partner, East Asia, is expected to continue to expand as the South Asia economies continue to develop.

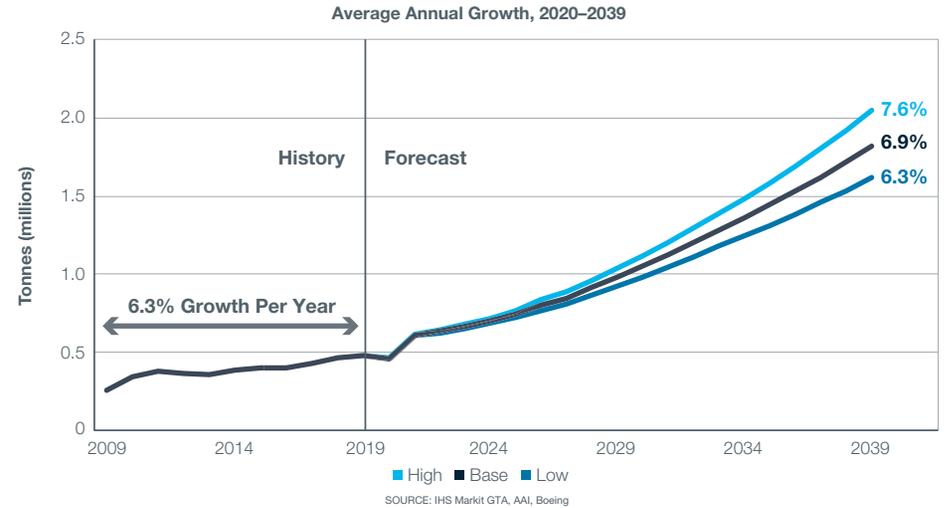
Baseline, low and high models were developed to forecast the South Asia–East Asia air cargo market. GDP projections of 0.5% below and above the baseline were assessed and the results of these growth rates are reflected in the low- and high-growth scenarios.

Trade between South Asia and East Asia has remained steady despite the COVID-19 pandemic. This recent trend serves as an indicator that there will be a quicker COVID-19 air cargo traffic recovery than witnessed in domestic India. This is also a result of continued GDP and population growth in the South Asia region along with healthy GDP growth for East Asia. However, growing political tensions between India and China may impede air trade in this

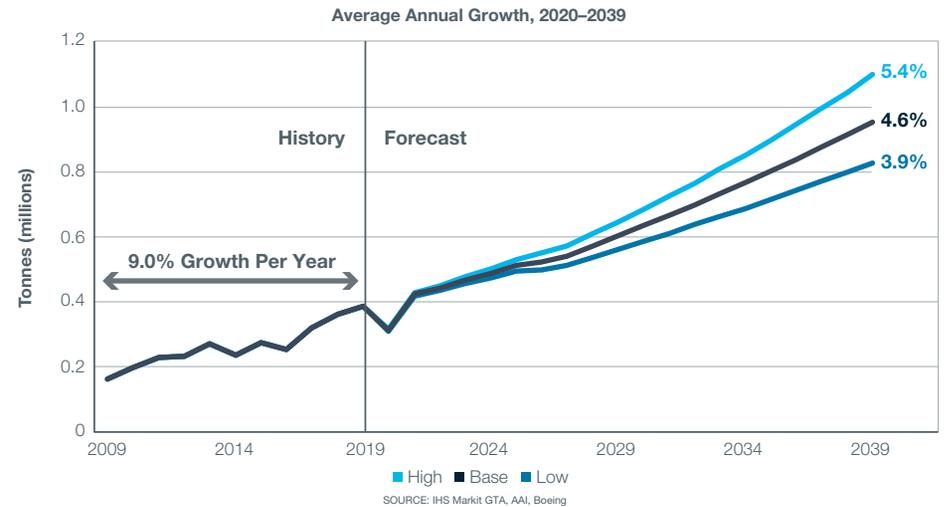
trading bloc. These political tensions have prompted India to expand trade ties with other East Asia nations rather than with China, which makes up a large part of the East Asia market. In 2020, South Asia air imports from East Asia have remained relatively strong compared to South Asia air trade volumes with other trading blocs.

Exports to East Asia will see growth of 4.6% per year, continuing to build on the “Make in India” initiative that focuses on the establishment of India as a manufacturing and design hub. Despite India’s tensions with China, the initiative has dedicated special teams that include Japan Plus and Korea Plus, which should facilitate easier and faster exports to these countries.

East Asia-to-South Asia Air Trade Will Grow 6.9% Per Year



South Asia-to-East Asia Air Trade Will Grow 4.6% Per Year



South Asia–Europe forecast

As South Asia’s economy continues to see rapid growth, trade between South Asia and Europe is expected to continue to grow.

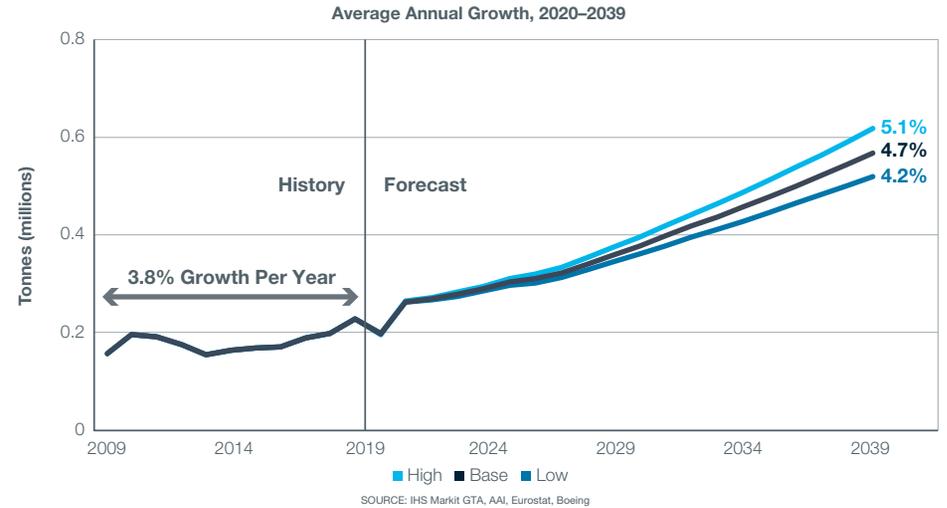
Air trade scenarios for South Asia to and from Europe were developed for baseline, low and high economic growth rates. GDP projections of 0.5% below and above the baseline were assessed and the results of these growth rates are reflected in the low- and high-growth scenarios.

Because of a rapidly growing middle class in India, imported goods coming from Europe will expand faster than air exports to Europe. In 2019, leading imported goods into South Asia included chemicals; machinery and

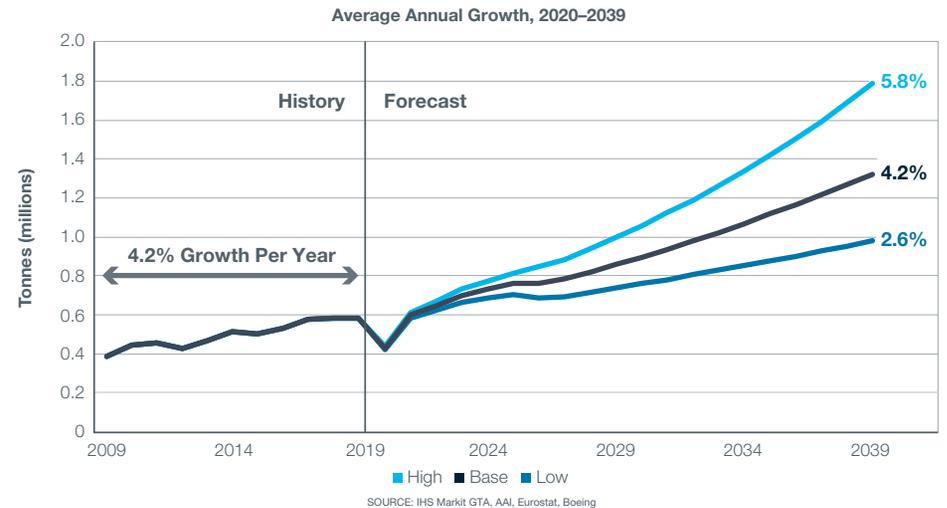
electrical equipment; and computers, office and communications hardware.

South Asia remains competitive in terms of production costs, which will drive continued air export growth to Europe. Additionally, in mid-July 2020, India and the European Union agreed to create a plan to liberalize trade policies with a formal free trade agreement. For the baseline models, Europe-to-South Asia flows are forecast to grow an average 4.7% per year, while South Asia-to-Europe flows will grow 4.2%.

Europe-to-South Asia Air Trade Will Grow 4.7% Per Year

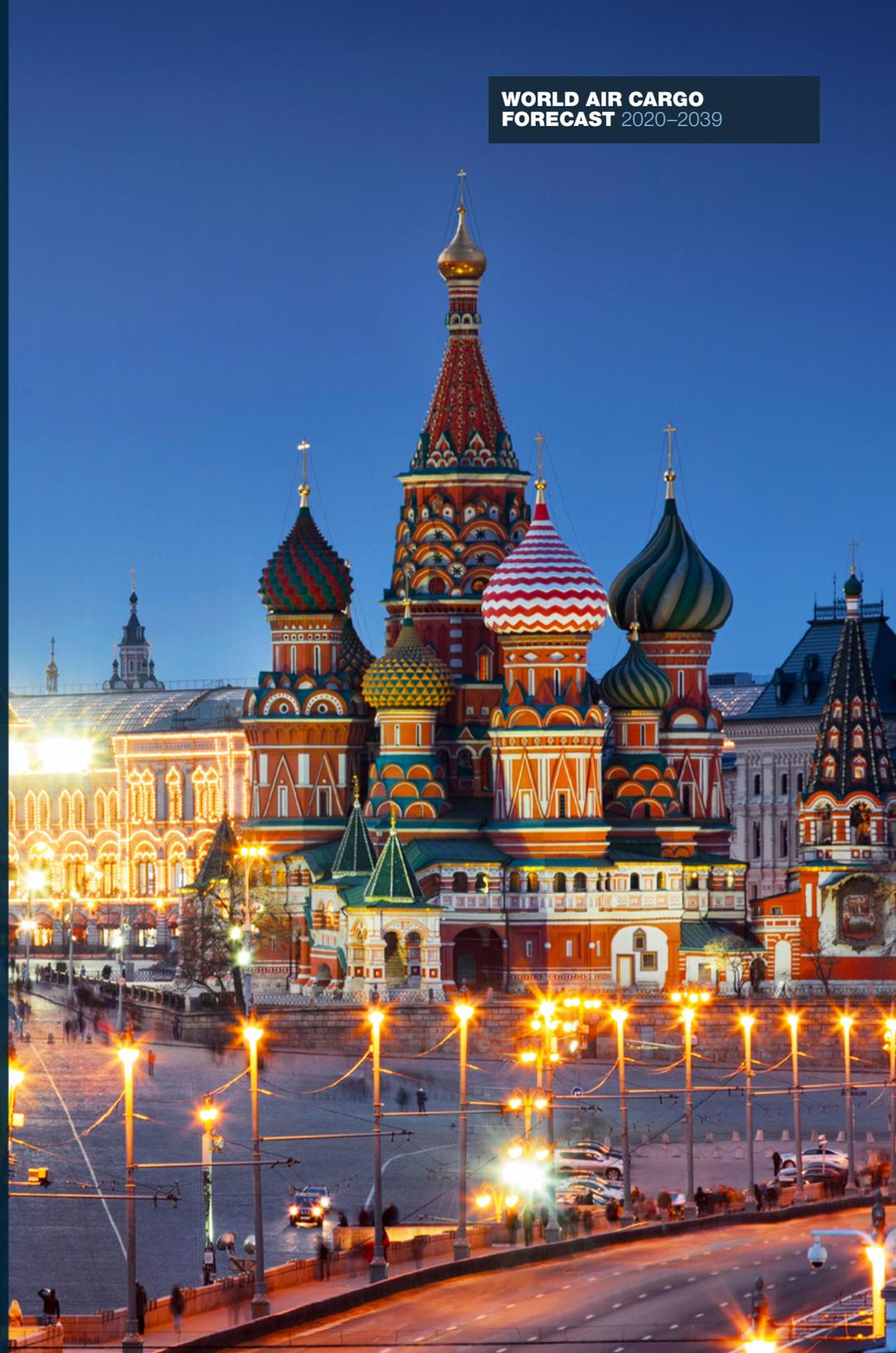


South Asia-to-Europe Air Trade Will Grow 4.2% Per Year



RUSSIA AND CENTRAL ASIA REGIONAL FORECAST

For the purposes of this forecast, Russia and Central Asia is defined as 12 of the 15 republics of the former Soviet Union, including Armenia, Azerbaijan, Belarus, Moldova, Georgia, Kazakhstan, Kyrgyzstan, the Russian Federation, Tajikistan, Turkmenistan, Ukraine and Uzbekistan. This region is bound by common historical, business and language ties.



Russia and Central Asia air trade was flat in 2019

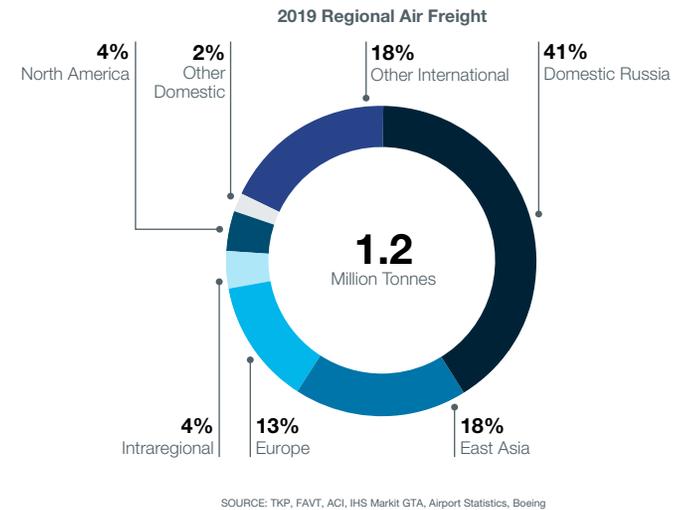
The Russia and Central Asia market accounts for approximately 1.3% of world total air cargo traffic in tonne-kilometers and 2.3% in tonnage.

Air trade originating in or destined to Russia and Central Asia was estimated at 1.2 million tonnes in 2019, based on the region's airport statistics. Growth averaged 3.3% from 2009 to 2019, based on tonnage handled at airports. Principal markets in the region include domestic Russia, Asia and Europe, with Russia commanding 75% of regional air commerce because of its size and economic concentration.

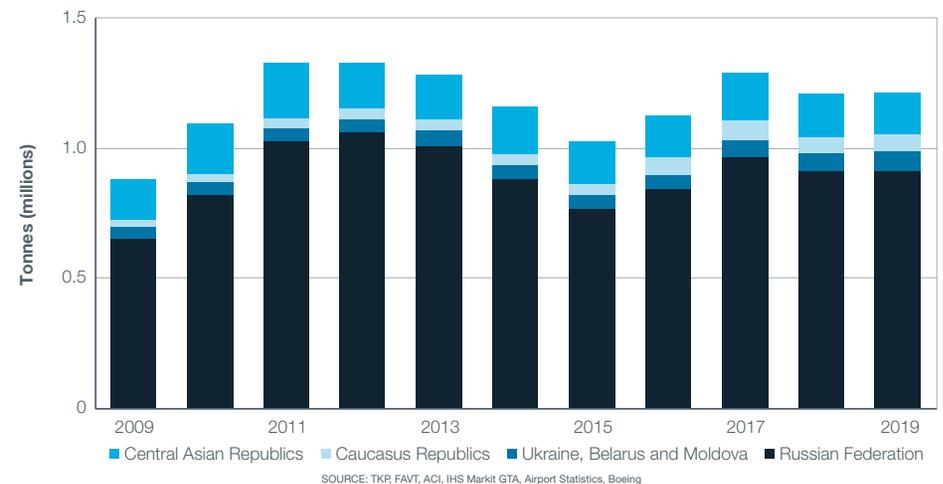
Helped by high oil and gas prices, Russia and Central Asia air trade expanded 50% after 2009, peaking at 1.3 million tonnes in 2011. Levels remained nearly the same in 2012 and then fell modestly in 2013. Contraction in the region's air cargo volumes

gathered pace in 2014 and 2015, as investment in extractive industries slowed, consumer spending fell, and trade sanctions were imposed on Russia for its support of the conflict in Ukraine. Regional air trade expanded 10% and 14% in 2016 and 2017, respectively, as the world economy recovered, commodity prices stabilized, and Russia reoriented much of its international air trade toward Asia rather than Europe. However, this period of high growth ended in 2018, as overall world trade levels began to weaken midyear. The air freight slowdown in the Russia and Central Asia region was further exacerbated as oil prices fell nearly 40% during fourth quarter 2018.

Domestic Russia Leads All Region-Related Air Trade



Russia and Central Asia Airport Air Cargo Traffic Stagnated in 2019 After Falling 5.7% in 2018



Domestic air trade

Domestic air trade is a vital part of commerce in this expansive region, particularly in Russia.

In 2019, airports reported that Russia's domestic air cargo comprised more than 489,000 tonnes, although airline totals were about half of this figure. The region's vast distances and relatively underdeveloped surface transportation links often necessitate air transport to move goods and industrial materials, especially to remote oil and

gas extraction projects in the Arctic regions, Siberia and the Russian Far East. Along with Moscow, leading air freight cities include Novosibirsk, St. Petersburg, Vladivostok, Yekaterinburg and Khabarovsk. The domestic markets of the other 11 countries of this regional bloc totaled 22,300 tonnes, as reported by airports.

International air trade

International trade, both intraregional and interregional, accounts for 696,000 tonnes of regional air cargo.

Of that, 363,000 tonnes flow to and from Russia. Kazakhstan, Azerbaijan, Ukraine and Uzbekistan account for most of the remaining tonnage (333,000 tonnes). Russia and Central Asia international air trade centers almost exclusively on European and East Asian nations.

Ongoing sanctions have reshaped the region's international air trade, particularly for Russia. Until 2015, the region's largest air trade partner was Europe. Over the past decade,

East Asia had eclipsed Europe as the region's biggest air trade partner, reaching an estimated 216,000 tonnes. Furthermore, since 2016, e-commerce-related air imports, particularly into Russia from East Asia, have been key drivers in the region's air cargo growth. For Russia specifically, during 2019, a decline of 5,000 tonnes in international air freight was offset by a rise of 7,000 tonnes of international airmail, a trend largely driven by e-commerce imports of consumer goods.

Russia and Central Asia imports

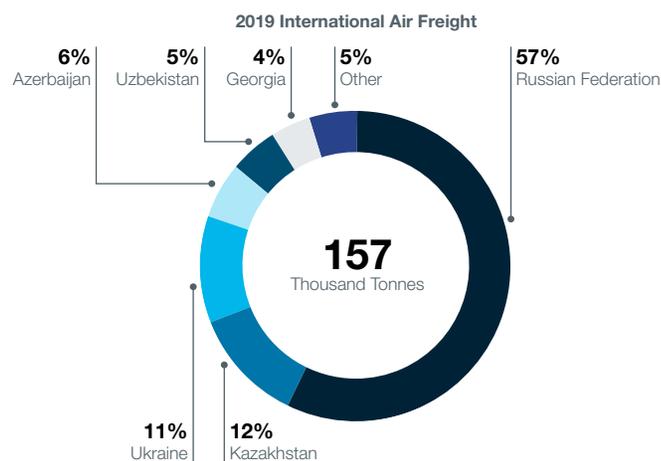
Demand for electronics, apparel, and other consumer goods — particularly from China and other East Asia countries — has helped make Russia and Central Asia–East Asia traffic one of the region's strongest flows.

However, in 2002, Russia implemented customs regulations that curbed direct air import to Russia from East Asia, leading some importers to transport Russia-bound freight to nearby countries by air before entering Russia by truck.

Despite the relatively recent surge in international air trade with East Asia, Russia and Central Asia–Europe traffic remains a large market. Total regional air trade with Europe was 157,000 tonnes in 2019, of which about 137,000 tonnes

were imports from Europe. Russia and Central Asia air imports consist primarily of intermediate manufactured goods (subcomponents, such as automobile parts), industrial machinery, apparel, flowers, and pharmaceutical and medical products. Russia and Central Asia airborne exports to Europe totaled about 20,000 tonnes in 2019. Intermediate manufactured goods, industrial machinery, jewelry, food products and aerospace equipment are the main products flown from Russia and Central Asia to Europe.

Russia and Kazakhstan Lead Regional Air Trade With Europe



SOURCE: Eurostat, TKP, IHS Markit GTA, Airport Statistics, Airline Reports, Boeing

Transit cargo movement using region-domiciled carriers

To accurately assess Russia and Central Asia air cargo traffic volumes, it is necessary to distinguish between true origin-and-destination traffic and cargo flights that stop in the region in transit to countries outside the region.

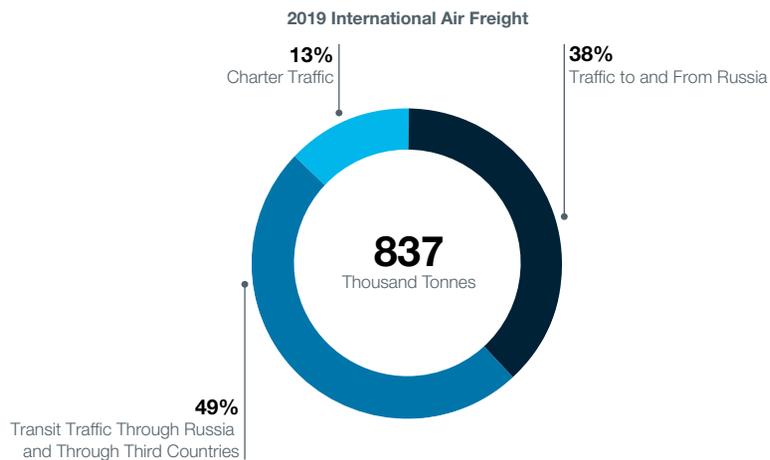
Locally based operators carry a significant portion of the region's international cargo on scheduled international flights that pass through Russia and Central Asia.

Locally based operators also provide charter services for multinational firms and foreign governments, carrying freight to and from markets unconnected to their country of domicile. Russian airlines carried an estimated 519,000 tonnes of transit

or international charter cargo in 2019, representing approximately 62% of the total international traffic on Russian carriers.

Some Russia-domiciled carriers take advantage of their central location to serve routes between Europe and East Asia. In 2019, Russian carriers transported about 282,000 tonnes between Europe and East Asia, transiting Russia without commercial stops inside the country.

Russia-Domiciled Carriers Depend on International Traffic Flows



SOURCE: TKP, Airline Reports, Boeing

Former military freighter usage

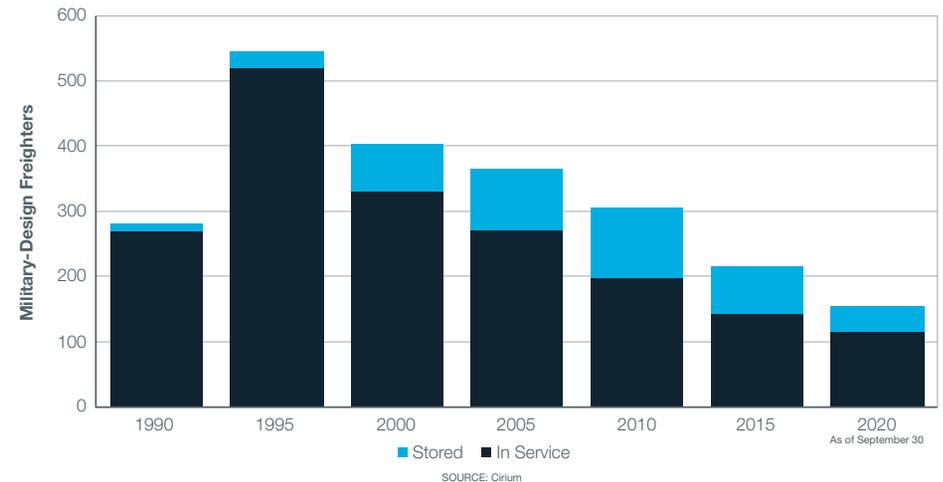
Russia and Central Asia-based airlines operate a significant number of former Soviet military turboprop and jet airplanes to run charter freight flights.

Following the end of the Soviet Union, the region saw a dramatic increase in the number of former Soviet military aircraft repurposed for charter air cargo services. The influx of readily available freighter capacity in the 1990s corresponded with a surge in new air cargo carriers because of the low acquisition cost of these aircraft.

The unique loading capabilities of Russian- or Soviet-built freighters, coupled with their ability to operate from airports with lagging infrastructure

investment, have allowed operators using charter flights to move freight that is dimensionally too large or too heavy for civilian widebody freighters. A select group of carriers in Russia and Ukraine use very large ramp-loading military freighter aircraft to serve this specialized sector, which accounted for about 26,000 tonnes of freight worldwide in 2019 (down significantly from its peak of 140,000 tonnes in 2010). Most of this outsized cargo traffic does not originate or terminate in Russia and Central Asia.

About 115 Russian- or Soviet-Manufactured Military-Design Freighters Remain in Commercial Service



In the past two decades, the number of Russian- and Soviet-built aircraft in service has declined as aging freighters have been stored or fully retired. As of third quarter 2020, about 115 locally built freighters were servicing cargo markets, a decline of more than 400 aircraft since the peak of 520 in 1995. The region's airlines are augmenting or upgrading their fleets with Western-built freighters in response to aging airplanes, high fuel consumption and community noise issues associated with military freighters.

Russia and Central Asia-built aircraft still in service continue to be called upon for outside cargo charter services around the world, predominately between Europe, North America and Asia. Typical industries and groups served by these flights include humanitarian aid efforts, oil and gas extraction, aerospace manufacturing, electrical power generation, entertainment or other infrastructure development projects.

Russia and Central Asia–Europe forecast

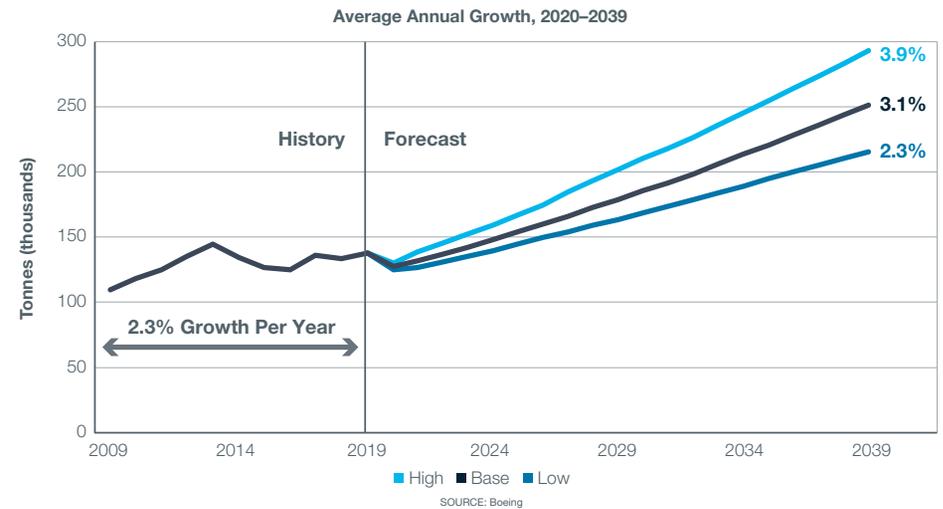
The Russia and Central Asia–Europe air cargo market will grow at an average annual rate of 3.0% for the next two decades.

Russia and Central Asia air imports from Europe are forecast to grow 3.1% per year, expanding from 137,000 tonnes in 2019 to almost 251,000 tonnes by 2039. This growth will continue to depend on petroleum prices and the development of the region's middle class. If petroleum and gas prices are able to rebound in the recovery period following the 2020 downturn induced by the COVID-19 pandemic, regional demand for European consumer goods, industrial equipment and spare parts, and oil and gas extraction equipment will recover. Air import traffic should then develop in accordance with the baseline forecast or even the high-growth projection. Conversely, a lack of economic diversification in the

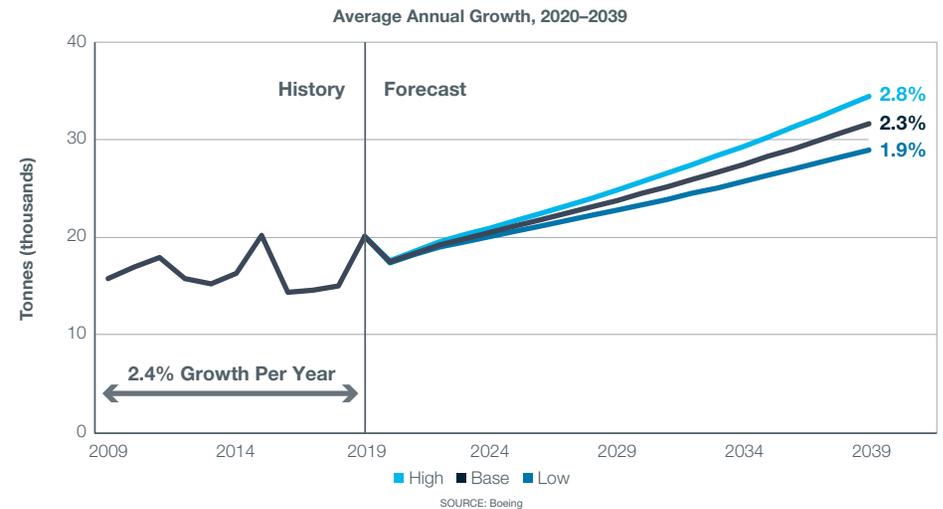
region and continuing regional conflicts will drive the trend toward the low-growth projection.

Russia and Central Asia air exports to Europe will grow at a rate of 2.3% to reach nearly 32,000 tonnes by 2039. European demand for Russia-produced intermediate manufactured goods, specialty chemicals and industrial metals, and aerospace goods will bolster growth for the forecast period. Pro-business legislation and an improved foreign investment climate could promote an export-driven economy for a wide array of manufactured and intermediate goods, leading to the high-growth projection. Conversely, continuing regional conflicts, laws and regulations

Europe-to-Russia and Central Asia Air Trade Will Grow 3.1% Per Year



Russia and Central Asia-to-Europe Air Trade Will Grow 2.3% Per Year



adverse to new businesses, or renationalization of industries would impede air trade growth, leading to the low-growth projection.

DOMESTIC CHINA REGIONAL FORECAST

For the purposes of this forecast, we define domestic China as the mainland, or what is commonly referred to as the People's Republic of China.



Domestic China air cargo traffic has grown 7.3% annually

Domestic China air cargo traffic currently accounts for 9.1% of the world's total air cargo traffic by tonnage and 2.8% of the world air cargo market in tonne-kilometer.

China has rapidly become the world's premier manufacturing center, with key industries producing commodities such as apparel, automotive, and computing and telecommunication equipment. Most of these goods are intended for export and have traditionally been transported by air.

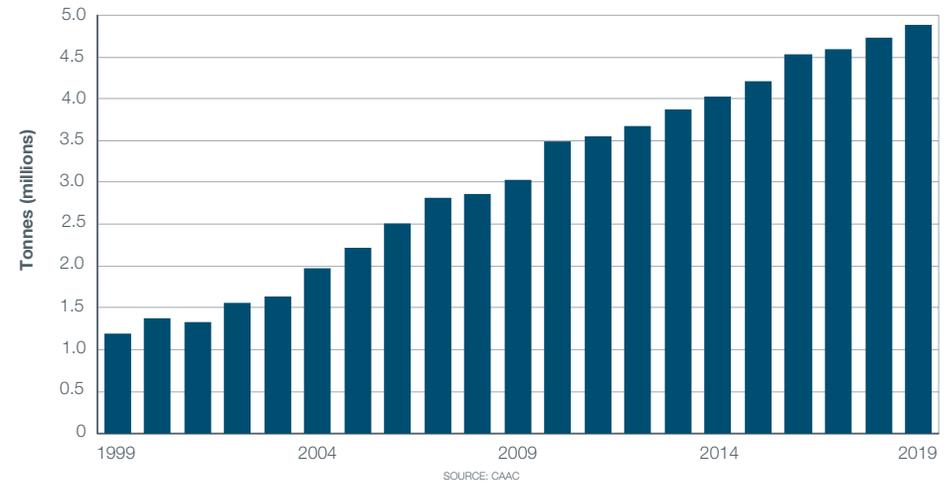
The tremendous increase in air trade with other countries throughout Asia, Europe and North America has long been a major driver of growth in domestic China air cargo traffic. During the past decade, consumer demand in China's rapidly developing large cities has become another important driver as China shifts to a consumption-driven economy. Since 2010, the service/consumption sector now contributes more than 52% of China's GDP. Consumption per capita has more than doubled. As China shifts toward a consumer economy, air traffic and air cargo demand will further accelerate.

At 4.9 million tonnes transported annually, the domestic China air

cargo market is second only to that of the United States. Air cargo activity is concentrated in the coastal and southern provinces, where the bulk of the country's 1.4 billion people and \$14.2 trillion economy is situated. Strong economic growth, rising foreign investment and competitive labor rates stimulated growth in domestic air cargo over the past 20 years, growing 7.3% per year.

For the first seven months of 2020, domestic China air cargo traffic contracted 17.1% because of the COVID-19 pandemic, which shut down the world's second largest economy for more than six weeks. Since reopening its economy, China has seen a return to pre-COVID activity levels in many industries. China's economy is recovering, but very slowly. China's economic growth for 2020 is expected to be flat.

Domestic China Air Cargo Has Grown 7.3% Per Year Since 1999



China's e-commerce growth continues

The rapidly growing e-commerce and express air cargo market will be a growth driver for the domestic China air cargo market. China boasts the world's largest e-commerce market, valued at approximately \$1.5 trillion in 2019. During the past nine years, its annual growth rate has been 36%, more than 2.4 times the U.S. growth rate of 15%.

Online sales accounted for 20.7% of China's total retail sales, up from 18.4% in 2018 and 10.6% in 2014. The two largest players in the e-commerce business in China are Alibaba and JD.com. In 2019, gross e-commerce sales revenue for Alibaba's Singles' Day sale and JD.com's 618 shopping festival were \$36.4 billion and \$29.2 billion, increases of 24.2% and 27.3% over 2018, respectively.

E-commerce continues to grow in spite of the COVID-19 pandemic. In June 2020, JD.com's 618 sales reached approximately \$38.1 billion, growing 30.5%. Strongest growth categories were health care products, groceries and kitchenware. Mobile phones, personal computers and home appliances all led in total sales.

With over 60 billion parcels moved by air annually, growing 35% per year from 2014 through 2019, airlines have responded by nearly doubling the number of freighters over the same time period. There are currently 128 freighters operating to meet China's domestic e-commerce and express market demand.

High-speed rail freight competition

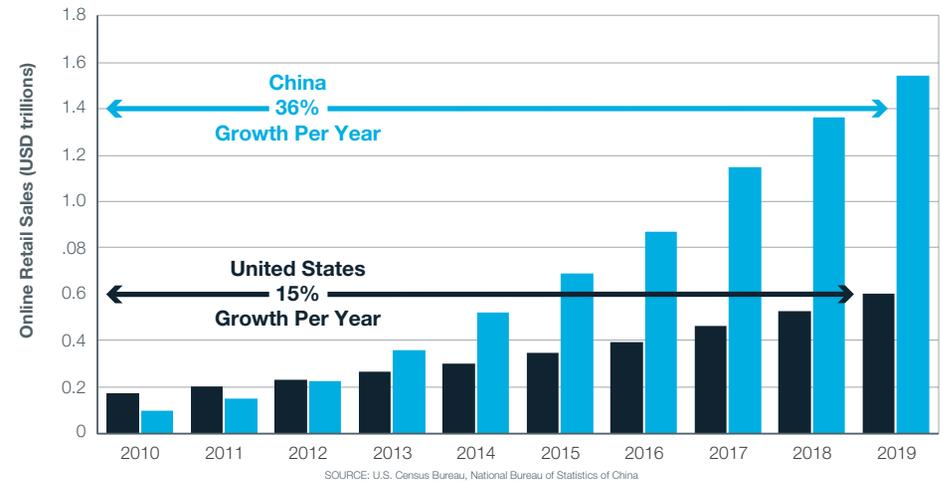
High-speed rail (HSR) in China is the world's longest and most extensively used HSR network. Developed over the past 12 years, the network has over 35,400 kilometers of track and most major cities are covered. China's HSR network is projected to double in length by 2035 under a new plan released by state-owned China Railway Group.

The development of HSR services has raised the question of its potential for freight transport. The extensive HSR passenger network can provide a foundation for developing HSR freight. At \$1.5 trillion, China is the largest e-commerce market, growing nearly 25% per year over the last five years. Strong growth in the e-commerce and express cargo market further illustrates the need for fast service deliveries dedicated to the movement of goods.

Singles' Day 2019 (or Double 11) marked the fourth year that China's Fuxing bullet train was used for China's largest shopping day. The number of parcels handled on November 11 was three times that of a normal day. HSR freight service has shown to be useful in augmenting freight capacity during peak times.

HSR freight service is fairly new and still faces many challenges. HSR in China is mainly designed for passenger traffic, so its operation does not take into consideration freight traffic requirements. Existing platforms do not include freight access and trans-

China's Online Retail Sales Have Passed US\$1.5 Trillion



shipment facilities. HSR stations and parcel distribution centers are far from each other. HSR freight service is only suitable for delivery of small or light cargo because the HSR infrastructure was designed for passenger trains and is subject to weight limits.

In addition, current HSR stations do not presently have cargo warehouses, stacking areas, loading and unloading machines, sorting facilities, and other systems designed to move cargo on a large scale. The current passenger-dedicated line will also need to be transformed to passenger-freight mixed service.

Current HSR freight service mainly uses vacant HSR passenger carriages. Operation time and schedule services are constrained by passenger traffic. Therefore, it may be necessary to offer a dedicated high-speed freight train. However, a dedicated high-

speed freight train would require sufficient volume guarantee. Thus, volume guarantee from mail and parcel delivery companies or other shippers will be essential to the success of a dedicated HSR freight service.

Although HSR freight service does show potential, especially in providing added cargo capacity during peak times, there are many challenges it must contend with for it to be a viable and profitable business. The use of HSR freight service may be limited to a few dense lanes to support local express package traffic demand. With China's strong e-commerce and express market growth, HSR freight services would be complementary to the air cargo business.

Domestic China forecast

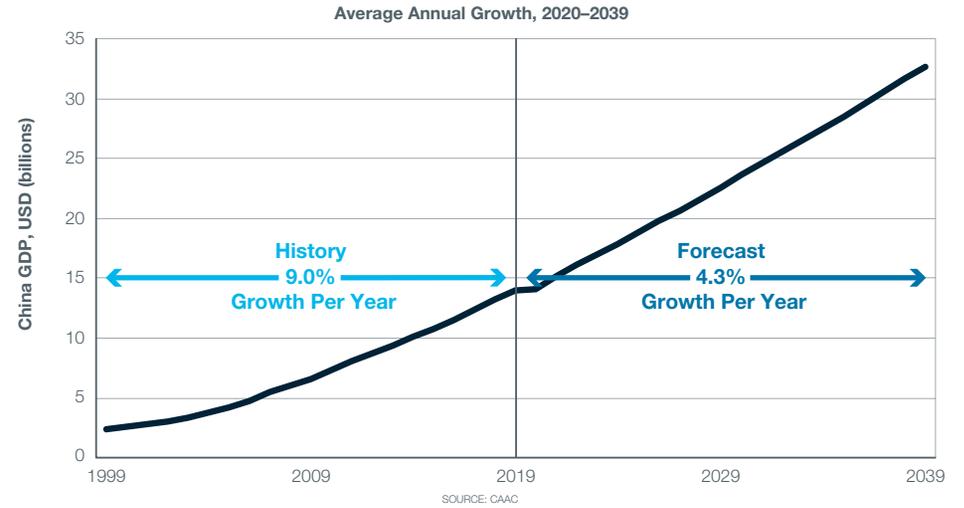
China's GDP is forecast to grow 4.3% per year in the next 20 years. China currently accounts for 55% of East Asia GDP and is projected to account for 65% of East Asia GDP by 2039.

Base-, low- and high-growth GDP models were developed to forecast domestic China air cargo growth. The low- and high-growth air cargo scenarios reflect GDP projections

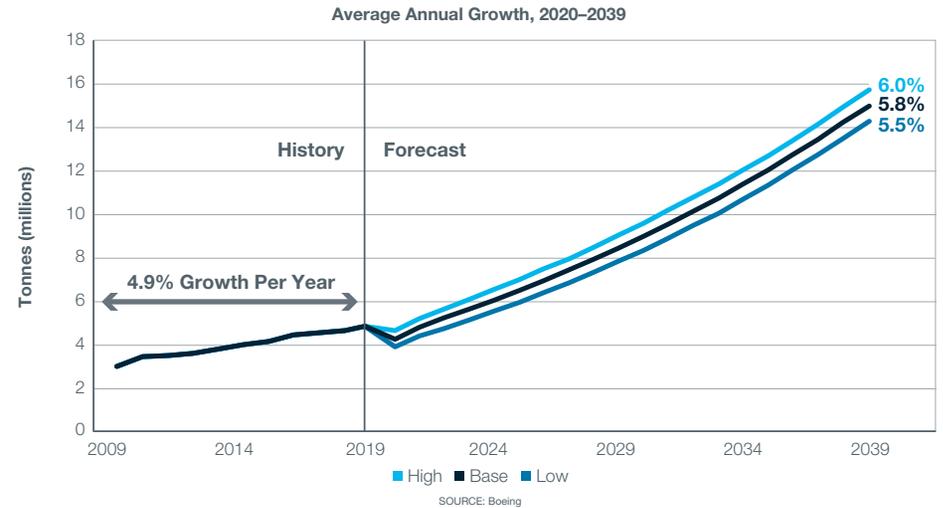
for 0.5% below and 0.5% above the baseline GDP per capita growth, respectively.

Overall, domestic China air trade will grow 5.8% annually for the forecast period, with most rapid growth in the first half and slowing down in the second half, in conjunction with GDP and population growth rates.

China's GDP Is Expected to Increase 2.3 Times Over the Next 20 Years



Domestic China Air Cargo Traffic Will Grow 5.8% Per Year



WORLD FREIGHTER FLEET FORECAST



The Role of Freighters in Air Cargo

Freighters comprise less than 8% of the total commercial jet fleet, yet they carry more than 50% of all air cargo traffic. Their essential role in the global supply chain is underpinned by a number of factors.

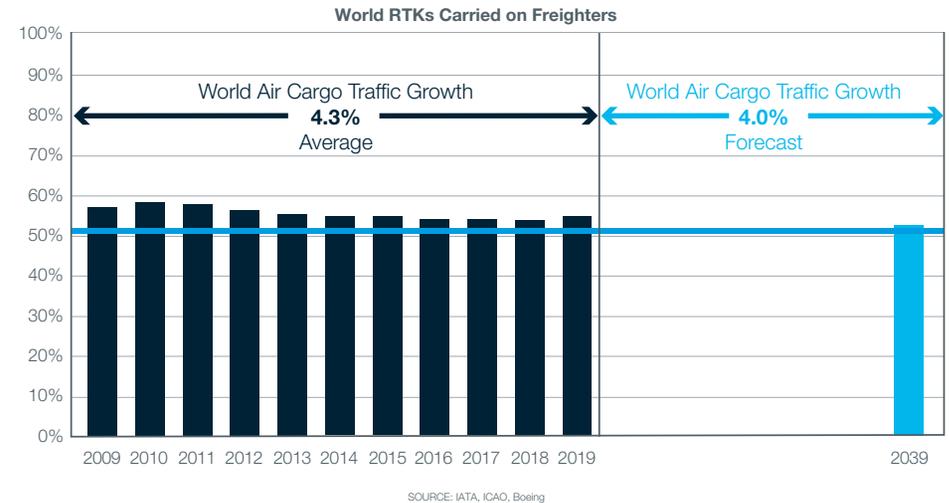
- Of the 26,000 jet transports in service at year-end 2019, over 19,000 were single-aisle and/or regional jet airplanes that do not have lower holds to accommodate freight pallets or containers. Freight forwarders prefer palletized capacity, which is only available on widebody passenger or freighter airplanes.
- Most passenger airplanes with lower-hold capacity do not serve key trade routes, and for such routings, freighters are the most efficient form of cargo transport.
- Dedicated freighter services offer control over timing and routing that is unmatched by lower-hold capacity. As air cargo is an industrial tool, demand for cargo capacity surges on weekends as shippers try to use idle time between different factories as the “warehouse in transit.” Consequently, twin-aisle passenger airline schedules often

do not meet shipper timing needs for industrial demand.

- Freighters offer speed to market for high-value, time-sensitive products such as capital equipment, electronics, pharmaceuticals, fashion goods and perishable commodities.
- Passenger airplane lower holds are severely limited for transporting hazardous materials and project cargo, meaning a group of shipments moving as one aggregated consignment. The grounding of much of the world’s passenger airplane fleet because of the COVID-19 pandemic during 2020 has only served to underscore the importance of freighters. With the removal of significant twin-aisle passenger airplane lower-hold capacity, freighter utilization rates from March through September 2020 surged up to 20% over 2019 levels to partially compensate for this missing capacity.

Nearly 90% of all air cargo revenue is generated by airlines that operate freighters. Freighters augment an airline’s cargo operations, helping the airline compete more effectively.

Freighters Will Continue to Carry Over 50% of World Air Cargo Traffic



Types of freighters

The freighter fleet forecast categorizes airplanes by capacity, measured in tonnes.

Standard-body freighters are those with less than 45 tonnes of carrying capacity. Fuselage cross-sections are those of single-aisle airplanes. Standard-body freighters are supplied to the industry almost exclusively through the conversion channel. The uptake of factory-built small freighters has been modest and is not expected to increase.

Medium widebody freighters have capacities of 40 to 80 tonnes. In

cross-section, these are twin-aisle airplanes. They are supplied through both conversion and production, with the product mix influenced by operator requirements as well as feedstock availability.

Large freighters are those with more than 80 tonnes of capacity. Although large freighters were historically sourced from both the conversion and factory-production channels, we believe that, in the future, demand in this segment will favor factory production.

Freighters for replacement and growth

The freighter fleet forecast calls for 3,260 airplanes in service by 2039, an increase of over 60% against the in-service 2019 fleet of 2,010.

During the forecast period, we expect 1,180 retirements of older and less-efficient types, which will create demand for replacement by new conversion and production airplanes.

In addition, we forecast that 1,250 airplanes will be required for growth. In the immediate aftermath of the

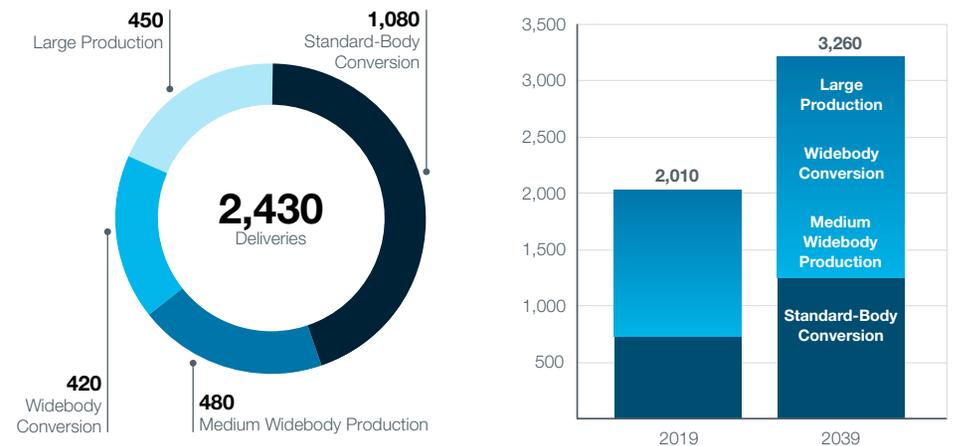
COVID-19 pandemic, a reduction of widebody passenger flights diverted time-sensitive cargo toward dedicated freighter services, resulting in increased activity and strong yields. Longer term, we expect the increase in e-commerce and the global spread of express services to support further growth. Passenger lower-hold capacity is an imperfect substitute for the critical advantages of freighter services, and the need for dedicated freighters will continue.

Freighter Fleets Are Categorized by Capacity

| Standard Body <45 tonnes | Medium Widebody 40–80 tonnes | Large >80 tonnes |
|-----------------------------|---------------------------------|---------------------|
| Boeing 727 | Boeing 767 | Boeing 747 |
| Boeing 737 | Boeing DC-10 | Boeing 777 |
| Boeing 757 | Airbus A300/A310 | Boeing MD-11 |
| Boeing MD-80 | Airbus A330 | Antonov An-124 |
| Boeing DC-9 | Ilyushin Il-76TD | Ilyushin Il-96T |
| Airbus A320 Series | | |

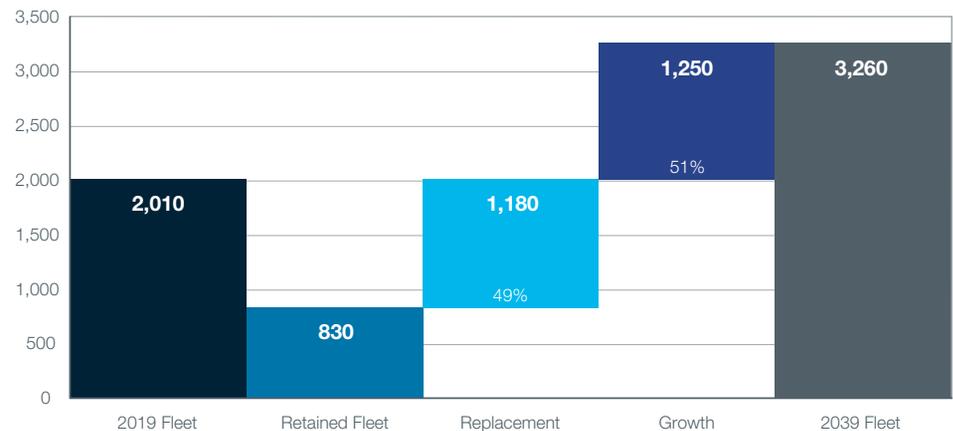
NOTE: Production and conversion models assumed for each type unless otherwise specified.

Freighter Fleet Will Grow Over 60% by 2039



SOURCE: Boeing

2,430 Freighters Required for Growth and Replacement



SOURCE: Boeing

Cargo airlines: cargo specialists and general-market operators

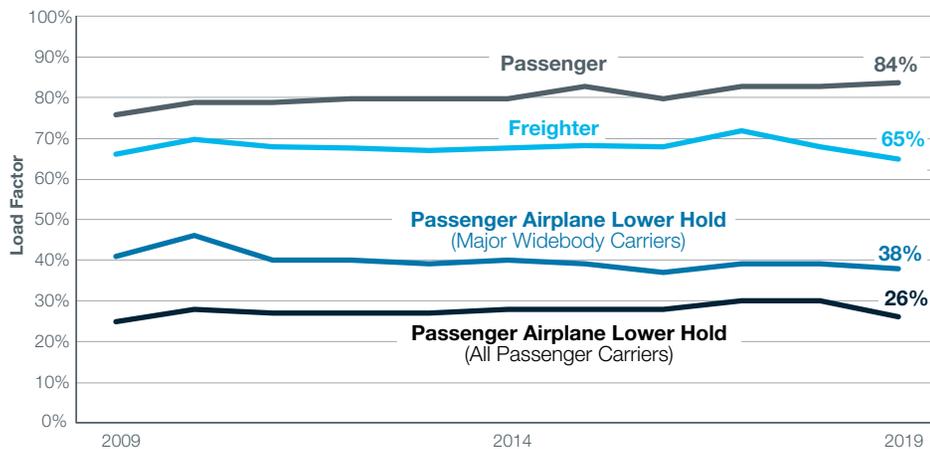
Cargo specialists only operate freighters. They may, or may not, contract with passenger airlines for use of lower-hold capacity. Such players are strong competitors in market niches with specialized requirements, such as outsize cargo or cold chain.

General-market operators are often combination carriers, flying both passengers and cargo. Lower holds on passenger flights are used to feed freighter flights. Historically, the passenger lower-hold cargo load factor has been about half the cargo load factor of dedicated freighter operations. Passenger airlines that operate freighters achieve much better load factors in the lower hold than passenger airlines that carry cargo but do not operate freighters, emphasizing the critical role that freighters play in creating effective cargo networks.

Both operator types tend to use their freighters in similar ways, flying relatively short stages, loading and offloading cargo at various points along a general route, in a pattern that is variously known as “load building.” Sixth freedom cargo hubs are also a feature of these networks, given that the bilateral agreements covering cargo carriage tend to be more liberal than those covering passenger travel.

Cargo specialists and general-market operators have high utilization rates and are successful at building loads that fully utilize the structural and volumetric capabilities of the aircraft. These airlines emphasize unit costs over acquisition costs, resulting in a preference for large, capable, factory-built freighters.

Freighter Cargo Load Factors Double That of Passenger Lower Holds



SOURCE: IATA, ICAO, Boeing

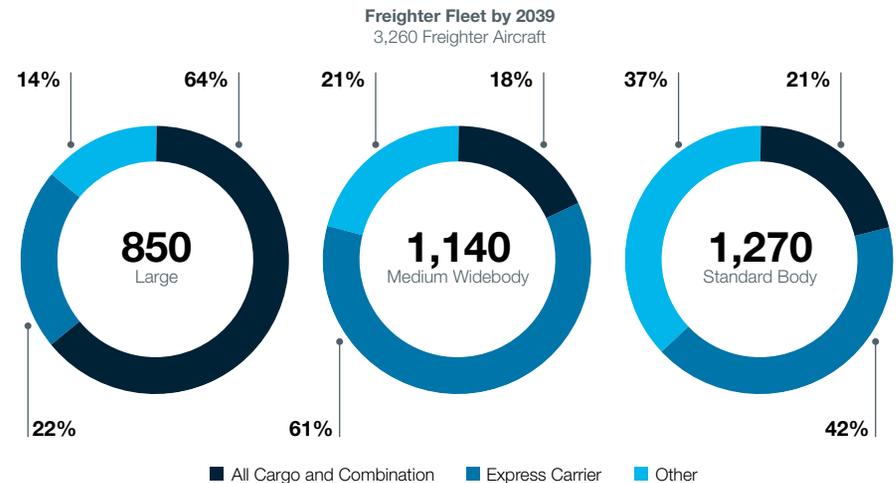
Cargo airlines: express

Express carriers have a different business model, moving large numbers of smaller shipments and using other modes of transport to reach the final recipient. For these carriers, the average cargo density (weight or unit volume) is less than for general freight operators. The time-definite services provided by express carriers provide higher yields, while utilization rates (flight-hours per day) can be very low without affecting profitability. Networks tend to be of the hub-and-spoke variety, with flights arriving at the central hub at night and departing again to facilitate the morning’s deliveries. Much of this flying is domestic, or within defined trading blocs, rather than on long-haul international routes.

Because payload density and airplane utilization are lower than those of

general freight operators, express operators tend to balance unit cost against acquisition cost and the need to cover routes in the network with daily frequencies or better. These airlines fly a mix of freighters, with sizes ranging from small to large, sourcing airplanes opportunistically from conversion suppliers or from airframe manufacturers. Because of this unique focus on the balance of capability, acquisition cost and unit cost, the express carriers use medium freighters to a greater extent than other cargo airlines. Express carriers also require large numbers of standard-body freighters, sourced through the conversion channel, to support the lower-volume nodes in their networks.

Large Freighters Serve General Carriers; Medium Widebodies for Express



SOURCE: Boeing

Emerging markets and startups

Emerging-market cargo airlines and startups share some common attributes.

- They often serve markets with small cargo volumes.
- Their networks are still in early stages of development, limiting opportunities for load building and sixth freedom operations.
- They are more sensitive to acquisition than operating costs.

Because of the small cargo volumes and acquisition-cost sensitivity, startups and emerging-market operators gravitate toward standard-body freighters, which cost much less to purchase than other types of freighters.

Similarly, these airlines favor converted airplanes, given the limited options and higher costs of purpose-built freighters.

While there is a niche for converting airplane types that have not proved popular in passenger operations, more conversions are based on types that have widespread use in the passenger market. One consideration is feedstock; the more popular passenger airplanes will become readily available for conversion as they are released from passenger airlines, as there are simply more of them in the fleet. But feedstock availability does not provide the whole story. Other factors such as required structural modifications or technical issues may limit the passenger-to-freighter conversion viability of an airplane type.

Regional outlook

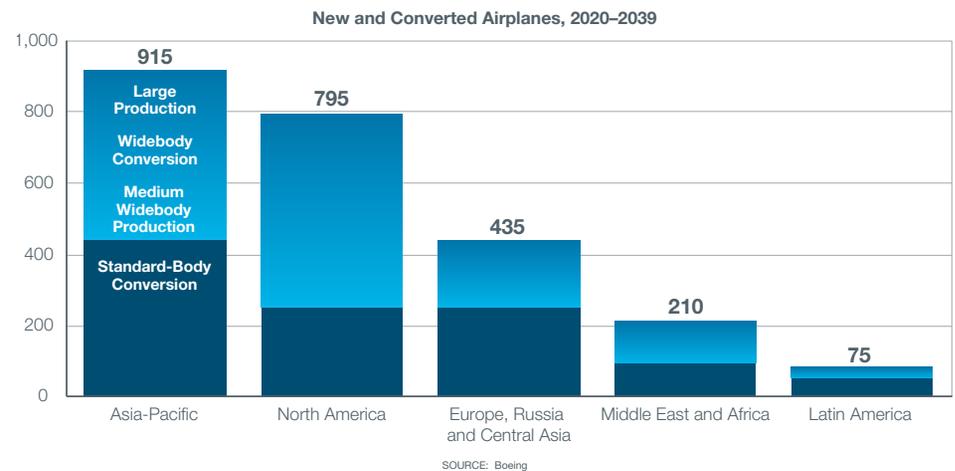
As the engine of global economic growth, the Asia-Pacific region will continue as the largest market for new and converted freighters in the next 20 years. The build-out of express networks within China is fueling demand for standard-body freighter conversions as well as medium widebodies, while the continued importance of cargo-intensive international routes supports the need for large freighters.

North America is the second-largest market for freighter deliveries, with needs driven mainly by express carriers domiciled in the United States. As noted, these airlines will require a large number of medium widebody freighters, supporting a balance of moving cargo with relatively low-density

cargo volumes and providing daily flights to connect all network nodes. We expect that these airplanes will be mainly sourced as purpose-built aircraft rather than conversions, although the decisions of key industry players can influence the product mix.

Demand for large freighters in Europe, Russia and Central Asia, the Middle East and Africa is supported by several all-cargo and combination carriers domiciled in these regions, who provide sixth freedom freight services and operate networks that are global in scope.

Asia-Pacific Region Expected to Receive Majority of Deliveries



FORECAST METHODOLOGY



Boeing publishes the World Air Cargo Forecast (WACF) to provide a comprehensive, up-to-date overview of the air cargo industry. The forecast summarizes the world's major air trade markets, identifies major trends, and presents forecasts for the future performance and development of markets, as well as for the world freighter airplane fleet. The forecasting process involves several approaches and a variety of data sources.

Econometric Modeling

Econometric modeling helps determine the overall importance of underlying economic factors, such as GDP, and provides forecasts that are linked to expectations of those factors. This method is useful for medium- and long-range forecasts in regional markets.

Judgmental Evaluation

Judgmental modifications often account for expected changes in non-econometric growth factors. For example, estimating the effect of air service agreements, trade quotas,

restrictions on airport night operations and changes in trade patterns could be vital to an airline's strategic plan. Incorporation of anticipated increases in capacity, route restructuring and market programs can contribute to more reasonable forecasts.

Trend Analysis

A trend analysis is used to evaluate changes in economic factors. This approach is useful in evaluating general changes in the marketplace that can be attributed to the combined effects of a number of factors. Such trends can be extrapolated into the future.

Demand Pulls Air Cargo Traffic



SOURCE: Boeing

Freighter Fleet Forecast

The freighter fleet forecast begins with air cargo traffic forecasts. Traffic is allocated to main-deck and lower-hold services, then to domiciles and airline groups, and finally to equipment types. Results are checked for balance by traffic flow, operator domicile, equipment type, airline market share, manufacturer capacity and conversion capacity. Forecast inputs include our internally developed Airline Cargo Traffic Database (ACTD), current business intelligence and the strategic direction of industry players. Our forecast allows for changes in industrial structure; it is not a simple extension of current trends.

The Freighter Fleet Forecast is integrated with the Boeing Commercial Market Outlook. **Find out more at www.boeing.com/cmo.**

Data Sources

Data represented as historical in this document were compiled from many sources, including but not limited to airline reports, airport statistics, Airports Authority of India (AAI), Airports Council International (ACI), Association of Asia Pacific Airlines (AAPA), Association of European Airlines (AEA), Boeing Foreign Trade Database, Cargo Facts Consulting, Cirium, Civil Aviation Administration of China (CAAC), Clarkson Research Services Limited (CRSL), Diiio, Directorate General of Civil Aviation (DGCA) of India, Drewry Maritime Research, Eurostat, Federal Agency

for Air Transport (FAVT) of Russia, IHS Markit Global Trade Atlas (GTA), International Air Transport Association (IATA), International Civil Aviation Organization (ICAO), Johns Hopkins University School of Advanced International Studies—China Africa Research Initiative, National Bureau of Statistics (NBS) of China, Oxford Economics, Transport Clearing House (TKP) of Russia, U.N. Probabilistic Population Projections 2019, U.S. Census Bureau, U.S. Department of Commerce (DOC), and U.S. Department of Transportation (DOT).

Aircraft, crew, maintenance and insurance (ACMI): Package (or wet) lease of an airplane. The package includes the airplane, crew, maintenance and insurance, but excludes fuel.

Air freight: Goods shipped by air that do not include mail.

Available tonne-kilometer (ATK): One tonne of available freight capacity for one kilometer. Basically, the number of tonnes that can be carried multiplied by the number of kilometers flown.

Cargo: Freight, express and airmail (for the purposes of this document).

Chartered operations: Reservation of an aircraft for private transport of goods, people or both.

Combination carrier: A commercial operator (scheduled and chartered) that carries both passengers and cargo on revenue flights. Most do so on passenger airplanes with cargo in the lower hold, but many of the world's largest cargo carriers also operate freighters in addition to passenger airplanes.

Daily shipment count: An alternative method of recording revenue cargo traffic volume in addition to more

conventional measures such as weight (e.g., tonnes) and combining weight with distance (e.g., revenue tonne-kilometers). Most often used by integrated (express) carriers because their business is composed largely of smaller parcels.

Express shipments: Cargo with a guaranteed or time-definite service component. Express carriers usually are characterized as integrated because, in addition to carrying mostly airport-to-airport, time-definite cargo, they also offer many other services, such as door-to-door pickup and delivery.

Feedstock: Used passenger aircraft available and ready to convert to freighters.

Freight forwarder: Entity that organizes the shipment of goods from the originating company to end market, consumer or distribution location.

Freight tonne-kilometer (FTK): One tonne of cargo carried one kilometer.

Integrator: A cargo company that offers its customers complete services: pickup, airport-to-airport transport, delivery and all the supporting ancillary services. Usually synonymous with a carrier that provides express services.

Load factor: Revenue tonne-kilometers divided by available tonne-kilometers.

Outsize cargo: Freight that is larger than can be accommodated on standard pallets. Often carried by a nose door-equipped 747 or a purpose-built Russian freighter.

Payload: The part of an aircraft load from which revenue is derived.

Revenue tonne-kilometer (RTK): One tonne of revenue freight carried one kilometer. Usually used interchangeably with freight tonne-kilometer but can include passenger weight for total revenue.

Scheduled operations: Aircraft flights operated on a predetermined schedule.

Sea-air market: A market in which cargo is transported from origin to destination by sea and air, taking advantage of the lower cost by ship between seaports and the speed of air over landmasses to balance time and cost.

Sixth freedom: The right to carry passengers or cargo from a second country to a third country by stopping in one's own country.

Truck flight: Also known as “road feeder service” (RFS). Cargo that is transported by surface, usually by a dedicated truck, on an airway bill. Carriage between origin and destination may be exclusively by surface or also may feed into airport-to-airport or surface transportation.

Utilization: Amount of time that an aircraft is used per unit of time.

Wet lease: An arrangement that covers all facets of operating an airplane on a carrier's behalf. Includes the airframe; crew; and most, if not all, of the airplane-related expense items.

Yield: Airline charges as measured in units of aggregated weight and distance (e.g., revenue per tonne-kilometer). Inclusion of surcharges, usually security or fuel or both, varies by the carrier reporting.

APPENDIX



World airline traffic by region of domicile

RTKs in millions

AFRICA

| Category | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019* |
|-------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Scheduled Freight | 1,944 | 2,603 | 2,508 | 2,910 | 2,970 | 3,206 | 3,211 | 3,279 | 4,105 | 4,079 | 4,462 |
| Charter Freight | 287 | 339 | 346 | 180 | 98 | 125 | 142 | 139 | 179 | 194 | 102 |
| Mail | 49 | 56 | 57 | 62 | 79 | 77 | 75 | 111 | 135 | 116 | 117 |
| Total** | 2,279 | 2,998 | 2,911 | 3,152 | 3,148 | 3,407 | 3,427 | 3,529 | 4,419 | 4,390 | 4,680 |

EAST ASIA AND OCEANIA

| Category | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019* |
|-------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Scheduled Freight | 63,117 | 78,142 | 75,363 | 70,640 | 70,573 | 75,878 | 77,995 | 79,577 | 86,731 | 88,907 | 83,774 |
| Charter Freight | 520 | 843 | 627 | 1,094 | 778 | 571 | 831 | 850 | 337 | 248 | 1,005 |
| Mail | 1,725 | 1,887 | 2,014 | 2,015 | 2,236 | 2,527 | 2,640 | 2,710 | 2,974 | 2,841 | 2,607 |
| Total** | 65,362 | 80,872 | 78,003 | 73,749 | 73,587 | 78,976 | 81,466 | 83,136 | 90,042 | 91,997 | 87,385 |

RUSSIA AND CENTRAL ASIA

| Category | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019* |
|-------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|---------------|---------------|---------------|
| Scheduled Freight | 2,944 | 4,144 | 4,687 | 5,148 | 5,281 | 5,713 | 6,540 | 8,106 | 9,919 | 9,718 | 9,070 |
| Charter Freight | 1,375 | 1,603 | 1,396 | 1,014 | 780 | 769 | 776 | 758 | 1,008 | 1,252 | 950 |
| Mail | 69 | 86 | 98 | 113 | 119 | 131 | 131 | 143 | 203 | 208 | 240 |
| Total** | 4,387 | 5,833 | 6,181 | 6,275 | 6,181 | 6,613 | 7,447 | 9,007 | 11,131 | 11,178 | 10,260 |

EUROPE

| Category | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019* |
|-------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Scheduled Freight | 32,878 | 37,792 | 39,717 | 41,263 | 41,638 | 42,495 | 41,314 | 43,379 | 48,127 | 49,935 | 50,426 |
| Charter Freight | 3,561 | 4,101 | 4,077 | 1,361 | 1,373 | 1,268 | 1,308 | 1,572 | 2,203 | 3,700 | 2,578 |
| Mail | 1,030 | 946 | 1,016 | 1,054 | 1,146 | 1,187 | 1,266 | 1,225 | 1,289 | 1,233 | 1,211 |
| Total** | 37,470 | 42,838 | 44,810 | 43,678 | 44,157 | 44,950 | 43,888 | 46,176 | 51,619 | 54,868 | 54,215 |

* Preliminary; complete for airline reports received as of October 2020.

** RTK totals may not sum equally because of numerical rounding.

World airline traffic by region of domicile

RTKs in millions

LATIN AMERICA

| Category | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019* |
|-------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Scheduled Freight | 4,048 | 4,393 | 4,481 | 4,742 | 5,877 | 5,974 | 5,934 | 5,992 | 6,306 | 6,734 | 6,688 |
| Charter Freight | 204 | 230 | 134 | 80 | 118 | 77 | 49 | 73 | 134 | 408 | 440 |
| Mail | 48 | 55 | 93 | 132 | 130 | 147 | 123 | 70 | 67 | 228 | 242 |
| Total** | 4,301 | 4,677 | 4,708 | 4,954 | 6,125 | 6,198 | 6,106 | 6,134 | 6,507 | 7,371 | 7,370 |

MIDDLE EAST

| Category | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019* |
|-------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Scheduled Freight | 12,801 | 16,226 | 17,656 | 20,165 | 22,683 | 24,986 | 28,133 | 30,324 | 33,081 | 34,000 | 32,173 |
| Charter Freight | 155 | 146 | 148 | 148 | 217 | 150 | 174 | 207 | 90 | 84 | 311 |
| Mail | 242 | 266 | 161 | 132 | 158 | 224 | 331 | 440 | 557 | 725 | 700 |
| Total** | 13,198 | 16,638 | 17,966 | 20,445 | 23,058 | 25,361 | 28,637 | 30,970 | 33,728 | 34,808 | 33,185 |

NORTH AMERICA

| Category | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019* |
|-------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Scheduled Freight | 36,375 | 41,300 | 41,443 | 40,977 | 40,679 | 42,897 | 43,475 | 44,672 | 48,167 | 49,773 | 49,559 |
| Charter Freight | 5,390 | 7,036 | 7,722 | 8,803 | 8,518 | 7,894 | 8,108 | 8,582 | 10,001 | 12,232 | 12,546 |
| Mail | 1,942 | 1,911 | 1,907 | 1,827 | 1,855 | 1,686 | 1,757 | 1,645 | 1,879 | 1,871 | 1,892 |
| Total** | 43,707 | 50,248 | 51,072 | 51,608 | 51,053 | 52,478 | 53,339 | 54,899 | 60,047 | 63,876 | 63,997 |

SOUTH ASIA

| Category | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019* |
|-------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Scheduled Freight | 1,948 | 2,565 | 2,563 | 2,389 | 2,516 | 2,543 | 2,466 | 2,385 | 3,001 | 3,310 | 2,539 |
| Charter Freight | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mail | 87 | 86 | 61 | 55 | 52 | 63 | 68 | 66 | 87 | 82 | 71 |
| Total** | 2,036 | 2,650 | 2,624 | 2,444 | 2,568 | 2,606 | 2,534 | 2,451 | 3,088 | 3,392 | 2,610 |

WORLD

| Category | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019* |
|-------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Scheduled Freight | 156,056 | 187,166 | 188,418 | 188,234 | 192,218 | 203,691 | 209,067 | 217,713 | 239,437 | 246,457 | 238,690 |
| Charter Freight | 11,491 | 14,298 | 14,450 | 12,681 | 11,883 | 10,854 | 11,387 | 12,180 | 13,952 | 18,118 | 17,931 |
| Mail | 5,192 | 5,292 | 5,408 | 5,390 | 5,776 | 6,043 | 6,389 | 6,410 | 7,191 | 7,305 | 7,080 |
| Total** | 172,739 | 206,756 | 208,276 | 206,306 | 209,877 | 220,589 | 226,844 | 236,303 | 260,580 | 271,880 | 263,701 |

* Preliminary; complete for airline reports received as of October 2020.

** RTK totals may not sum equally because of numerical rounding.



For more information, visit our website
[boeing.com/wacf](https://www.boeing.com/wacf)

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