



# WORLD AIR CARGO FORECAST

2018–2037



# FOREWORD

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 2018–2037 production team included Boeing Creative Services, Digital Strategy Team, and our colleagues in the Market Analysis Group. We give special thanks to Ryo Abe for his diligent efforts on the Airline Cargo Traffic Database (ACTD), which includes more than 800 airlines, as well as his research and authoring of the Intra-Europe and South Asia chapters. Thank you also to Wendy Moore, who researched and modeled the air freight yield curves in the Air Cargo Industry Overview; Katrina Krebs, for development of the North America chapter; Adin Herzog, who authored the Latin America and Europe chapter, analyzed the historical airline cargo revenues, and assisted in the development of the Air Cargo Industry Overview; Ben Su, for analysis and authoring of the Latin America and North America chapter; and Jayden Lee, who developed the insights and analysis behind the Intra–East Asia and Oceania chapter and the Executive Summary. Lastly, we would like to acknowledge the professional work accomplished by summer interns Calvin Jin, Oybek Muminov, and Jamshid Tokhirov, who assisted in the research and authoring of the Europe and North America, East Asia and North America, and Domestic China chapters, respectively.

**The next update to the WACF will appear in fourth quarter 2020.** The authors welcome any questions or comments readers may have. All queries and suggestions should be directed to the following:

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# TABLE OF CONTENTS

Executive Summary	4
Air Cargo Industry Overview	10
<b>North America</b>	<b>22</b>
Latin America and North America	27
Latin America and Europe	31
Europe and North America	35
Intra-Europe	38
Middle East	42
Africa	45
East Asia and North America	50
Europe and East Asia	54
Intra-East Asia and Oceania	57
South Asia	61
Russia and Central Asia	66
Domestic China	71
World Freighter Fleet	75
Forecast Methodology	81
Glossary	82
Appendix	83



# EXECUTIVE SUMMARY

## AIR CARGO MARKETS HAVE RECOVERED

Following several years of weak demand and a lagging recovery following the global economic downturn, air cargo traffic fully recovered in 2017. Air cargo traffic grew 10.1 percent, more than double the long-term average growth rate of 4.2 percent. Three key elements support the recent strong uptick in the air cargo market: synchronized global economic expansion, increasing industrial production, and world trade growth. In addition, air cargo traffic greatly outpaced capacity growth in the last two years, absorbing excess capacity in the market. Air freight operators have benefited as a result of rising load factors and yields that have improved profitability.

While global air freight growth has moderated in 2018 after unusually strong growth in 2017, many indicators show that the air cargo market is fundamentally well positioned to sustain the growth momentum at or above the long-term trend. In addition to underlying macroeconomic trends, strong growth in e-commerce will play an increasingly important role in air cargo markets. Generally, goods transported by air, such as time-sensitive perishables and high-value commodities including computers, consumer electronics, and pharmaceuticals, are some of the fastest-growing trade flows around the world.

While there are potential risks in the market, including trade tensions and volatile fuel prices, air cargo market fundamentals remain favorable. In 2018, air cargo transport measured in revenue tonne-kilometers (RTK) is forecast to grow 4 percent and cargo revenue is expected to exceed \$100 billion.

## 2017 AIR CARGO GROWTH BY MAJOR MARKET

<b>World 10.1%</b>	<b>Latin America–Europe 6.2%</b>
<b>East Asia–North America 9.1%</b>	<b>Latin America–North America 4.3%</b>
<b>Europe–East Asia 8.1%</b>	<b>Africa–Europe 3.7%</b>
<b>Intra–East Asia 8.6%</b>	<b>South Asia–Europe 6.7%</b>
<b>Europe–North America 10.7%</b>	<b>Middle East–Europe 0.4%</b>
<b>Intra–North America 10.0%</b>	<b>Intra–Europe 9.7%</b>
<b>Domestic China 1.6%</b>	

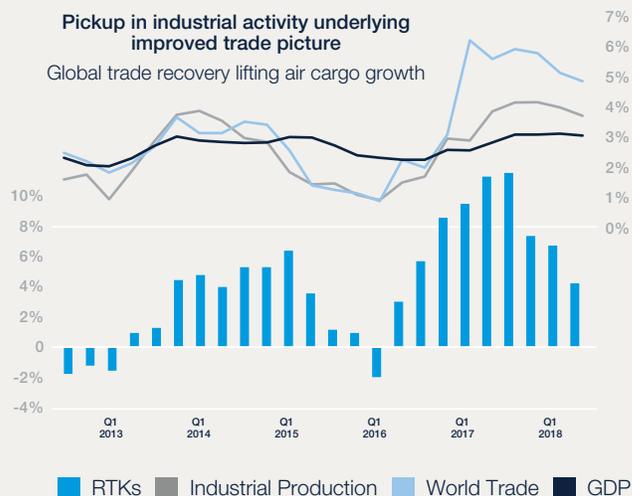
Source: IATA, ICA, ACI, AAPA, US DOT, US Trade, US DOC, TRADE, Eurostat, IHS Markit, CAAC, AAI, India DGCA, FAVT, Airline data, Airport data, Boeing

## GLOBAL GDP GROWTH HAS RECOVERED



Source: IHS Markit

## AIR CARGO VOLUMES GROWING AMID INTERNATIONAL TRADE SURGE



Source: Oxford Economics, IATA, Boeing

## EXECUTIVE SUMMARY

### E-COMMERCE IS A GROWING SHARE OF THE AIR CARGO MARKET

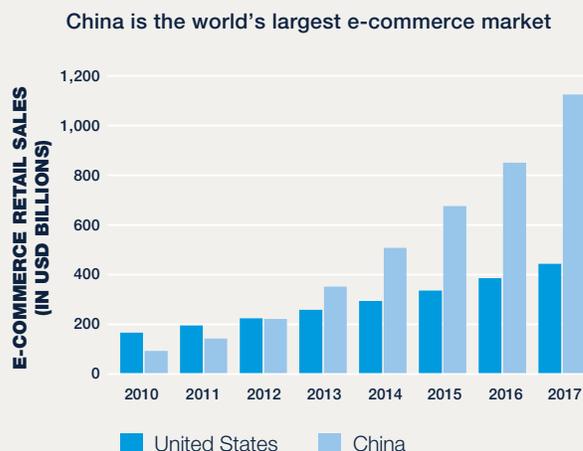
In the last two decades, the evolution of Internet technology has led to the explosive growth of e-commerce. With easy access to the global marketplace, the rise of e-commerce has radically transformed business and consumer buying behavior. In 2017, global retail e-commerce sales were \$2.3 trillion, more than double the \$1.1 trillion spent in 2012. With no signs of slowing down, 2018 is set to be another strong year, with more than \$2.8 trillion in sales.

While e-commerce is a global phenomenon, the market size varies by country. Driven by China, the Asia-Pacific region, defined as South Asia and East Asia, is the largest e-commerce market in the world. As China continues shifting to a consumption-driven economy, the country's e-commerce sales have grown almost 40 percent in the last five years and are now valued at approximately \$1.1 trillion. Japan and South Korea are the next biggest e-commerce markets in Asia-Pacific, with high income levels and urbanization rates, as well as high-speed Internet penetration. Furthermore, many countries in Southeast Asia are emerging as fast-growing e-commerce markets. For example, the Indonesia market is projected to exceed \$200 billion in e-commerce sales by 2025.

The United States is currently the second largest e-commerce market in the world, with more than \$450 billion in e-commerce sales in 2017, a 16 percent increase from 2016 and the highest growth rate since 2011. Led by Amazon, which now accounts for nearly half of the US e-commerce industry, e-commerce sales comprised 13 percent of the total retail sales in 2017, a sizeable increase from 11.6 percent in 2016.

While the recent boom in e-commerce has stimulated air cargo, its contribution to air cargo growth is difficult to quantify since air cargo packages are generally not identified specifically as e-commerce

### CHINA ONLINE RETAIL SALES HAVE PASSED \$1 TRILLION



Source: US Census Bureau, National Bureau of Statistics of China

## EXECUTIVE SUMMARY

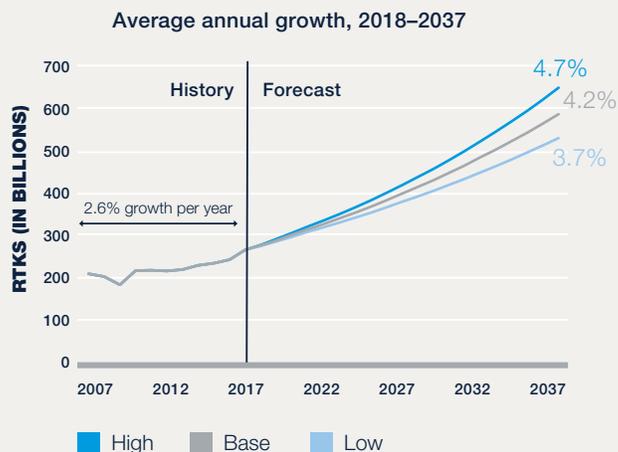
by shippers. Yet it is clear that e-commerce is revolutionizing customer expectations and air cargo logistics. Its market size is forecast to increase 20 percent per year during the next five years, to nearly \$4.9 trillion in 2021.

### WORLD AIR CARGO TRAFFIC GROWTH OUTLOOK

World air cargo traffic is forecast to grow 4.2 percent per year in the next 20 years. In terms of RTK growth, air freight, including express traffic, is projected to grow at a rate of 4.3 percent per year while airmail will grow at a slower pace, averaging 2 percent annual growth through 2037. Overall, world air cargo traffic will more than double in the next 20 years, expanding from 256 billion RTKs in 2017 to 584 billion RTKs in 2037.

Asia will continue to lead the world in average annual air cargo growth, with domestic China and intra-East Asia markets expanding 6.3 percent and 5.8 percent 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. Middle East and Latin America markets connected to Europe and North America will grow at approximately the world average. In the more established and mature trade flows between North America and Europe, growth will be below the world average.

### WORLD AIR CARGO WILL GROW 4.2% PER YEAR



Source: IHS Markit, IATA, ICAO, Boeing

### AIR CARGO GROWTH RATES

REGION	HISTORY 2007–2017 by percentage	FORECAST 2018–2037 by percentage
World	2.6	4.2
East Asia–North America	1.2	4.7
Europe–East Asia	4.2	4.7
Intra–East Asia	3.8	5.8
Europe–North America	0.0	2.5
Intra–North America	2.3	2.3
Domestic China	5.0	6.3
Latin America–Europe	3.0	4.0
Latin America–North America	-0.3	4.1
Africa–Europe	-1.0	3.7
South Asia–Europe	2.4	4.2
Middle East–Europe	3.3	3.2
Intra–Europe	3.1	2.3

Source: IATA, ICAO, ACI, AAPA, US DOT, US Trade, US DOC, TRADE, Eurostat, IHS Markit, CAAC, AAI, India DGCA, FAVT, Airline data, Airport data, Boeing

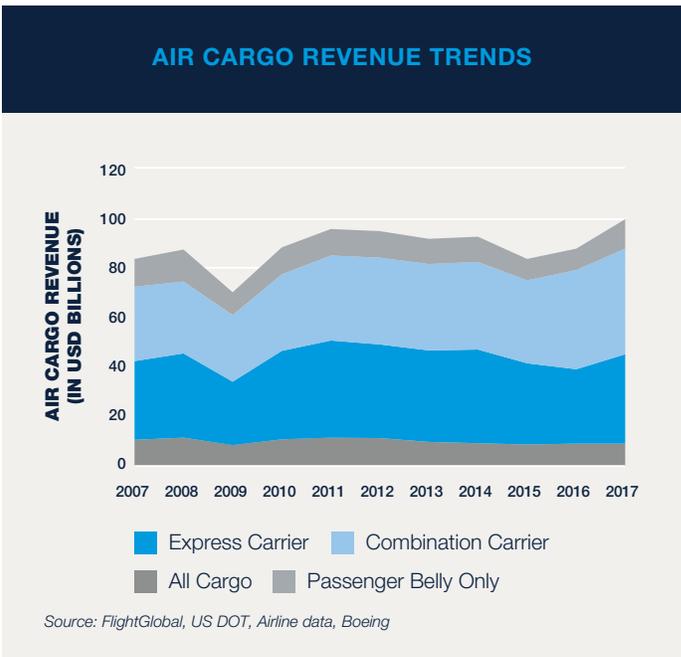
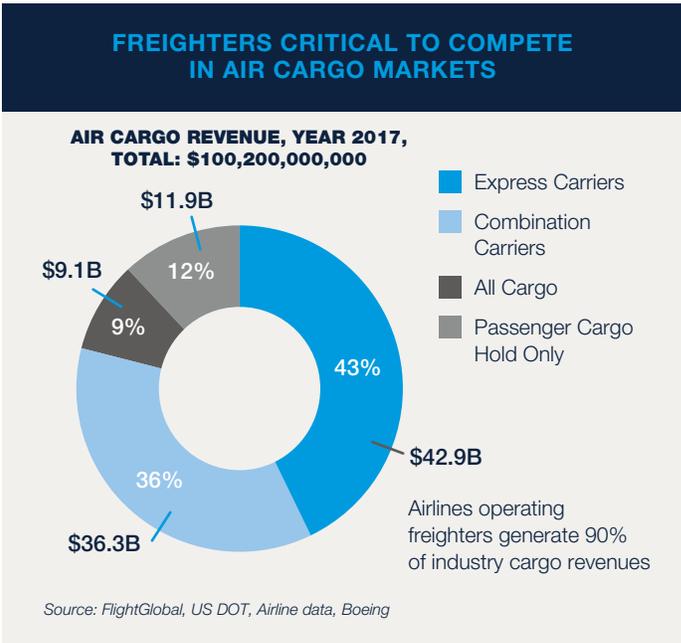
# EXECUTIVE SUMMARY

## THE IMPORTANCE OF FREIGHTERS

Air cargo represents less than 1 percent of global trade by tonnage, yet air cargo transports more than \$6 trillion worth of goods every year, representing more than 35 percent of global trade by value. Such a large disparity between tonnage and value reflects air cargo's unique position in transporting goods that often require a high level of speed, reliability, and security. Among those traded goods, computing equipment, machinery, and electrical equipment account for the highest share of airborne trade tonnage versus containership tonnage.

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 more than 90 percent 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 transportation 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 by nearly 6 percent in the last five 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,



## EXECUTIVE SUMMARY

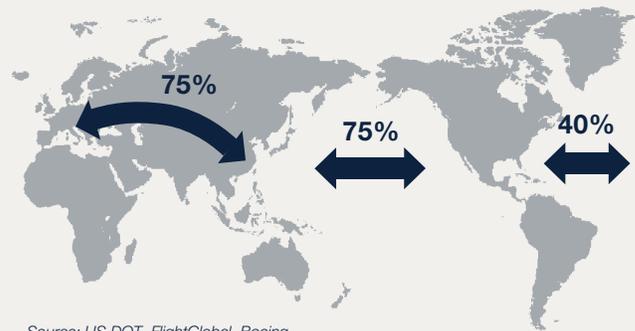
freighter routes are highly concentrated on relatively few trade lanes, especially in the world's two largest trade routes, East Asia–North America and East Asia–Europe. In contrast, passenger networks are much broader and often include destinations where cargo demand is minimal. This difference in passenger and cargo traffic distribution explains the considerable load factor difference in belly space and freighters, which average approximately 30 percent and 70 percent, respectively. 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.

Express carriers continue to operate substantial freighter fleets, flying more than half of the widebody freighters and generating 43 percent of air cargo industry revenues in 2017. Because of a unique business model that is tailored to the needs of their customers by using unique schedules, specialized airplanes, and a door-to-door transportation network, carriers that only operate lower hold cannot offer the same level of service.

Low-cost carriers (LCC) have increased their share of air cargo traffic, particularly in Southeast Asia. However, even with fast growth in passenger markets and the recent surge in low-cost long-haul development, LCCs are still estimated to carry less than 2 percent of air cargo traffic.

### FREIGHTERS PLAY KEY ROLE IN MAJOR EAST–WEST MARKETS

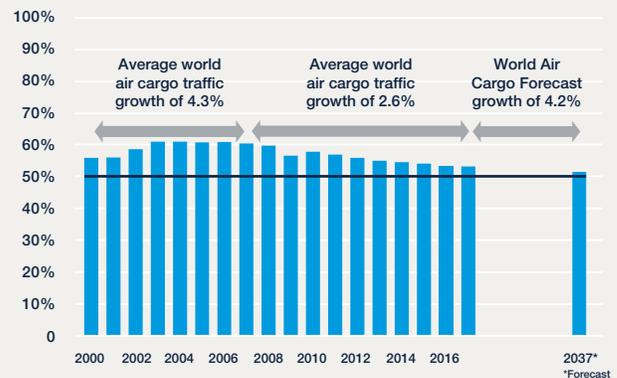
Share of total air cargo traffic carried by freighters



Source: US DOT, FlightGlobal, Boeing

### DEDICATED FREIGHTERS CARRY—AND WILL CONTINUE TO CARRY—MORE THAN HALF OF AIR CARGO TRAFFIC

World RTKs carried on freighters



Source: Boeing

# EXECUTIVE SUMMARY

## FREIGHTER FLEET OUTLOOK

With air cargo traffic more than doubling in the next 20 years, the world freighter fleet will grow by more than 70 percent, from the current 1,870 to 3,260 airplanes. Growing demand for regional express services in fast-developing economies will boost the standard-body share of the freighter fleet from 37 percent today to 39 percent. Like the current fleet, the 1,170 standard-body freighter deliveries forecast in the next two decades will be converted passenger airplanes.

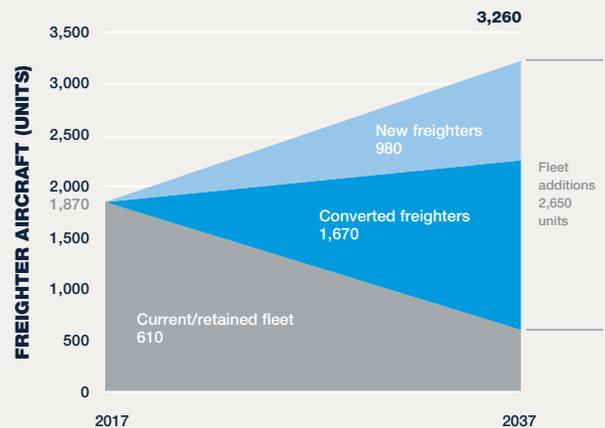
In the next 20 years, 2,650 freighters are forecast to be delivered, with approximately half replacing retiring airplanes and the remainder expanding the fleet to meet projected traffic growth. More than 63 percent of deliveries will be freighter conversions, of which nearly 70 percent will be standard-body passenger airplanes. A projected 980 new production freighters, valued at \$280 billion, will be delivered, of which more than 50 percent will be in the large-freighter category, such as the 747 Freighter and 777 Freighter.

### FREIGHTER FLEET WILL INCREASE BY MORE THAN HALF; STANDARD-BODY FREIGHTERS GAIN SHARE



Source: Boeing

### NEW AND CONVERTED FREIGHTERS SUPPORT FLEET GROWTH



Source: Boeing

# AIR CARGO INDUSTRY OVERVIEW

## AIR CARGO FACES COMPETITION FROM OTHER MODES, STRUCTURAL DYNAMICS OF CARGO TRANSPORT MARKETS

In addition to economic factors, a range of issues beyond cyclical trends influence the growth of air cargo markets, including modal competition, environmental regulations, globalization, market liberalization, national development programs, inventory management techniques, and new air-eligible commodities. This discussion will highlight some of these subjects.

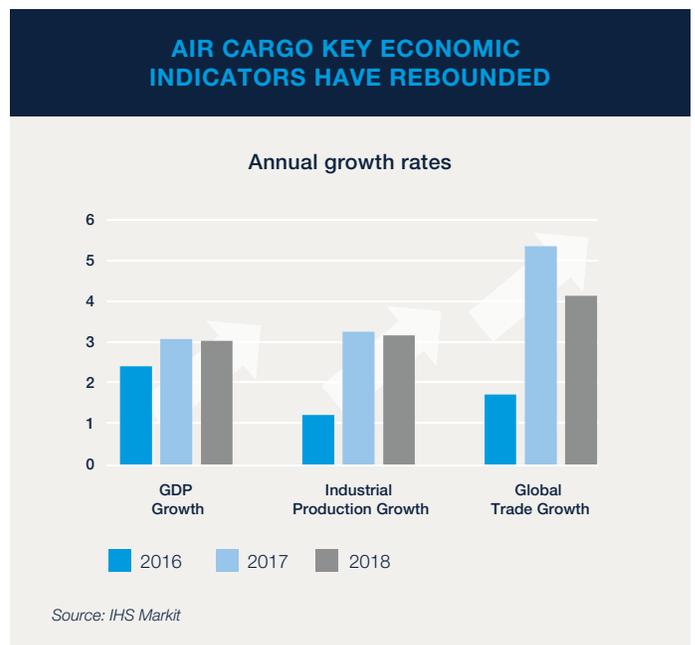
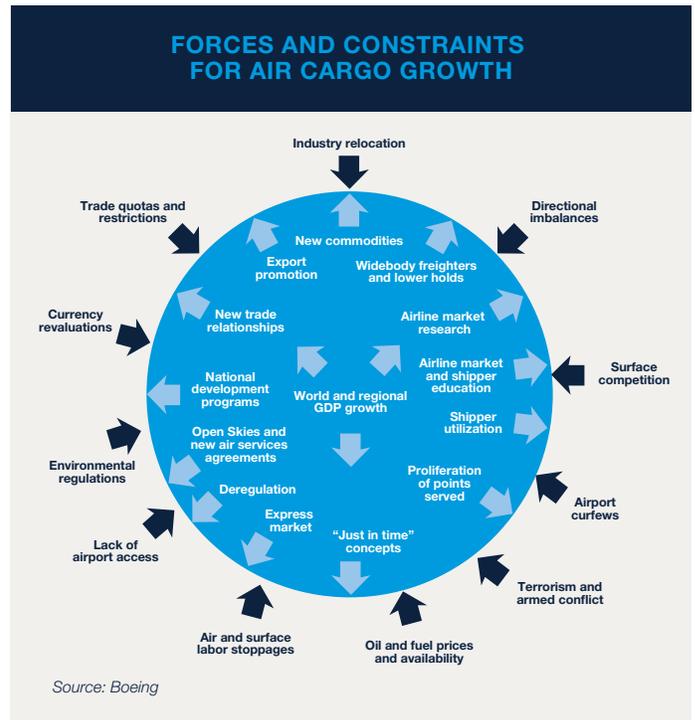
## HEALTHY ECONOMIC ACTIVITY KEY TO STRONG AIR CARGO MARKET

**Economic activity is the primary influence on world air cargo development. The world's economy is forecast to grow at an average annual rate of 2.8 percent in the next 20 years.**

Since slowing significantly in early 2016, the global economy has seen a remarkable recovery. Just two years ago more than two dozen economies around the world were shrinking, many of them trade-focused emerging markets. In contrast, 2018 is expected to see only a handful of smaller economies contracting. The United States, Europe, and China are all growing at or above trend rates, and many commodity-producing economies are recovering, aided by gradually rising oil prices. The global economy of 2018 looks a lot more balanced geographically.

More importantly, in 2017 the industrial side of the economy recovered to its strongest growth since 2011. And industrial production is expected to remain strong in 2018. As a key driver of global trade, this development was among the most important factors underlying the recent double-digit growth performance of the air cargo industry.

A sustained period of good economic growth, together with ongoing accommodative monetary policy, also



## AIR CARGO INDUSTRY OVERVIEW

creates a stimulus for industrial investment, which can further substantiate trade growth. Part of the turnaround in the global economy can be attributed to pent-up demand having been filled after a half decade of timid business sentiment and slow economic growth. Thus, growth rates are not expected to be as stellar going forward. However, conditions remain favorable for both GDP and trade to grow near their respective long-term trend rates. Asia-Pacific is expected to contribute most to growth during the forecast period, at an average annual rate of 3.9 percent. Emerging markets, most of which are witnessing strong middle-class growth with more sophisticated consumption patterns and more advanced manufacturing production, will be key drivers of global trade as well. GDP in Europe and the United States will grow at 1.7 percent and 2 percent, respectively. They continue to be key sources of traded goods demand.

The composition of global trade also helps explain the recent success of air cargo. Trade in goods more likely to be transported by air saw higher growth rates than heavy or bulky commodities such as fuel and grains. For example, the computers and electronics equipment commodity group, a major source of air cargo traffic, was the fastest growing in 2017. We expect this growth distribution to continue, positioning air cargo to outgrow overall trade again in 2018—settling in to trend growth at a rate of at least 4 percent per year.

The economic outlook is not without risk, however. An accelerating trade conflict between the world's two largest economies, recurring political and financial market instability in some emerging markets, and eventually rising interest rates in advanced economies will pose challenges going forward. However, trade remains the historically proven path to rising living standards for many billions of citizens of the emerging world. The integration of new and increasingly sophisticated economies into the global trading system will provide trade growth going forward. The world may not witness a boost akin to the ones resulting from opening up the eastern world or China joining the

### ASIAN ECONOMIES LEAD ECONOMIC GROWTH

Annual GDP growth, 2018–2037



Source: IHS Markit

## AIR CARGO INDUSTRY OVERVIEW

World Trade Organization, but assuming a standstill in international commerce seems unrealistic. We expect trade to grow faster than GDP, at 3.4 percent on average annually for the next 20 years, providing solid support for air cargo demand growth.

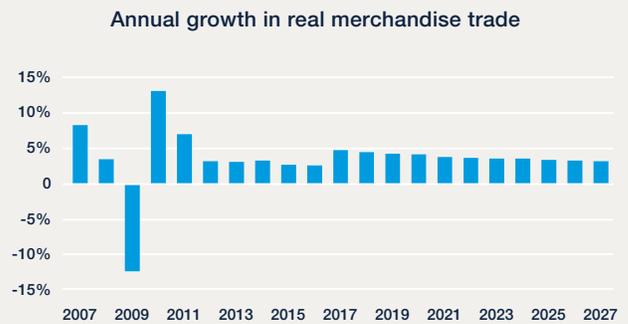
### FUEL PRICES, VOLATILITY PRESENT CHALLENGES TO AIR CARGO INDUSTRY

Triggered by increasing production and decreasing global demand, the price of crude oil and jet fuel fell dramatically starting in mid-2014. After fuel prices fell to less than half of the June 2014 price, they have increased to more than \$80 per barrel (at the time of this publication) because of geopolitical conflict and a strong worldwide economy. Crude oil prices are forecast to exhibit volatility and are projected to settle at \$60 to \$80 per barrel in the next few years.

Fuel is a significant cost element for air cargo carriers and impacts their yields by adding to unpredictability. Therefore, 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. This contributes to market uncertainty, which 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.

Finally, rising fuel costs magnify the inherent cost advantages of ground transport over air transport, and although fuel costs decreased in the 2015–2017 timeframe, ground transport managed to retain its cost advantage over air transport.

### GLOBAL TRADE HAS REBOUNDED; FORECAST TO OUTPACE ECONOMIC GROWTH



Source: IHS Markit

## AIR CARGO INDUSTRY OVERVIEW

### MODAL COMPETITION IS REAL, BUT AIR CARGO OFFERS UNIQUE, UNBEATABLE ADVANTAGES

**Air cargo represents less than 1 percent of world trade by weight, but more than one-third by value.**

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 transportation 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, while air transport offers speed and reliability.

The maritime transportation industry is much larger than the air cargo industry when measured in tonnes of goods transported. In 2017, the world maritime industry carried an estimated 11.6 billion tonnes compared to 61.9 million tonnes for the air cargo industry. By weight, more than 84 percent 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 percent of world trade tonnage is carried by air cargo, but because of the high value of these goods, they represent about 35 percent of the value of goods shipped globally.



## AIR CARGO INDUSTRY OVERVIEW

### CONTAINERSHIP TRANSPORTATION

**Containership traffic growth has been driven by traffic diversion from other maritime segments rather than air.**

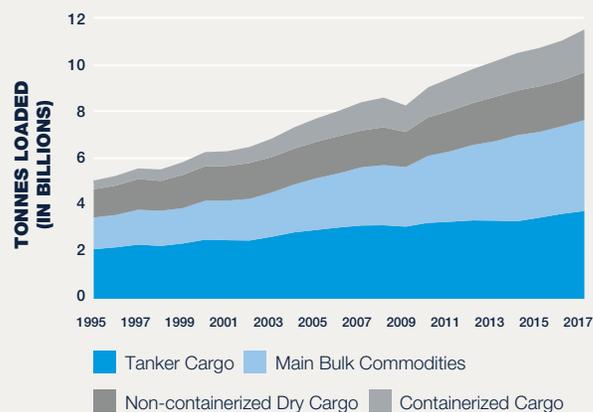
Containerized cargo is the sector of maritime that most closely corresponds to air cargo. While the majority of maritime cargo is bulk and low value, containerships also carry some of the same commodities as air cargo and offer a low-cost transportation alternative for goods that do not require the speed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

Globalization and regional specialization of industry, particularly in Asia, have driven rapid growth in containership freight flows. Worldwide containership tonnage in 2017 was estimated to be 1.8 billion tonnes. Containership tonnage has historically grown faster than other maritime transportation segments. From 1995 to 2017, the containerized cargo tonnage growth rate averaged 7.5 percent annually while tanker cargo, main bulk commodities, and noncontainerized dry cargo averaged 2.6, 4.9, and 2.5 percent, 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

#### CONTAINERSHIPS HAVE GROWN BY TAKING MARKET SHARE FROM OTHER MARITIME SEGMENTS



Sources: CRSI

in transporting these types of products instead of the high-value goods shipped by air.

New, more stringent regulations related to vessel emissions set by the International Maritime Organization (IMO) for 2020 have the potential to disrupt the global maritime sector. That year IMO will introduce a global cap on the level of ships' sulphur emissions, which will be added to the Emission Control Area (ECA) limits already in place. To comply, vessel operators will be required to either use low-sulphur fuels, fit "scrubber" equipment to allow the continued use of conventional fuel oil, or adopt alternative propulsion technology such as LNG-fueling. According to Clarksons Research, less than 2 percent of the current global merchant fleet in vessel number terms (and less than 3 percent of the world containership fleet) is currently able to meet this forthcoming emissions standard without switching to compliant low-sulphur fuel, although the proportion of vessels on order able to do so is much larger (more than 20 percent of the world fleet). There remains significant uncertainty as to how the industry will meet this challenge over time or whether IMO will eventually provide any relief. However, if a hurried effort to upgrade existing vessels

## AIR CARGO INDUSTRY OVERVIEW

ensues or compliance is enforced, this disruption may provide a temporary boost to world air cargo traffic.

### TYPES OF AIR CARGO SERVICE VARY TO SERVE DIFFERENT AIR CARGO MARKET REQUIREMENTS

#### General freight carriers

General freight carriers transport a large portion of total world air cargo. Carriers in this category (all cargo airplane operators, combination carriers, and passenger airplane lower-hold carriers) are responsible for more than 80 percent of world RTKs. These carriers are integral to the global supply chain worldwide and generate 57 percent of total air cargo industry revenues.

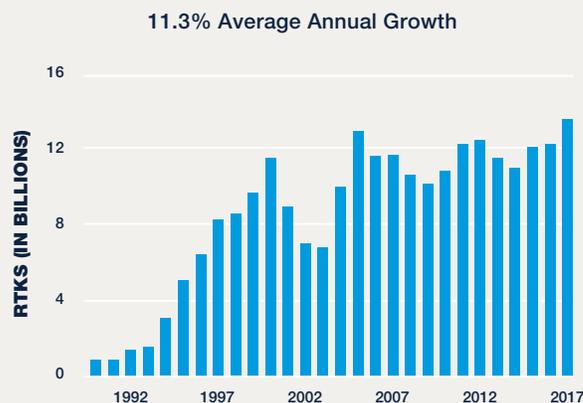
#### Large widebody freighter ACMI services

Large widebody aircraft, crew, maintenance, and insurance (ACMI) providers have seen volatile traffic volumes since the global economic downturn, and with the recent strong performance in air cargo, ACMI providers were maintaining about 5 percent of world air cargo traffic at the end of 2017.

ACMI providers, also referred to as wet-lease providers, offer cargo operators the flexibility to obtain lift on a trial basis, augment existing markets, and provide service in markets that are highly seasonal—all with no capital equipment investment required.

Large freighters in long-haul markets account for the most significant segment of the air cargo ACMI business. The ACMI business is sensitive to changes in the overall air cargo business, but it has been an established industry subsector since the early 1990s. ACMI providers have maintained approximately a 4 to 6 percent share of total world air cargo traffic for the past decade.

### ACMI PROVIDERS TRANSPORT ABOUT 5.2% OF WORLD AIR CARGO TRAFFIC



Source: US DOT, Airline data, Boeing

# AIR CARGO INDUSTRY OVERVIEW

## International express

International express traffic continued to grow faster than the average world air cargo growth rate, expanding 4.5 percent in 2016 and 11.5 percent in 2017.

The distinction 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 are consolidating. The acquisition of TNT by FedEx will further change the competitive environment of the express industry. Ultimately, the air cargo customer benefits from increased service options and lower prices as market pressure brings competing service offerings into the market.

International express traffic grew rapidly from 1992 to 2008 following the growth pattern of the US express industry in the 1970s and 1980s. International express traffic growth was interrupted in 2009, however, falling 12.6 percent as a result of the global economic downturn. Since 2010, the international express market has continued to grow at a healthy average rate of 7.7 percent per year through 2017. Growth in 2017 was an impressive 11.5 percent.

Higher-than-average annual growth boosted the express share of international air cargo traffic from 4.1 percent in 1992 to 13.4 percent in 2008. The international express share remained at about 13 percent of total international traffic during the global economic downturn from 2008 through 2010. Share growth resumed in 2011, and market share reached 17 percent in 2013. Market share registered 17.3 percent in 2014 and 17.6 percent in 2015, and 2016 and 2017 shares remained stable at 17 percent and 17.1 percent, respectively.

## INTERNATIONAL FREIGHT AND MAIL, INTERNATIONAL EXPRESS HAD STRONG GROWTH IN 2017

Express share of international air cargo was 17.1% in 2017



Source: Cargo Facts Consulting, IATA, ICAO, US DOT

## AIR CARGO INDUSTRY OVERVIEW

### LCC, LCLH operators

Low-cost carriers (LCC) comprise a very small market share but are growing because of business model growth.

LCCs have grown strongly in the past three decades. Many of the carriers in this segment either have not carried significant quantities of cargo or have never been cargo carriers. Thus, the LCCs have held a very small percentage of the world air cargo market, just 0.5 percent in 2007 and 0.7 percent in 2012. However, with the consistent long-term growth of the LCC segment and the emergence of low-cost long-haul (LCLH) and widebody fleets, there has been a further increase in the LCC and LCLH share, up to 1.3 percent in 2017. While still insignificant, it is a growing share of the market that is worth monitoring.

### WORLD AIR CARGO TRAFFIC FORECAST

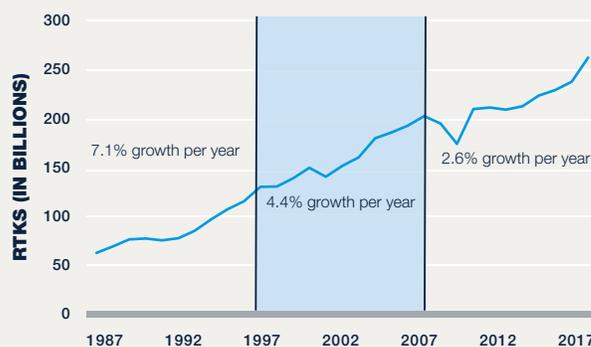
#### Steady growth of 4.2 percent is supported by solid GDP and trade growth.

Although air cargo growth has slowed in the past decade compared to the prior two decades, it is important to remember that the lackluster growth rate reflected the poor industry performance that resulted from the global economic downturn.

As global GDP and world trade growth continues, air cargo traffic, measured in RTKs, is projected to grow an average of 4.2 percent per year in the next 20 years.

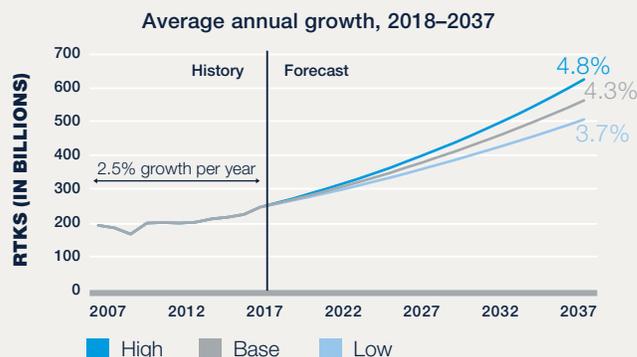
Low, baseline, and high annual growth of 3.7 percent, 4.2 percent, and 4.7 percent, respectively, are forecast for world air freight traffic. High and low scenarios correspond to GDP growth of 0.5 percent above long-term projections and 0.5 percent below, respectively. The baseline growth scenario is based upon continued positive yields because of world economic growth and the impacts of e-commerce. Worldwide

### WORLD AIR CARGO TRAFFIC HAS SLOWED IN THE PAST DECADE



Sources: IATA, ICAO, US DOT, Airline data, Boeing

### WORLD AIR FREIGHT WILL GROW 4.3% PER YEAR



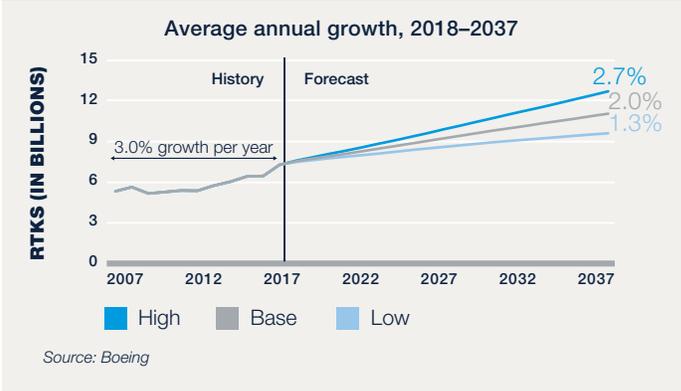
Source: Boeing

# AIR CARGO INDUSTRY OVERVIEW

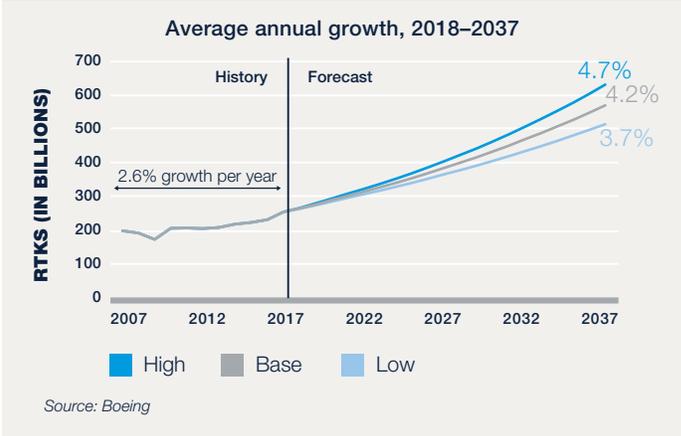
air freight is expected to more than double in the next 20 years, increasing from 256 billion RTKs in 2017 to 582 billion RTKs by 2037. Sustained economic growth and decreasing yields are the two primary drivers of growth in the air cargo industry.

World airmail is forecast to grow 2 percent 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.

## WORLD AIRMAIL WILL GROW 2% PER YEAR



## WORLD AIR CARGO (FREIGHT AND MAIL) WILL GROW 4.2% PER YEAR



# AIR CARGO INDUSTRY OVERVIEW

## YIELD TRENDS

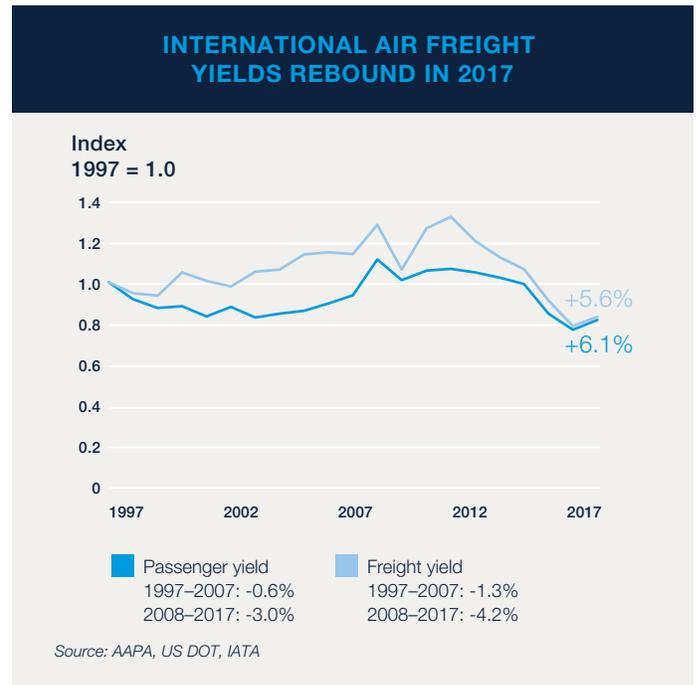
**International freight yields rebounded more than 5 percent in 2017 after declining approximately 3 percent annually for the past 20 years. Both volumes and prices increased across the board in 2017, a market dynamic that has not been seen for over a decade.**

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.

Air cargo has showed varied growth and declines throughout the past decade. Increases in yield during this time period were related to fuel and security surcharges that began to rise in 2003. In 2008, fuel surcharges imposed in response to the fuel crisis helped push yields up 16 percent compared to 2007 yields. Between mid-2003 and mid-2008, spot prices for jet fuel rose almost five-fold. Therefore, with jet fuel representing the largest component of freighter airplanes' operating costs, raising prices became a necessity for air cargo operators.

After cost-driven yield increases in 2003–2008, yields fell again in 2009. The global economic downturn resulted in newfound consumer caution, and businesses strived to minimize inventory holdings. At the same time, excess capacity remained in the market for too long, leaving operators to suffer from withering price competition.

Growth resumed strongly in 2010, leading to cargo yields increasing as demand grew faster than capacity. Unfortunately, this rebound did not last; traffic growth markedly weakened from 2011 to 2016, growing just over 2 percent per year. As a result, cargo yields declined 14 percent in 2016, largely as



## AIR CARGO INDUSTRY OVERVIEW

a result of falling fuel surcharges. Although declining yields helped stimulate growth for the industry, the lack of volume growth during this time period can be attributed to subpar economic and trade activity.

Cargo traffic rebounded in 2017, growing 10 percent. Cargo volumes have shifted to the European carriers, which have the highest yields of these markets. For the first time in almost a decade, yields in these major markets trended upward along with traffic in 2017. Healthy demand for perishables, medicines, and electronics as well as strong economic growth around the world contributed to this rebound.

The economic fundamentals, such as improved world trade, industrial production, consumer confidence, and business sentiments, along with strong e-commerce growth are supporting continued healthy air cargo growth in 2018. World air cargo traffic has grown 5 percent and freight yield has increased approximately 15 percent for the first half of 2018.

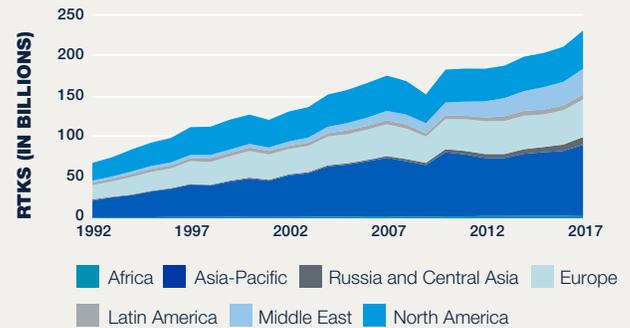
Air cargo provides the speed and reliability manufacturers and consumers are demanding. Long-term positive trends are forecast for the world economy and industrial production, indicating continued positive growth for the air cargo market.

### AIR CARGO GROWTH, DYNAMICS VARY BY REGION

**The market share of airlines based in Asia and the Middle East has grown relative to that of airlines based in other regions.**

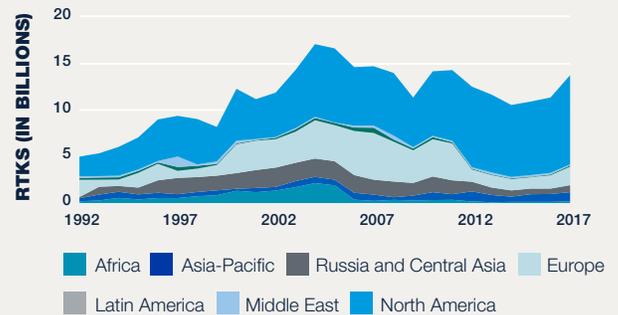
Regional air cargo market shares have changed significantly during the past two decades. Airlines based in Asia-Pacific, Europe, and North America have accounted for nearly 80 percent of the world's air cargo traffic for that entire period. Airlines based in North America led all other world regions with a 35 percent share of the world's air cargo traffic in 1992. This changed during the 1990s and early 2000s as the

### ASIA-DOMICILED AIRLINES ARE LEADING PROVIDERS FOR SCHEDULED AIR FREIGHT



Sources: IATA, ICAO, US DOT, Airline data, Boeing

### NORTH AMERICA-DOMICILED AIRLINES ARE LEADING PROVIDERS FOR CHARTER AIR FREIGHT



Sources: IATA, ICAO, US DOT, Airline data, Boeing

## AIR CARGO INDUSTRY OVERVIEW

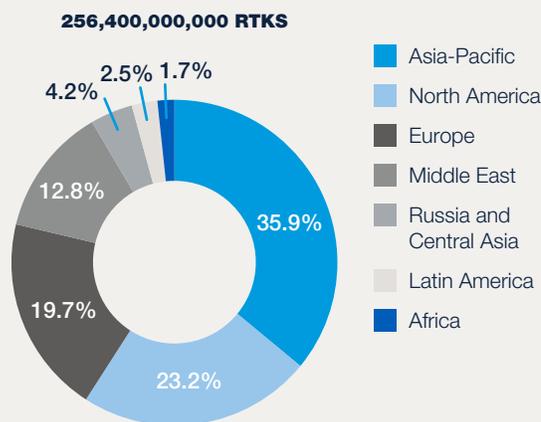
share flown by airlines based in Asia-Pacific, including those based in China, grew from 28 percent in 1992 to 40 percent in 2010, reflecting the rapid expansion of Asian export markets.

Since 2000, however, carriers based in the Middle East have leveraged their geographic position at the crossroads between Africa, Asia, and Europe. Middle East carriers have quickly expanded their widebody passenger and freighter fleets, allowing them to increase their share of world air cargo traffic from 6.1 percent in 2007 to 12.8 percent in 2017. In 2017, airlines based in Asia-Pacific, Europe, North America, and the Middle East accounted for 90 percent of all world air cargo traffic.

Air cargo markets linked to Asia, especially East Asia, will lead all other international markets in average annual growth between 2018 and 2037.

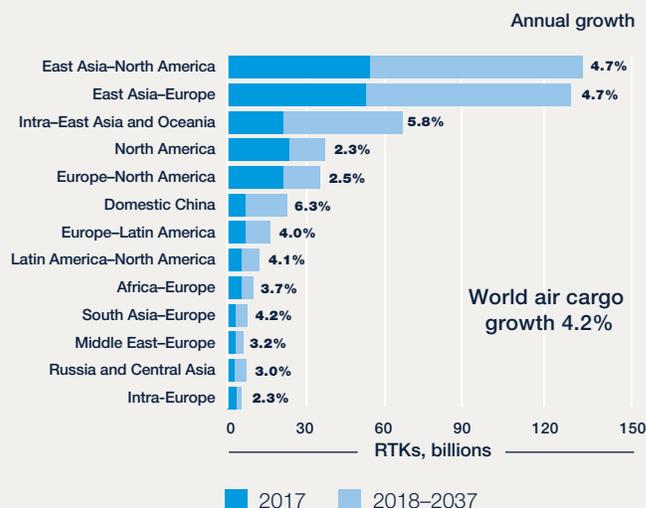
Market shares will continue to change as a result of varying regional growth rates. Intra-East Asia is currently the fifth largest air cargo market, but because it is forecast to grow 5.8 percent per year in the next 20 years, it will be the third largest air cargo market by 2037. The share of world air cargo traffic associated with East Asia, including the domestic markets of China and Japan and all international markets connected to East Asia, will increase from 52.5 percent in 2017 to 60 percent in 2037. Increasingly affluent consumers in East Asia continue to drive strong growth in the Europe-to-East Asia air trade lane.

### 2017 AIR CARGO MARKET SHARE BY AIRLINE DOMICILE



Source: IATA, ICAO, US DOT, Airline data, Boeing

### EAST ASIA MARKETS WILL CONTINUE TO LEAD INDUSTRY GROWTH



Source: Boeing

For the purposes of this forecast, North America is defined as the United States and Canada.

## AIR CARGO TRAFFIC GREW STRONGLY IN 2017

**Air cargo moving to, from, and within the United States and Canada accounts for 9 percent of the world's air cargo traffic in tonne-kilometers and 13.8 percent in tonnage.**

Overall, North America air cargo traffic grew 4.2 percent in 2016 and 10 percent in 2017. US domestic air cargo, which accounts for 96.4 percent of the North America market, grew 4.2 percent in 2016 and 10.3 percent in 2017, while Canadian domestic air cargo, 2.2 percent of the market, grew 4.8 and 4 percent, respectively, over the same time period. For 2017, transborder traffic from the United States to Canada made up 1.2 percent of the North America market; traffic in the opposite direction made up 0.2 percent.

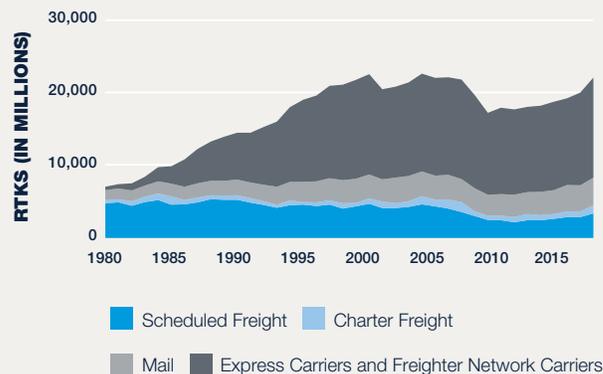
## US DOMESTIC AIR CARGO MARKET

**The US domestic market grew 14.9 percent from 2016 through 2017.**

The US domestic market is mature, and after the bounce back from the global economic downturn, growth was relatively flat in the period through mid-2016. However, the country's domestic traffic began to show signs of strong growth later in the year, which continued at an accelerated rate through a very strong 2017. US air cargo surged to 22.1 billion revenue tonne-kilometers (RTK) in 2017, an increase of 2.1 billion RTKs from 2016.

There has been very little shift in the air cargo market share by carrier category in the United States during the past 10 years. The rise of e-commerce has increased the mail category somewhat because of the role the US Postal Service has in this segment. However, express carriers and freighter network carriers remain the dominant sector, taking 63 percent of the market, which has held relatively constant in the past 10 years.

### EXPRESS CARRIERS AND FREIGHTER NETWORK CARRIERS DOMINATE US AIR CARGO MARKET WITH 62% OF TRAFFIC



Source: Cargo Facts Consulting, Boeing

## NORTH AMERICA

After increasing consistently during the 1980s and 1990s, the air shipment volume of the express carriers flattened between 2001 and 2007 as the market matured. Volumes remained flat through 2013 following the global economic downturn of 2008 and 2009. Express carrier volume remained relatively flat between 2008 and 2013—within a range of 5.3 million and 5.7 million shipments per day for the period—and then experienced growth in 2014 and 2015, increasing to 5.8 million and 6.2 million shipments per day, respectively. In 2015, traffic returned to 2013 levels (11.4 billion RTKs). Express carrier domestic traffic was 12.2 billion RTKs in 2017, a 3.7 percent increase over 2016. While express shipments by air have experienced flat to slow growth in recent years, the express carriers have seen stronger growth in deferred and ground shipments.

Beginning in 2015, there has been renewed interest and activity in expanding US domestic express networks to expedite movement of e-commerce flows.

### CANADA DOMESTIC AIR CARGO MARKET

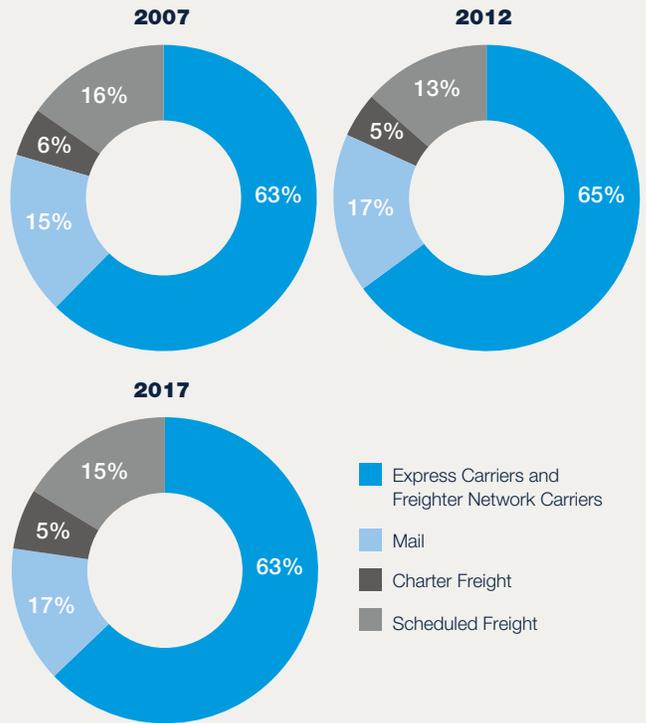
**Canada's share of the region's air cargo market has remained steady.**

The Canada domestic market accounts for a small proportion of the total North America air cargo market. Domestic Canada traffic grew at 4 percent in 2017 to log 505 million RTKs.

Canada's economy grew 3 percent in 2017. Its domestic economy has picked up significantly since 2015 and 2016, as oil prices have recovered since their early-2016 lows and the US economy performed stronger in 2017. The 3 percent growth rate exceeded the 20-year compound average annual growth rate of 2.4 percent.

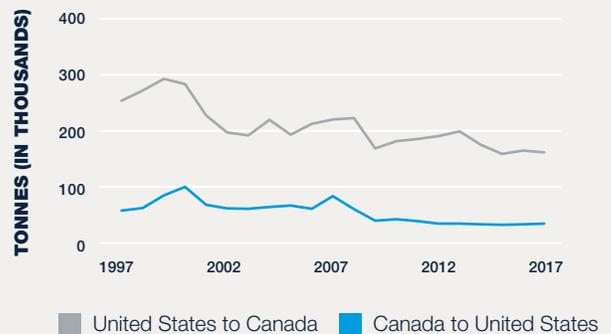
However, US–Canada transborder air cargo declined slightly, from 230,000 tonnes in 2016 to 228,000 tonnes in 2017. Traffic from the United States to Canada increased 3.8 percent in 2016 but fell 2

### LITTLE CHANGE HAS OCCURRED IN US AIR CARGO MARKET SHARE BY CARRIER CATEGORY SINCE 2007



Source: Cargo Facts Consulting, Boeing

### NORTHBOUND CONTINUES TO EXCEED SOUTHBOUND TRANSBORDER TONNAGE



Source: IHS Markit

percent in 2017, while traffic from Canada to the United States was up 2.9 percent in 2016 and 3.4 percent in 2017 as the US economy strengthened.

Canada's largest trading partner is the United States. In 2016 and 2017, air cargo represented 4.8 percent of Canada's total trade with the United States in terms of value. Northbound tonnage continued to exceed southbound tonnage, as it has since the mid-1980s.

## CARGO CARRIERS INCREASE USE OF TRUCKS

**Reductions in the size of the passenger fleet, the predominance of single-aisle airplanes on domestic routes, and the demise of scheduled domestic air freight airlines have reduced North America domestic air cargo capacity, measured in available tonne-kilometers.**

Continuing the trend of past years, combination carriers continue to rely on trucks to offset the loss of domestic air capacity that has resulted from reduced fleet size and the shift of widebody airplanes from domestic to international markets. Truck flights allow combination carriers to offer service comparable to that of pure cargo carriers. Rising fuel costs magnify the inherent cost advantages of ground transport over air transport, and although fuel costs decreased in the 2015–2017 timeframe, ground transport retained its cost advantage over air transport.

The global economic downturn dramatically decreased domestic shipping demand after years of steady growth. In 2008 and 2009, both air and truck tonnage declined significantly. It is interesting to note that the recovery that occurred in 2017 finally brought air and truck tonnage back to levels not seen since 2006.

## TRUCKING, AIR CARGO TRAFFIC HAVE RECOVERED

US domestic trucking and air cargo volume  
Tonnage, indexed to 1990



Source: American Trucking Association, Cargo Facts Consulting, IATA

### **TRUCKING TRANSPORT CONGESTION AND IMPACT OF ELD LAW**

**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 is not expected to be 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.

A more urgent concern for the air cargo industry is the increase in congestion that truck operators face in the transport of goods. As urbanization has increased in the United States, the industry is facing more delays. Large increases in population in many major metropolitan areas have resulted in increases in traffic, as infrastructure growth has not kept up with population growth. Delays from congestion can interrupt supply chain flows, and those delays cost the trucking industry more than \$60 billion in annual operational costs, according to 2015 estimates. Furthermore, the delays from congestion impact the air cargo industry, as trucks are the primary method of transporting goods to and from air cargo ports.

### **ECONOMIC OUTLOOK FOR NORTH AMERICA**

**The GDP growth rate is projected to average 2 percent per year between 2017 and 2037.**

The US economy grew 1.5 percent and the Canadian economy grew 1.4 percent in 2016. In 2017, US GDP growth accelerated to 2.3 percent, while Canadian GDP growth increased to 3 percent. Growth for 2018 is expected to be above long-term trend.

Industrial production, a bellwether of air cargo growth, began a steep increase in 2017 and has continued to show strength in 2018. The stronger GDP growth of 2017 and 2018 has led to above-average air cargo growth rates in North America.

## NORTH AMERICA FORECAST

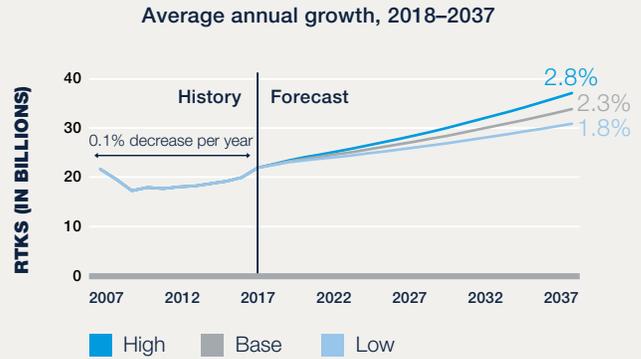
**Air cargo traffic in North America grew 4.2 percent in 2016 and 10 percent in 2017, reflecting full recovery from the global economic downturn. North America air cargo traffic is projected to average 2.3 percent growth during the next 10- and 20-year forecast periods.**

Transborder air cargo traffic growth is expected to exceed GDP growth rates and the domestic air cargo markets of both the United States and Canada. Expansion of passenger airline networks across North America will increase transborder air cargo capacity and traffic. Transborder air trade between Canada and the United States is projected to grow 3 percent annually during the entire forecast period through 2037.

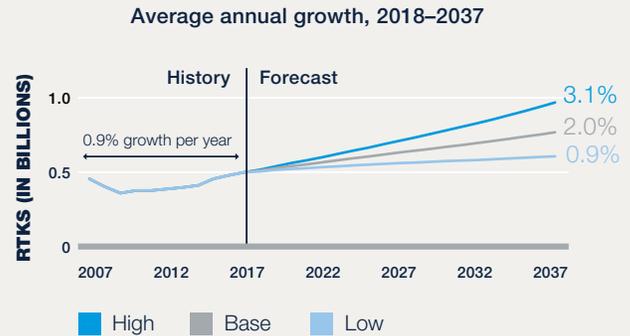
The US domestic market will maintain the dominant share of the total North America market, with about 96.4 percent of the total RTKs. The US domestic market is forecast to grow at an average annual rate of 2.3 percent during the 20-year period from 2018 to 2037.

The Canada domestic market is forecast to grow at an average annual rate of 2 percent during the 20-year period from 2018 to 2037, essentially matching Canada's GDP growth projections. Overall, growth in both North America domestic air cargo markets could be limited by continued expansion of trucking services in the time-definite sector.

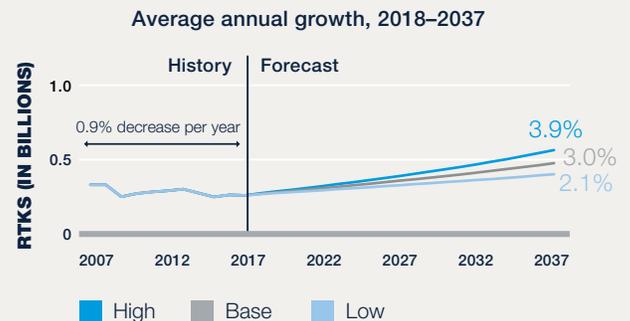
### US DOMESTIC MARKET WILL GROW 2.3% PER YEAR



### DOMESTIC CANADA AIR CARGO MARKET WILL GROW 2% PER YEAR



### US-CANADA TRANSBORDER AIR CARGO TRAFFIC WILL GROW 3% PER YEAR



# LATIN AMERICA AND NORTH AMERICA

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 the United States and Canada. Puerto Rico and the US Virgin Islands are not included in the United States GDP assumptions.

## LATIN AMERICA-NORTH AMERICA AIR CARGO MARKET EXPERIENCES GROWTH AFTER YEARS OF DECLINE

**The Latin America-North America market, which represents 2.2 percent of world air cargo traffic in tonne-kilometers and 2.5 percent in tonnage, grew 4.3 percent in 2017, showing gains for the first time since 2012. This growth followed a 3.5 percent decline in 2016.**

The United States is Latin America’s major North American trade partner, accounting for 94 percent of regional imports from North America and 90 percent of regional exports to North America. Therefore, monthly Latin America-US trade serves as a good approximation of month-to-month activity in the Latin America-North America air cargo market.

To analyze air traffic growth rates, Latin America has been divided into three subregions: South America, Central America, and the Caribbean Basin. During 2017, South America accounted for 70.8 percent of the total 1.3 million-tonne Latin America-North America air cargo market; Central America, 22.2 percent; and the Caribbean Basin, 7 percent.

South America-North America air trade declined 4.4 percent in 2016—in part because of recessions in Brazil, Argentina, and Ecuador—but rebounded and grew 3.3 percent in 2017 when those recessions ended. The factors affecting the South American economy were most evident in imports, which declined 12.6 percent in 2016 but grew 6.6 percent in 2017. Colombia overtook Chile to hold the largest share of South America’s air trade market, and while Brazil’s share grew in 2017, it remained the third largest. The majority of Colombia’s and Chile’s air

### US-LATIN AMERICA AIR TRADE HAS GROWN SINCE EARLY 2017

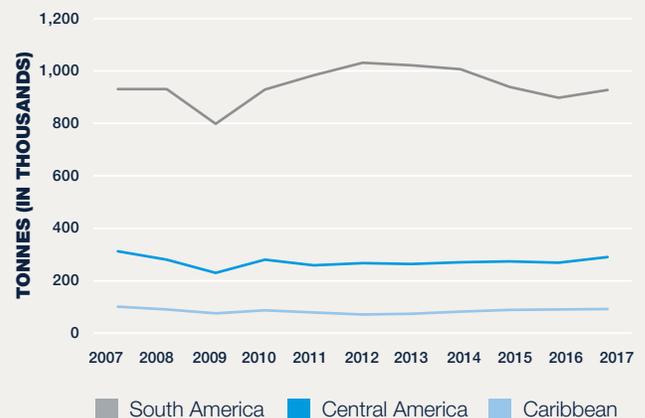
Monthly change in air cargo tonnage, year over year



Source: US Trade

### SOUTH AMERICA TRADE DRIVES LATIN AMERICA MARKET

Regional Air Trade



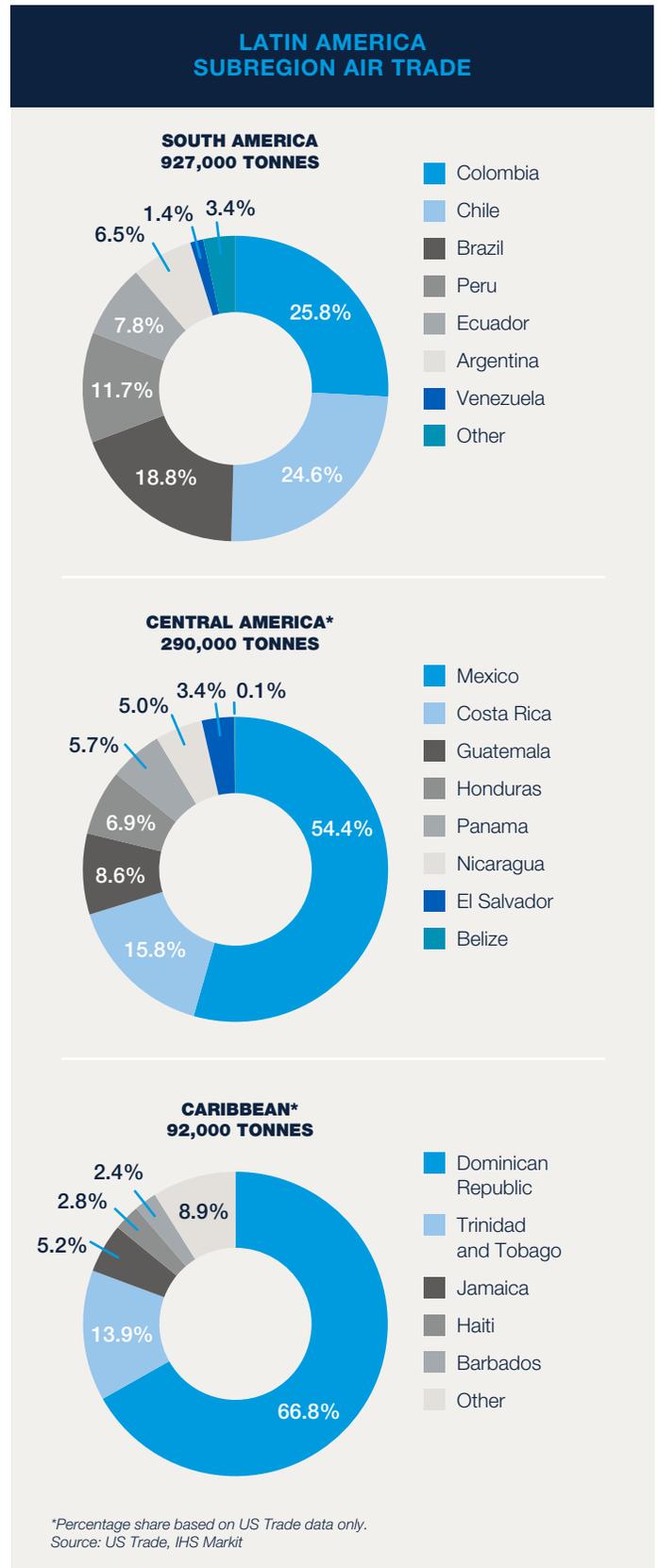
Source: US Trade, IHS Markit

# LATIN AMERICA AND NORTH AMERICA

trade consists of goods going to North America. Inversely, the majority of Brazil's air trade consists of goods coming from North America.

Central America–North America air trade declined 1.8 percent in 2016 but grew 7.9 percent in 2017. A 7.1 percent decline in North American exports to Mexico largely contributed to the 2016 decline, while the 2017 growth was largely attributable to 21.6 percent growth in North American imports from Mexico and 12.5 percent growth in North American exports to Mexico. Mexico remains North America's largest Central American air trade partner.

Caribbean Basin–North America air trade grew 1.3 percent in 2016 and 2.8 percent in 2017, representing more moderate growth than previous years. Notably, although air trade from the Caribbean to North America grew 5 percent in 2016 and 7.2 percent in 2017, North America-to-Caribbean air trade declined 3.6 and 3.7 percent, respectively, during the same time periods. The recession in Trinidad and Tobago, which has the second largest share in the Caribbean regional air trade market, weighed heavily on Caribbean imports. In particular, it partially offset the gains in Caribbean exports resulting from strong growth in the Dominican Republic, which maintains the largest share of Caribbean air trade.



# LATIN AMERICA AND NORTH AMERICA

## COMMODITIES DATA CONTINUES TO REFLECT UNIQUE DIRECTIONAL GOODS FLOW

Commodities data from 2017 show similar cargo flows from previous years. Latin America's northbound goods movement was primarily made up of perishables. For instance, 85 percent of Colombian exports to the United States were fresh flowers, while 72 percent of Chilean exports were fish products (mostly fresh). 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.

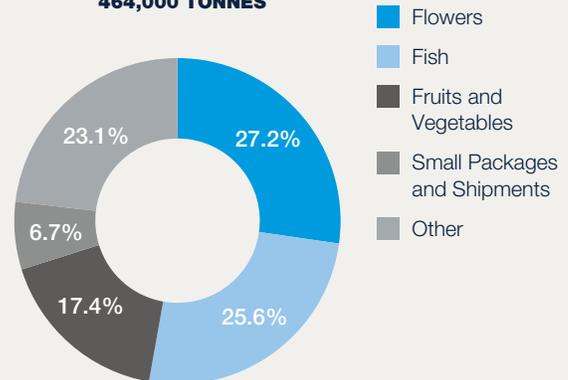
## LATIN AMERICA-NORTH AMERICA FORECAST

**The total Latin America-North America market for air cargo services is forecast to grow 4.1 percent per year from 2018 to 2037.**

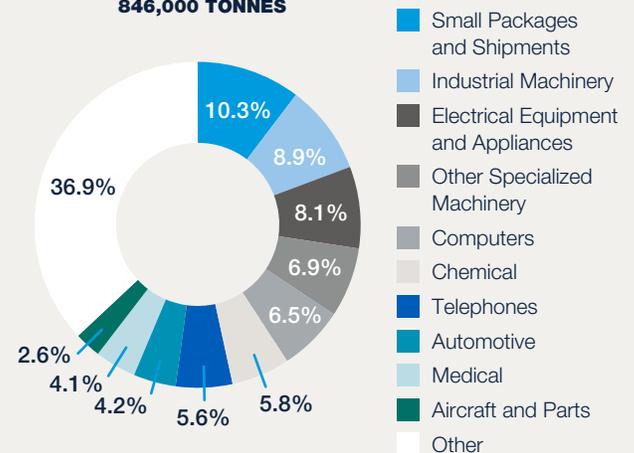
While the economies of Brazil and Argentina suffered recessions in 2016, those recessions ended in 2017, which improves the short-term outlook for the region. Additionally, the combined effects of overall global growth and recovering commodity prices have helped support Latin American countries that rely on commodities exports. More importantly, many countries in the region have also made efforts to improve domestic economic management by implementing policies to help stabilize exchange rates, reduce fiscal deficits, and control inflation. In many countries there have also been indications of improved labor markets, which have in turn increased private consumption. Additionally, Mexico, Central America, and parts of the Caribbean have benefited from stronger US growth, through trade and increases in remittances. Nevertheless, there still exist many uncertainties that could affect medium- and long-term outlooks, including election cycles in Brazil and Mexico, North American Free Trade Agreement (NAFTA) discussions and their effects on trade between the United States and Mexico, and the

### COMMODITY TYPE HEAVILY DEPENDENT ON DIRECTIONAL TRADE

**LATIN AMERICA TO NORTH AMERICA**  
464,000 TONNES



**NORTH AMERICA AND LATIN AMERICA**  
846,000 TONNES



Source: IHS Markit

# LATIN AMERICA AND NORTH AMERICA

ability of Latin American countries to maintain sound economic reforms in the long term.

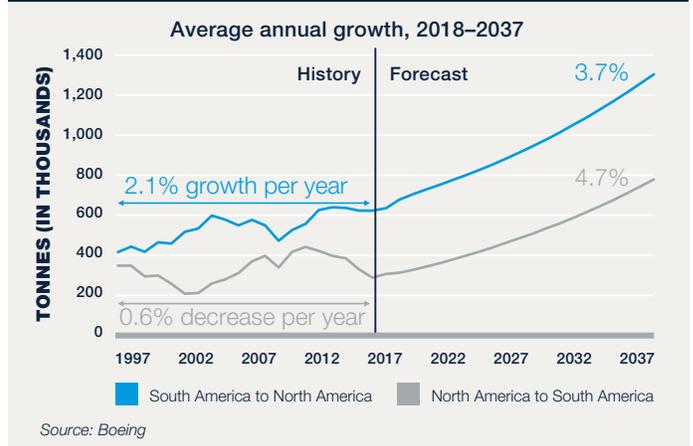
During the forecast period, GDP is expected to grow 3 percent per year in South America, 2.8 percent in Central America, and 3.7 percent in the Caribbean Basin. North American GDP is forecast to grow at an average annual rate of 2 percent during the next 20 years. For the Latin America–North America air trade market, this growth is expected to result in 3.8 percent growth per year from Latin America to North America and 4.6 percent growth per year from North America to Latin America.

The South America–North America air trade market is forecast to grow 4 percent per year in the next 20 years, with a faster rate of growth for traffic from North America to South America. This forecast takes into account the generally positive outlook for the South American economy, while also accounting for its potential risks. The market from South America to North America will continue moderate growth given the slightly lowered pace of GDP growth in North America.

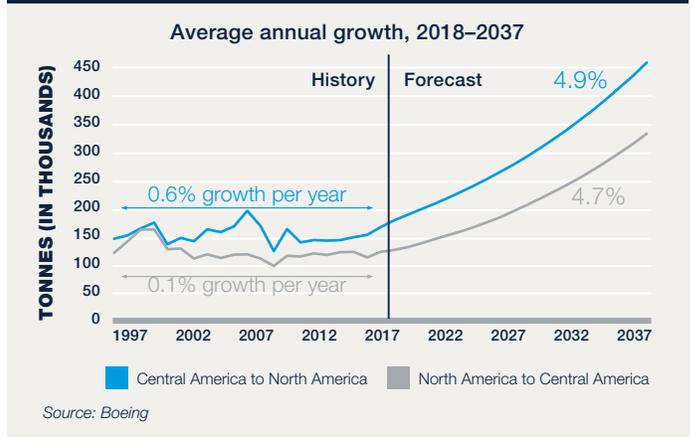
In Central America, trade and election uncertainties with Mexico lead to slightly lower projections of 4.8 percent air trade growth per year over the next 20 years. These uncertainties, along with potential changes in US immigration policies, are impacting business sentiment and investments. Overall, Central America’s outlook still remains positive, given the benefits the region’s economies experience as a result of growth in the United States.

Finally, the Caribbean Basin–North America air trade market is expected to grow 1.8 percent per year during the next 20 years. A slight increase to the growth projections for traffic from the Caribbean to North America is attributable to strong growth in the past five years, largely the result of recent sustained growth in the Dominican Republic and targeted efforts by its government to focus on growing exports.

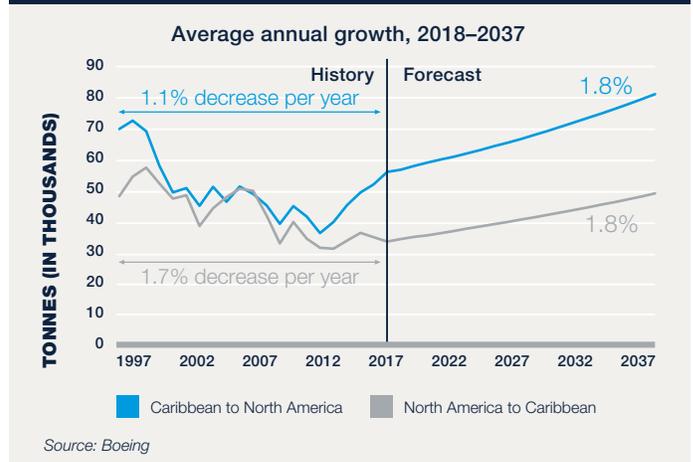
## SOUTH AMERICA–NORTH AMERICA AIR TRADE WILL GROW 4% PER YEAR



## CENTRAL AMERICA–NORTH AMERICA AIR TRADE WILL GROW 4.8% PER YEAR



## CARIBBEAN–NORTH AMERICA AIR TRADE WILL GROW 1.8% PER YEAR



# LATIN AMERICA AND EUROPE

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 28 member countries of the European Union (EU) plus Switzerland, Norway, Iceland, Turkey, Albania, Gibraltar, and all the countries of the former Yugoslavia.

## LATIN AMERICA–EUROPE MARKET GROWTH SHOWS SIGNS OF IMPROVEMENT

**In the Latin America–Europe market, which represents approximately 2.9 percent of global air cargo traffic in tonne-kilometers and 1.6 percent in trade tonnage, air cargo growth increased from 1.2 percent in 2016 to 6.2 percent in 2017.**

Latin American air trade rebounded in 2017, growing more than 6 percent year over year. Two important factors in this growth are the continued recovery of the Brazilian economy and increased trade between Mexico and Europe. Air trade growth in the three Latin American subregions varied in 2017. Central America remained strong, with a growth rate of 17 percent, while air trade growth in the Caribbean decreased 10.6 percent. Lastly, South America enjoyed its first positive growth in nearly three years, increasing 4 percent.

In 2017, vegetable products were the main imports shipped by air to Europe from Latin America. In the Europe-to-Latin America direction, machinery and electrical equipment and chemical products were the top air cargo commodities. The European Union remains an important air trade partner for Latin America, second only to the United States.

### LATIN AMERICA–EUROPE TRAFFIC BY SUBREGION



Source: Eurostat

## SOUTH AMERICA CONTINUES TO DOMINATE AIR TRADE BETWEEN EUROPE AND LATIN AMERICAN SUBREGIONS; CENTRAL AMERICAN GROWTH IMPROVES

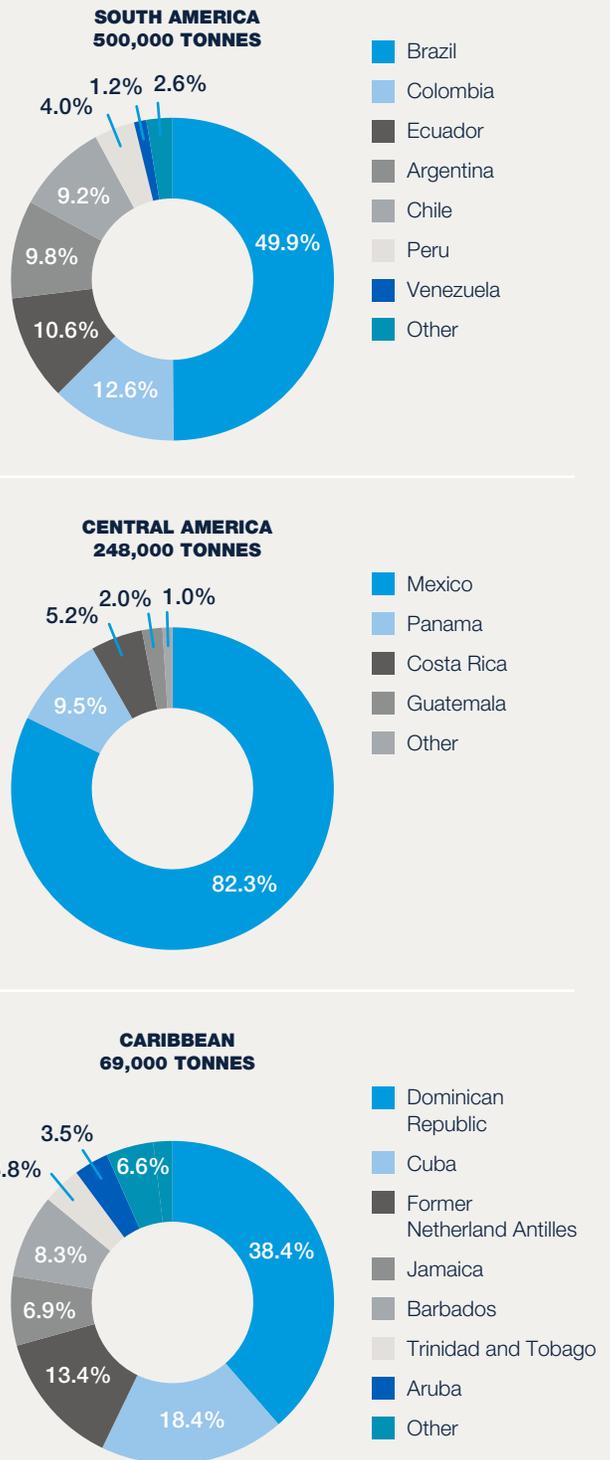
**Of the more than 850,000 tonnes of air cargo that transited between Latin America and Europe in 2017, 62 percent was through South America, followed by Central America at 29 percent and the Caribbean at 9 percent.**

After a brief period of decline in 2015 and 2016, air trade growth in the South America–Europe market recovered in 2017, with a growth rate of more than 4 percent. The Brazilian economy’s subsequent recovery has allowed the country to maintain its majority share of that market, with 50 percent of South American air trade originating or ending in Brazil. Argentina’s air trade share increased in 2017 to almost 10 percent, while Colombia’s and Ecuador’s shares continued to grow to 12.6 percent and 10.6 percent, respectively.

Central American air trade continued its impressive growth in 2017 with an overall growth rate of more than 17 percent. Mexico continues to be a major trading partner with Europe, reflected in its 82 percent share of the market. Panama increased its share of the Central America market by 4 percent in 2017.

Air trade between the Caribbean and Europe has been historically volatile, with growth rates fluctuating up to 30 percent within a matter of years. The last two years appear to follow this pattern, with Caribbean–European air trade slowing to a growth rate of only 0.7 percent in 2016 followed by a decrease of 10 percent in 2017, likely caused by severe weather in the region. While this market is not expected to grow significantly in the next few years, it is likely that the growth rate will turn positive once again as regional demand continues to recover.

### EUROPE–LATIN AMERICA TRADE CAN BE CLASSIFIED INTO THREE SUBREGIONS



Source: Eurostat

## LATIN AMERICA AND EUROPE

Since 2013, growth in air cargo shipments from Latin America to Europe has outpaced those in the opposite direction. As the Brazilian economy continues its slow recovery, Europe-to-Latin America trade may recover as well.

### ECONOMIC OUTLOOK FOR LATIN AMERICA AND EUROPE

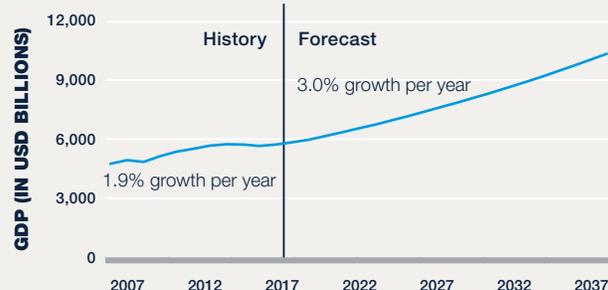
**Latin American economies are forecast to grow 3 percent per year between 2018 and 2037. Continued growth in the middle class and improved political stability will drive sustained economic growth in this region.**

In the subregions, the South American economy is expected to grow 3 percent annually during the forecast period. Brazil, in particular, continues its economic recovery and will account for 58 percent of South America's total GDP by 2037. Central America's economy is forecast to grow at an average rate of 2.8 percent per year during the 20-year forecast period. And the Caribbean economy, led by Cuba, is projected to grow at a rate of 3.1 percent during the 20-year forecast period, slightly less than previous growth expectations.

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

Europe's economy is forecast to grow at an average annual rate of 1.8 percent, reflecting modest yet consistent growth in the region.

### LATIN AMERICA'S ECONOMY WILL GROW 3% PER YEAR



Source: IHS Markit

# LATIN AMERICA AND EUROPE

## LATIN AMERICA-EUROPE FORECAST

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

Since 1999, air trade has benefited from several trade and association agreements, particularly in recent years. The continued success of these agreements could support increased demand for air cargo between Latin America and Europe.

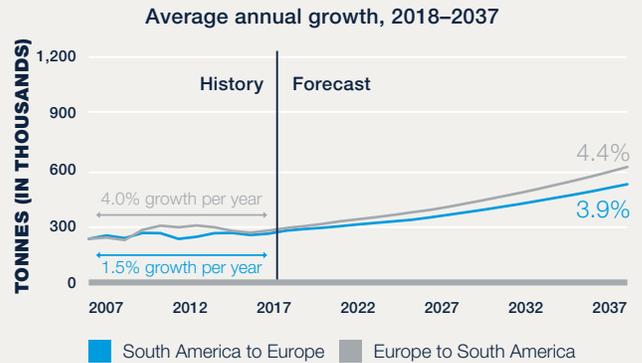
After growing at an annual rate of 3.7 percent in the past 10 years, the air cargo market for the region is projected to grow 4 percent in the Europe-to-Latin America direction and 3.5 percent in the opposite direction through 2037.

Air trade between South America and Europe is projected to grow an average of 4 percent in the next 20 years. Europe-to-South America air cargo traffic is forecast to grow 4.4 percent on average, while South America-to-Europe traffic is forecast to grow 3.9 percent.

The Central America-Europe market is projected to grow 4 percent on average in the next 20 years. Europe-to-Central America traffic is forecast to grow 5.3 percent, while Central America-to-Europe traffic is forecast to grow 4.8 percent per year through 2037.

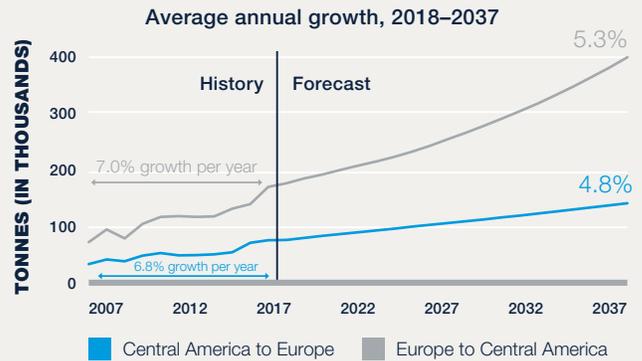
Growth in air cargo shipments between Europe and the Caribbean is projected to be similar in both directions, with total air trade forecast to grow 3 percent in the next 20 years. Air cargo traffic from Europe to the Caribbean is forecast to grow at an average annual rate of 2.9 percent, while air cargo traffic in the Caribbean-to-Europe direction is forecast to grow 3 percent per year during the forecast period. Air cargo traffic growth rates for the Caribbean will depend on continued political reform and integration within the subregion.

### SOUTH AMERICA-EUROPE AIR TRADE WILL GROW 4% PER YEAR



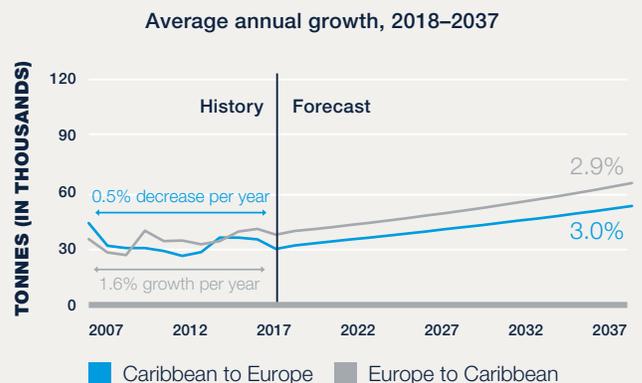
Source: Boeing

### CENTRAL AMERICA-EUROPE AIR TRADE WILL GROW 4% PER YEAR



Source: Boeing

### CARIBBEAN-EUROPE AIR TRADE WILL GROW 3% PER YEAR



Source: Boeing

# EUROPE AND NORTH AMERICA

For the purposes of this forecast, we define Europe as all 28 member countries of the European Union (EU) plus Switzerland, Norway, Iceland, Turkey, Albania, Gibraltar, and all the countries of the former Yugoslavia. We define North America as Canada and the United States.

## AIR CARGO RESURGENT IN 2017

**Air trade between Europe and North America, approximately 6.3 percent of world air cargo tonnage and 8.2 percent of tonne-kilometers, grew 2.6 percent in 2016 and increased 10.7 percent in 2017 to 3.3 million tonnes.**

In 2017, steady economic growth in North America and the highest level of growth in Europe in a decade boosted the market 10.7 percent to 3.3 million tonnes, a return to the peak figures of 2007.

The United States accounted for nearly 93 percent of North American air exports to Europe and 92 percent of the region's air imports from Europe in 2017.

Total air cargo tonnage between Europe and the United States grew 2 percent in 2016. The following year saw an 11.2 percent increase in total tonnage, the highest rate of growth since 2010.

In the US-to-Europe direction, air trade fell 2.1 percent in 2016 but grew 7.2 percent in 2017.

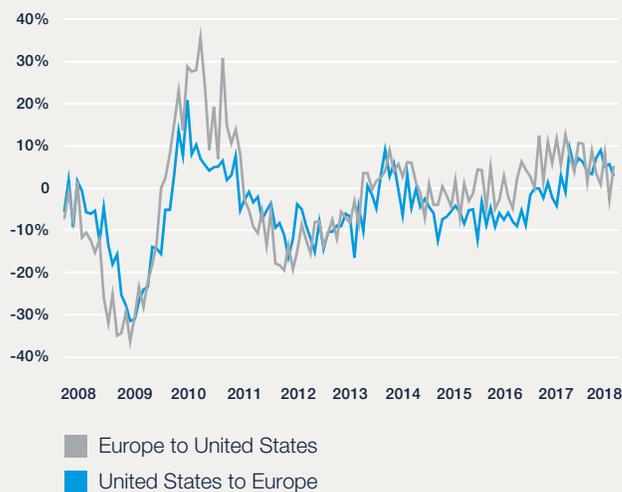
In the Europe-to-US direction, annual air trade expanded 5.2 percent in 2016 and 14.3 percent in 2017.

Total air trade between Canada and Europe grew 9.3 percent in 2016 and 4.9 percent in 2017. Canada-to-Europe air trade grew 14.4 percent in 2016 and 7.2 percent in 2017. In the Europe-to-Canada direction, air trade expanded 6.5 percent in 2016 and 3.5 percent in 2017.

Total air trade between Europe and North America grew 2.6 percent in 2016 and 10.7 percent in 2017. North America-to-Europe flows contracted 1 percent

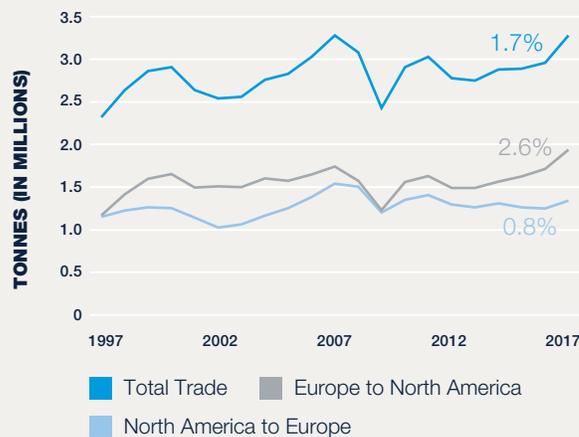
## EUROPE-US AIR TRADE HAS GROWN STEADILY SINCE Q4 2016

Monthly change in air cargo tonnage, year over year



Source: US Trade

## EUROPE-NORTH AMERICA AIR TRADE HAS GROWN 1.7% PER YEAR SINCE 1997



Source: US Trade, IHS Markit

# EUROPE AND NORTH AMERICA

in 2016 but rebounded 7.2 percent in 2017. Europe-to-North America flows increased 5.3 percent in 2016 and 13.3 percent in 2017.

Since 1980, five European countries—Germany, the United Kingdom, Italy, France, and the Netherlands—have comprised nearly 70 percent of all European air trade with North America. Air trade with the United Kingdom contracted slightly in 2016, while trade with the other four countries grew modestly. In 2017, trade with all five countries expanded, totaling a 10.4 percent increase in tonnage from the previous year.

Outsize cargo, shipment requirements, and the unique demands of shippers continue to prove that dedicated freighters are vital to the market, reflected by the 40 percent of transatlantic air cargo still carried on cargo aircraft and despite the increasing frequency of transatlantic passenger flights and enhanced capabilities of the lower holds of aircraft on these routes.

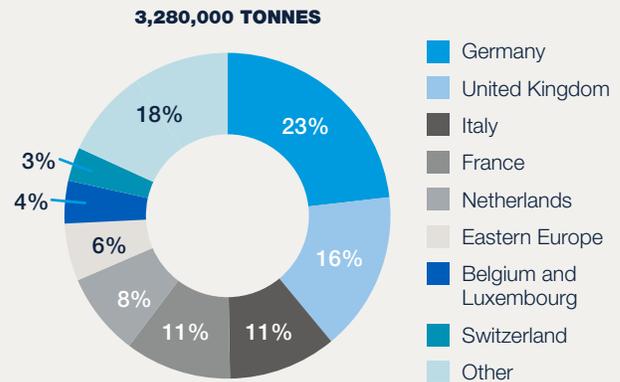
## AIR TRADE COMMODITIES

**Six commodity groups make up nearly 75 percent 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 more than 50 percent of all air trade commodities shipped from North America to Europe in 2017. Air commodities in this eastbound direction that are forecast to grow faster than predicted trends include computing and telecommunication equipment, beverages and oils, and chemicals.

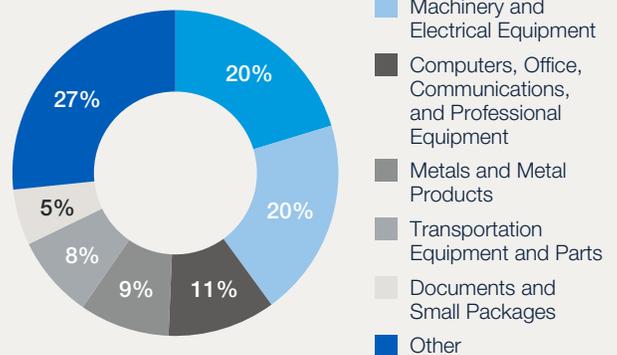
In the Europe-to-North America direction, capital equipment, express shipments, and chemicals made

### FIVE COUNTRIES ACCOUNT FOR 69% OF EUROPE-NORTH AMERICA AIR TRADE

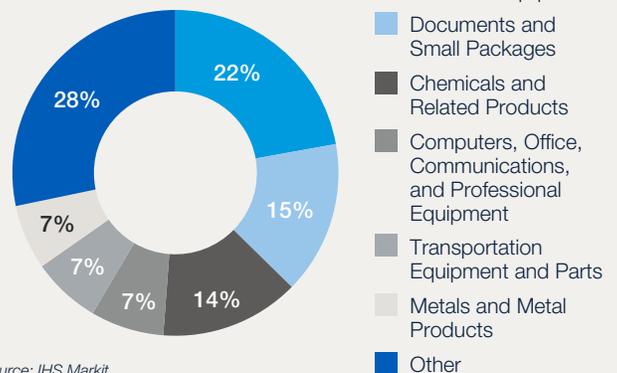


### TOP COMMODITIES ACCOUNT FOR ABOUT 75% OF THE DIRECTIONAL FLOWS

#### NORTH AMERICA TO EUROPE 1,340,000 TONNES



#### EUROPE TO NORTH AMERICA 1,939,000 TONNES



# EUROPE AND NORTH AMERICA

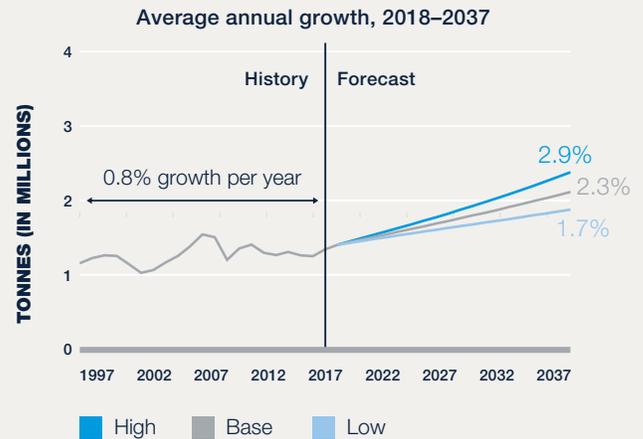
up around half of all air trade volumes in 2017. Air commodities in this westbound lane that are forecast to grow faster than predicted trends include capital equipment, computing and telecommunication equipment, and chemicals.

## EUROPE-NORTH AMERICA FORECAST

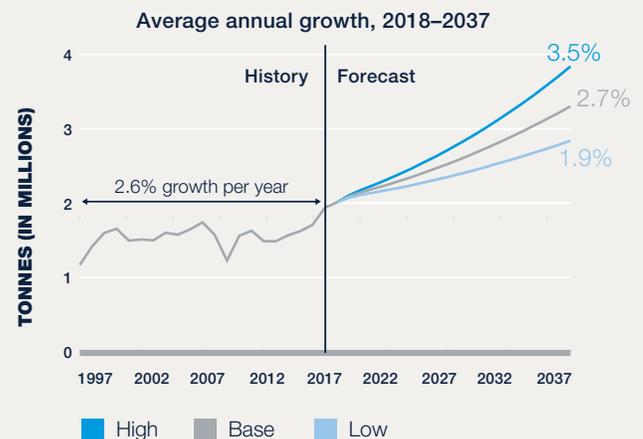
**GDP growth in Europe and North America will continue to be the broadest-based indicator of trade between these regions. The baseline GDP projections for Europe and North America through 2037 anticipate average annual growth of 1.8 and 2 percent, respectively. Low- and high-growth scenarios are based on projections of 0.5 percent 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 2.5 percent annually, compared to the 1.7 percent annual average of the previous two decades. Air trade in the North America-to-Europe direction will average 2.3 percent growth per year and will grow slightly faster in the Europe-to-North America direction at an average of 2.7 percent per year.

### NORTH AMERICA-TO-EUROPE AIR TRADE WILL GROW 2.3% PER YEAR



### EUROPE-TO-NORTH AMERICA AIR TRADE WILL GROW 2.7% PER YEAR



# INTRA-EUROPE

For the purposes of this forecast, we define Europe as all 28 member countries of the European Union (EU) plus Switzerland, Norway, Iceland, Turkey, Albania, Gibraltar, and all the countries of the former Yugoslavia.

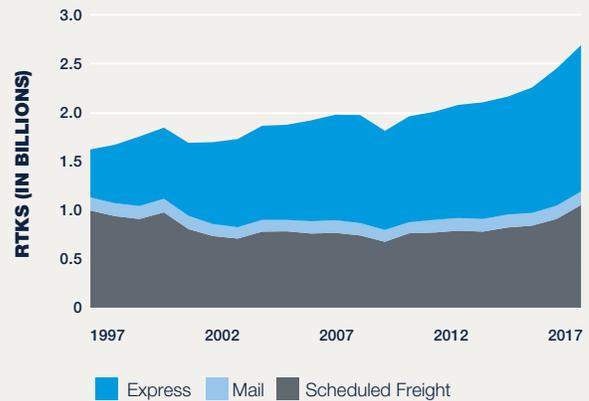
## INTRA-EUROPE AIR CARGO MARKET HAS GROWN AT ACCELERATED PACE

**The intra-Europe air cargo market comprises approximately 5.1 percent of the world's air cargo tonnage but, because the region is geographically compact, only 1.3 percent of the world's tonne-kilometers.**

Approximately 70 percent of all air cargo moving into, within, and out of Europe passes through one or more of the northern European countries of Germany, France, United Kingdom, Netherlands, Belgium, or Luxembourg, a slight market share decrease from 72 percent in 2015. The compact geography of air cargo markets within Europe generally limits routes to relatively short hauls, typically between 900 and 1,200 kilometers.

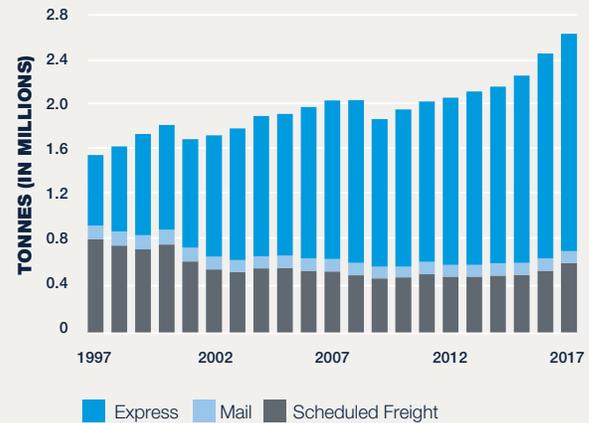
The intra-Europe air cargo market grew at an accelerated pace after recovering from stagnation between 2010 and 2013. In revenue tonne-kilometers (RTK), intra-Europe traffic grew 8.6 percent in 2016 and 9.7 percent in 2017. The air cargo tonnage also grew rapidly, 8.6 percent in 2016 and 7 percent in 2017, to 2.6 million tonnes. Much of this intra-Europe air cargo traffic resurgence can be explained by the recovery in European industrial activity, which began in 2016 and continued into 2017.

### INTRA-EUROPE AIR CARGO MARKET GREW AT ACCELERATED PACE



Source: AEA, ICAO, OAG, FlightGlobal, Boeing

### INTRA-EUROPE TONNAGE HAS INCREASED TO 2.6 MILLION TONNES



Source: AEA, ICAO, OAG, FlightGlobal, Boeing

## INTRA-EUROPE AIR CARGO TRAFFIC COMPRISES SCHEDULED FREIGHT, MAIL, AND EXPRESS

**The three primary components of air cargo traffic within Europe—scheduled freight, mail, and express—have grown at different rates. Express traffic averaged 5.7 percent growth per year during the past 20 years. Scheduled freight and mail traffic, on the other hand, grew at a slower pace, 0.3 percent per year, during the same period.**

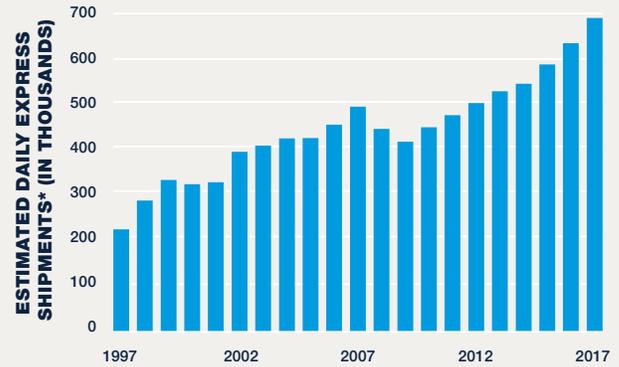
Scheduled freight and mail traffic were stagnant from 2000 to 2015, while the express segment alone accounted for nearly all growth in the intra-Europe air cargo market. Since 2015, however, scheduled freight and mail have recovered from the stagnation, recording 7.6 percent growth in 2016 and 14 percent growth in 2017, exceeding the peak of 1.13 billion RTKs in 2000.

Except during the global economic downturn, express traffic grew at a steady pace for the past decade. While express traffic grew 9.4 percent in 2016 and 6.5 percent in 2017, the annual traffic growth in the entire decade averaged only 3.3 percent, a marked decline from the previous decade's 8.2 percent average annual growth.

Integrated express carrier traffic has made up more than half of all intra-Europe air cargo tonnage since 1999, 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 in the past 20 years 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

### INTRA-EUROPE AIR EXPRESS SHIPMENTS HAVE INCREASED STEADILY SINCE GLOBAL ECONOMIC DOWNTURN



\*International shipments only  
Source: Cargo Facts Consulting

## INTRA-EUROPE

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. The shift toward ground transport has held overall intra-Europe air traffic to only 3.1 percent average growth during the 10-year period from 2007 to 2017.

After growing an average of 8.2 percent per year during the 10 years between 1997 and 2007, the estimated number of daily international air express shipments declined as a result of the global economic downturn. Shipments revived, however, and have grown steadily at 6.5 percent per year since 2009. Intra-European express shipments have grown 3.4 percent on average per year, from 495,600 to 691,000 shipments per day between 2007 and 2017.

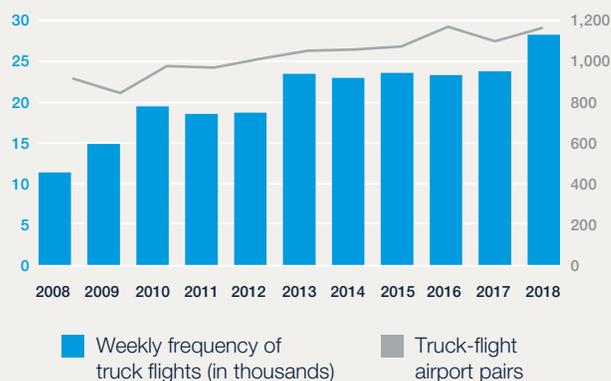
### TRUCKS COMPLEMENT SCHEDULED AIRPLANE FREIGHT SERVICES

**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 in the past decade has clearly contributed to a decline in growth of scheduled freight carried by air. According to the truck-flight schedules published by airlines, since 2008, airport pairs of truck flights grew 2.5 percent on average per year.

### TRUCK-FLIGHT FREQUENCY GREW 18.9% IN 2018



Source: Airline data, FlightGlobal

## INTRA-EUROPE

Weekly frequencies of truck flights grew 15.5 percent on average per year between 2008 and 2013, but the growth has paused since 2013. After a long period of stagnation from 2013 to 2017, weekly frequencies of truck flights grew 18.9 percent in 2018. Most of the growth occurred in the major hub airports of the carriers, strengthening their air cargo networks.

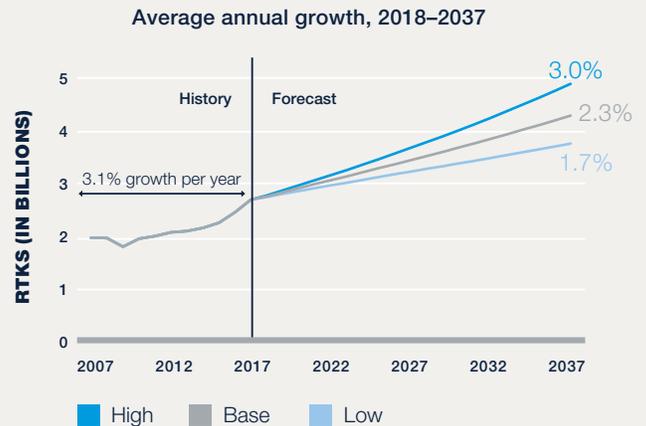
Truck-flight operations provide regularly scheduled freight service for high-value or work-in-progress goods between manufacturing facilities, especially to and from central and eastern Europe. Scheduled truck operations are often used where demand is too low or infrequent to warrant dedicated freighter airplane service.

### 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 percent per year through 2037. The 20-year forecast growth in air cargo traffic is lower than the 2.6 percent growth trend recorded during the previous 20-year period from 1997 to 2017.**

Economic activity, as measured by GDP, and industrial activity will remain the primary drivers for traffic growth in this market. For the long term, the baseline GDP for Europe will average 1.8 percent growth per year through 2037. GDP projections of 0.5 percent 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 1.7 and 3 percent.

### INTRA-EUROPE AIR CARGO TRAFFIC WILL GROW 2.3% PER YEAR



Source: Boeing

# REGIONAL MARKETS MIDDLE EAST

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 TRAFFIC GROWTH HAS MODERATED AS REGIONAL ECONOMIC GROWTH SLOWED

**Air cargo moving into, within, and out of the Middle East accounted for an estimated 1.6 percent of world tonnage and 1.3 percent of world revenue tonne-kilometers during 2017.**

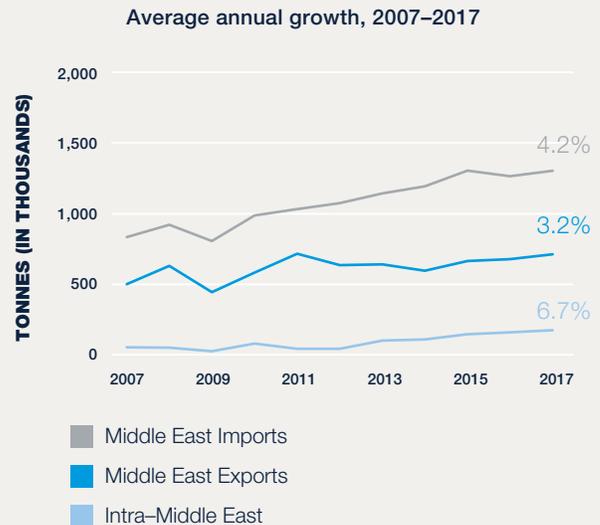
The Middle East continues to be a dynamic and key trading region, as well as an important crossroad for air trade in the Eastern Hemisphere.

Air cargo trade from 2007 to 2017 grew 4.1 percent, a decrease from the 5.7 percent growth during the 10-year period ending in 2015. Although worldwide air cargo grew an impressive 10.1 percent in 2017, Middle East cargo grew just 3.8 percent.

The Middle East's strategic geographic location positions it as a transit point for air cargo moving between Europe, Asia, and Africa. One-third of the total air cargo tonnage originates or terminates in Middle East countries, while two-thirds transfer 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, placing them among the top air cargo carriers worldwide.

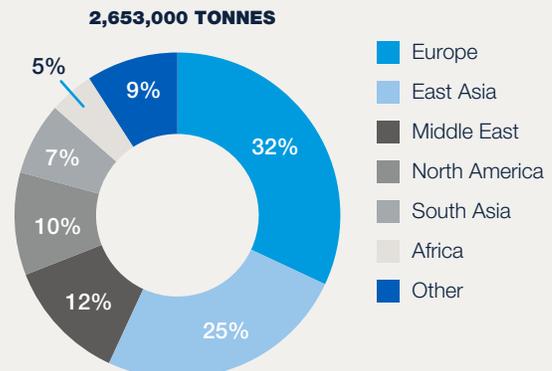
New infrastructure will continue to reinforce the region's role as an air cargo hub. All three of the largest cargo centers in the region—Dubai and Abu Dhabi in the United Arab Emirates and Doha in Qatar—are expanding their cargo-handling capacity to meet growing air cargo demand. Dubai's new Al Maktoum International Airport was designed to be the world's largest cargo hub, with the ability to handle 12 million tonnes of freight annually. The airport will be home to an integrated operation, combining different

## MIDDLE EAST AIR TRADE GREW 4.1% PER YEAR



Source: IHS Markit

## EUROPE IS LARGEST MIDDLE EAST AIR TRADE PARTNER



Source: IHS Markit

transportation modes, logistics, manufacturing, and assembly in a single free trade zone.

The region is also a significant sea-air market in which goods from South Asia arrive on ships and transfer to air en route to other regions.

## MIDDLE EAST-EUROPE TRAFFIC GROWING MODERATELY

**Air cargo traffic between the Middle East and Europe has grown moderately since 2007. Imports from Europe, significantly more than exports from the Middle East, have grown 3.5 percent per year; exports to Europe have declined 1.3 percent.**

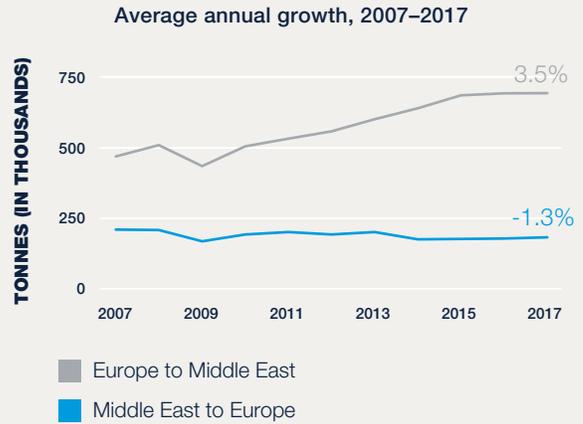
Trade with Europe represented one-third of the Middle East's international air cargo market, which accounted for 848,000 tonnes of air cargo in 2017. The primary commodities shipped to Europe are garments and perishables. Leading commodities shipped from Europe include non-alcoholic beverages, spirits, beer, fish, and seafood. Overall air cargo traffic in both directions has averaged 2.3 percent annual growth since 2007.

## MIDDLE EAST-EAST ASIA SHOWING STRONG GROWTH

**In 2017, East Asia traffic accounted for a quarter of the air cargo market in the Middle East, at 662,000 tonnes.**

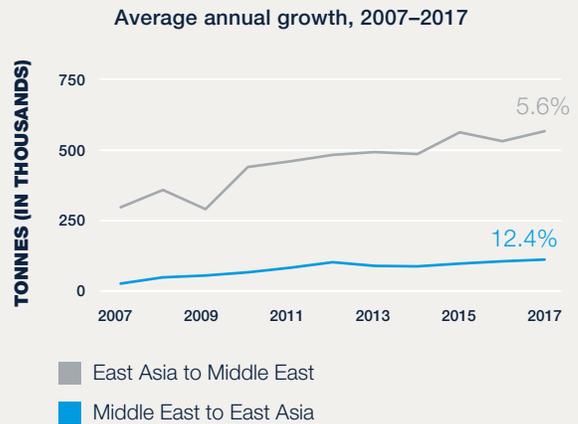
Air cargo shipments arriving from East Asia consisted predominantly of textiles, machinery, and electrical and computer equipment. Imports from East Asia have increased at a robust annual rate of 5.6 percent since 2007. The air cargo export flow to East Asia is very small (less than 20 percent of imports from East Asia), but grew at a strong 12.4 percent per year in the past decade.

### MIDDLE EAST-EUROPE AIR TRADE GREW 2.3% PER YEAR



Source: IHS Markit

### MIDDLE EAST-EAST ASIA AIR TRADE GREW 6.4% PER YEAR



Source: IHS Markit

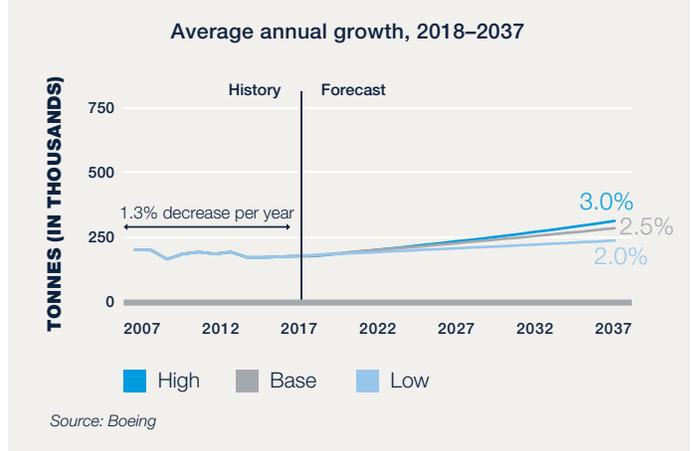
MIDDLE EAST FORECAST

**Overall air cargo between the Middle East and Europe will grow at an average annual rate of 3.4 percent between 2018 and 2037.**

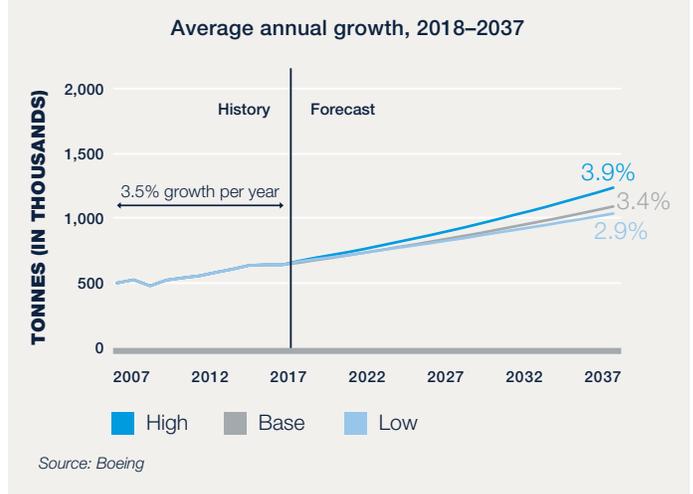
Direct flights connecting production centers in East Asia and Europe will continue to pose some risk to air cargo traffic growth prospects between the Middle East and Europe. Nevertheless, increasing local exports, coupled with the continued European market for goods transshipped from East Asia and Africa, 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 those of emerging light industries, will determine whether the trajectory of long-term growth tends more to the high or low projection.

MIDDLE EAST-TO-EUROPE AIR TRADE WILL GROW 2.5% PER YEAR



EUROPE-TO-MIDDLE EAST AIR TRADE WILL GROW 3.4% PER YEAR



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

## AFRICAN AIR TRADE PATTERNS CHANGING

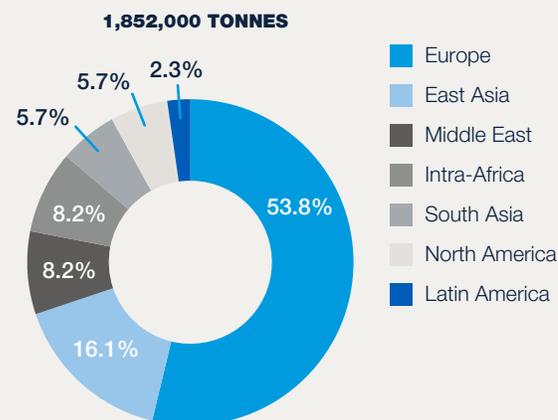
**The Africa market accounts for approximately 2.7 percent of global air cargo tonnage and 2.7 percent of global air cargo traffic in tonne-kilometers.**

Based on regional air trade and airport statistics, overall African air trade was estimated at 1.9 million tonnes in 2017. While East Asia and North America are critical market partners for the region, Europe accounts for nearly 54 percent of African cargo and commands the majority 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 16.1 percent in 2017. The region—in particular, China—has built new commercial ties to Africa. Chinese enterprises have sought out new raw materials to fuel that country’s industrial expansion. Robust economic growth in subregions such as Southeast Asia also provides a bright prospect for future trade between Africa and East Asia.

In 2017, North America accounted for 5.7 percent of Africa’s international air trade, estimated at 105,900 tonnes. Africa–North America air trade decreased in 2016 because of a fall in commodity and oil markets and the resulting decrease in demand for industrial machinery from North America. In the future, Africa’s immense economic potential, increasing integration into global markets, and booming population will create further trade and investment opportunities between the two regions. Although the growth is not as fast as with East Asia, North America remains one of the key partners for the Africa freight market.

### EUROPE REMAINS AFRICA’S PRIMARY TRADE PARTNER; EAST ASIA, INTRA-AFRICA, MIDDLE EAST RAPIDLY EXPAND SHARE



Source: IHS Markit, Eurostat, US DOC, ACI

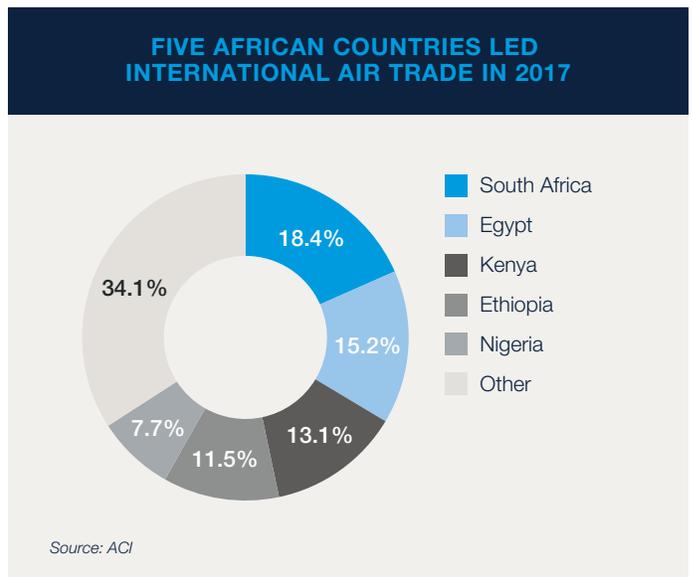
Intraregional Africa has rapidly expanded its share of African air trade in recent years. Trade among African nations was estimated at 152,000 tonnes for 2017, which accounts for 8.2 percent of the total Africa cargo market. This is a 12 percent increase from two years ago. Africa is moving forward to implement new free-trade agreements and air service agreements, such as the African Continental Free Trade Area agreement and Single African Air Transport Market. These agreements encourage operators to develop new intra-Africa air cargo lanes, which will stimulate more economic growth within the continent. Also, current ground infrastructural 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.

In general, African air exports tend to be dominated by perishables, while air imports tend to be industrial machinery and electrical equipment, computers and telecommunication equipment, and manufactured goods.

## FIVE AFRICAN COUNTRIES LEAD INTERNATIONAL AIR TRADE

**The majority of African international air trade is conducted by relatively few economies.**

As of 2017, leading international air cargo markets on the Africa continent included South Africa (18.4 percent), Egypt (15.2 percent), Kenya (13.1 percent), Ethiopia (11.5 percent), and Nigeria (7.7 percent). Only South Africa and Ethiopia have increased international air cargo volumes in the last two years. Overall, international imports to Africa decreased as the economy in the region slowed.



## AFRICA-EUROPE TRAFFIC

**After a decline in 2016, air cargo flows between Africa and Europe resumed growth in 2017.**

After suffering from more than a half decade of decline after the 2008 global economic downturn, Africa-to-Europe air flows finally rebounded, to more than 506,000 tonnes in 2014 and 502,000 tonnes in 2015. There was a decline in 2016 to 496,000 tonnes, but growth returned in 2017 to 519,000 tonnes. Europe-to-Africa air flows have been volatile. After two years of growth in 2014 and 2015, air cargo imports from Europe declined in 2016 but grew again in 2017. The directional imbalance between Africa to Europe and Europe to Africa is relatively small.

## AFRICA-EAST ASIA TRAFFIC

**Africa-East Asia air cargo trade is driven by continued East Asian investment and African consumer demand.**

The developing Africa-East Asia air cargo market has increased 7.2 percent 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 about four times as much East Asian air cargo entering as leaving Africa.

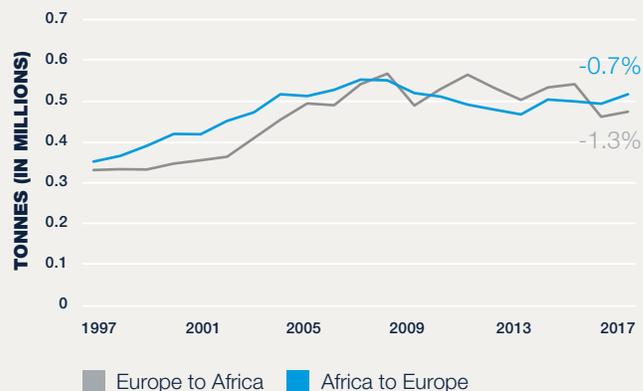
## AFRICA-NORTH AMERICA TRAFFIC

**North America's air cargo trade is dominated by exports to Africa, which are about double the African exports to North America.**

Air cargo trade with North America represents 5.7 percent of Africa's market for international air cargo. Trade in both directions was nearly balanced during the early 2000s but began to diverge in volume levels when demand for North America-manufactured specialty oil

### AFRICA-EUROPE AIR TRADE HAS DECLINED SINCE 2008 GLOBAL ECONOMIC DOWNTURN

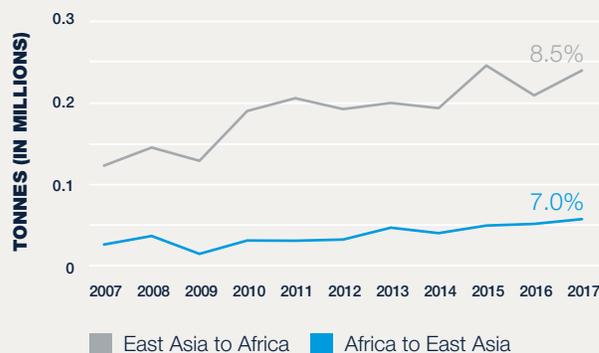
Europe remains Africa's largest air cargo partner  
Average annual growth, 1997-2017



Source: IHS Markit, Eurostat, ACI, Boeing

### AFRICA-EAST ASIA AIR TRADE CONTINUED TO INCREASE IN LAST DECADE

East Asia-to-Africa tonnage is about 4 times larger than Africa-to-East Asia  
Average annual growth, 2007-2017



Source: IHS Markit, Boeing

and gas extraction equipment began to grow in the mid-2000s. African imports from North America represented 64.3 percent of this regional flow in 2017, largely consisting of small parcels and documents, oil and gas equipment, industrial and mining equipment, and chemicals. A fall in the commodity and oil markets decreased demand for industrial machinery, and a sharp decline in 2016 of air cargo imports from North America to Africa resulted. By 2017 the markets had stabilized and air cargo slightly increased. African exports declined for the past decade, largely because of a reduction of US demand for miscellaneous manufactured articles. Leading African air cargo exports to North America include apparel, perishables, and automobile components.

## AFRICA-MIDDLE EAST AND DOMESTIC AFRICAN TRAFFIC

**Traditional air cargo trade patterns are supplemented by sea-air trade and goods flowing from South Africa by air.**

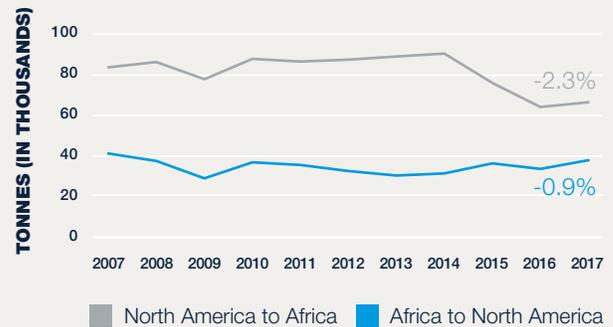
The Middle East market accounts for 8.2 percent of African air cargo, estimated at 152,200 tonnes. The most important characteristic of this trade lane is its role as a distribution hub for goods traveling to and from Africa. Traveling to the Middle East are goods such as meat products, fruits and vegetables, and flowers. Products related to the oil industry dominate westbound traffic to Africa, supplemented by pharmaceuticals and machinery. Emerging oil and gas production in east Africa markets like Uganda will further expand this trade lane, given its close proximity to the Middle East.

## AFRICA FORECAST

**Overall, air cargo trade between Africa and Europe will grow 3.7 percent per year, while Africa-East Asia air cargo trade will expand at an average annual growth rate of 6.1 percent. Air cargo trade between Africa and North America will grow 5.3 percent per year, albeit from a smaller base than either Europe or Asia.**

### NORTH AMERICA-TO-AFRICA AIR CARGO VOLUME DROPPED IN 2016

Drop in commodity and oil markets led to less demand for North American air cargo imports  
Average annual growth, 2007–2017



Source: US DOC

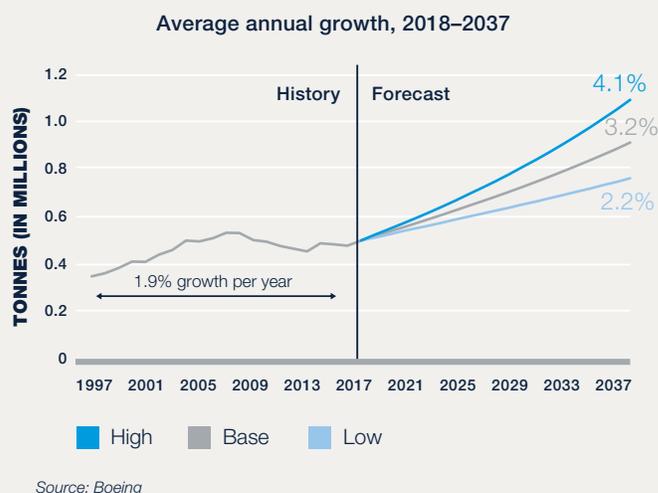
Base, low, and high models were developed to forecast the Africa–Europe air cargo market. GDP projections of 0.5 percent below and above the baseline were assessed, and the results of these growth rates are reflected in the low- and high-growth-rate scenarios. The Africa-to-Europe market is expected to average 3.2 percent growth per year. European economic growth, African economic diversification into manufactured products, and resumption of moderate growth in African perishables are assumed in the baseline forecast for this air trade flow.

A higher level of growth is forecast for the Europe-to-Africa market, reflecting the higher economic growth rates expected for Africa. At 4.2 percent, the base growth rate forecast reflects both African 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.

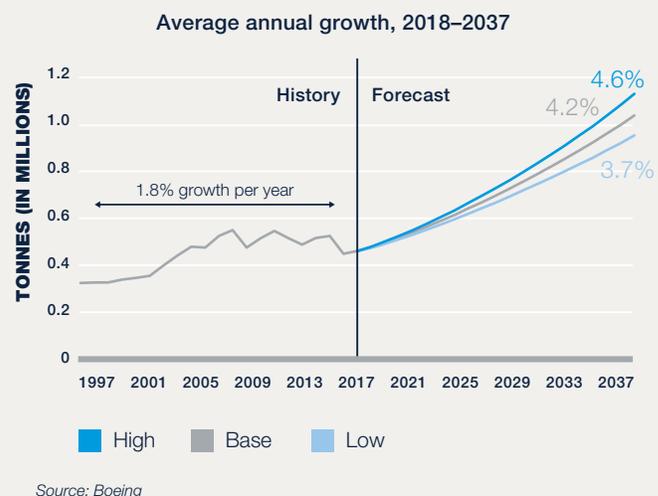
Growth in African air trade with East Asia will be driven principally by East Asian imports into the continent. Follow-on investment by China in extractive industries in Africa and—equally important—continuing urbanization and rising demand for consumer goods in Africa will propel East Asia-to-Africa air trade growth at a rate of 6.2 percent per year for the forecast period. Conversely, Africa-to-East Asia air cargo trade will expand at a slower rate of 5.8 percent per year as Africa slowly develops industrial ties with East Asia.

Development of African air cargo trade with North America will also remain directional. North America-to-Africa flows are expected to grow 6.1 percent per year through 2037, driven by continued US and Canadian investment in African extractive industries. Africa-to-North America air cargo trade will grow at almost the same rate, 3.3 percent per year, as African light manufacturing develops export markets in North America.

## AFRICA-TO-EUROPE AIR TRADE WILL GROW 3.2% PER YEAR



## EUROPE-TO-AFRICA AIR TRADE WILL GROW 4.2% PER YEAR



# EAST ASIA AND NORTH AMERICA

For the purpose of this forecast, we define East Asia as Australia, Cambodia, China, Hong Kong, Indonesia, Japan, Macau, Malaysia, 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 GREW 9.1 PERCENT IN 2017

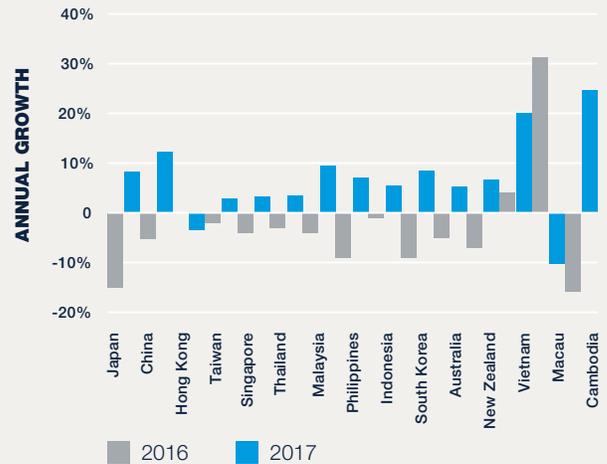
The East Asia-North America market represents 20.9 percent of the world’s air cargo in tonne-kilometers and 8.5 percent in tonnage.

The overall East Asia-North America market declined 6.2 percent in 2016 but grew 9.1 percent in 2017.

Air freight in the East Asia-to-North America direction increased from 2.5 million tonnes in 2016 to 2.8 million tonnes in 2017. Similarly, air freight from North America to East Asia grew slightly, from 1.6 million tonnes in 2016 to 1.7 million tonnes in 2017.

The United States accounts for 93 percent of the overall air trade market between East Asia and North America.

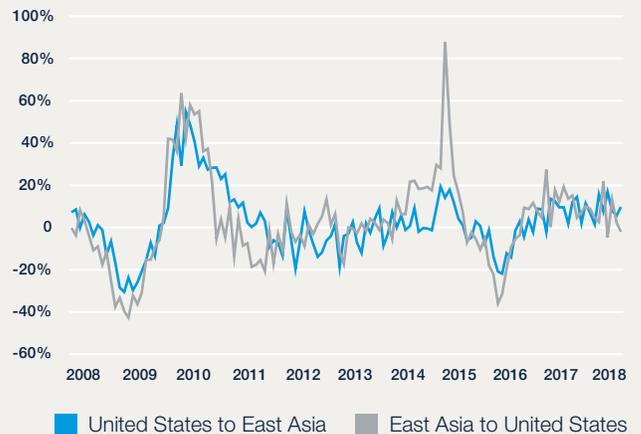
### AIR FREIGHT MARKET GREW 9.1% IN 2017



Source: US DOC

### EAST ASIA-NORTH AMERICA AIR FREIGHT GROWTH CONTINUES; 8% INCREASE FOR FIRST HALF OF 2018

Monthly change in air cargo tonnage, year over year



Source: US DOC

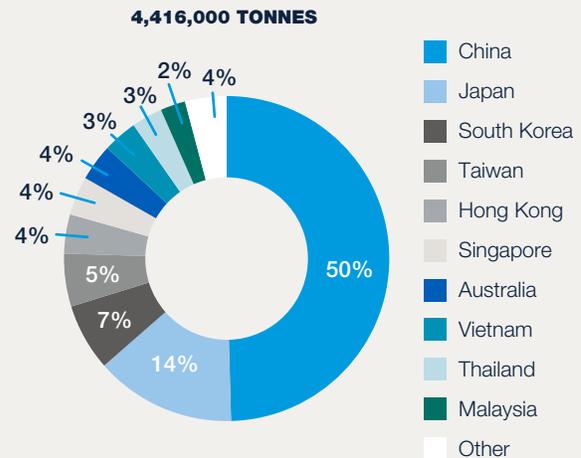
## EAST ASIA AND NORTH AMERICA

China continues to represent the largest air cargo market in the East Asia–North America market; its market share rose from 14.1 percent in 1997 to 36.7 percent in 2007, reaching a high of 50 percent in 2017. This increased Chinese dominance led to a decline in Japan’s share, from 30.9 percent in 1997 to 20.1 percent in 2007 and 14.1 percent in 2017. Korea holds the third-largest share, 7 percent, as of 2017. The recent trend of rapid middle-class growth in China will likely ensure continued growth for China’s air cargo market.

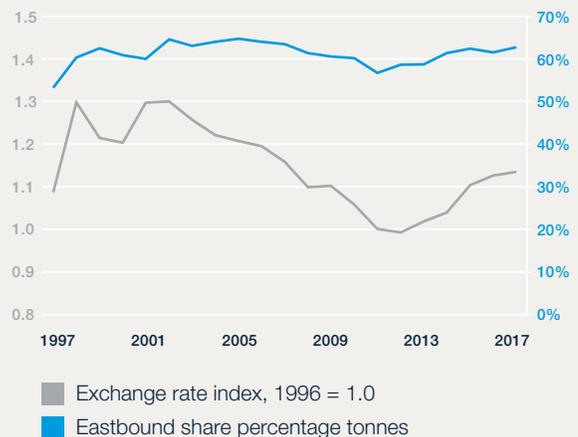
Total air tonnage on the transpacific route is determined by the combined economic activities of North American and East Asian countries, international trade patterns, and the different types of trade commodities. Economic growth in the importing region primarily determines directionality of tonnage flow, but flow is also influenced by exchange rates, which affect the cost of imported goods in national currencies. A strengthening US dollar increases eastbound traffic, whereas a weakening US dollar increases westbound traffic.

To this point, eastbound traffic dropped from 68.3 percent of the East Asia–North America air trade market in 1985 to 49.7 percent in 1995; in the same period the US dollar dropped nearly 30 percent compared to other currencies in this region. Conversely, eastbound traffic increased from 57 to 63 percent when the US dollar strengthened in relation to East Asian currencies between 2011 and 2017.

### CHINA ACCOUNTS FOR 50% OF TRANSPACIFIC AIR CARGO MARKET



### EXCHANGE RATE AFFECTS DIRECTIONALITY OF TRANSPACIFIC TRADE FLOW



## EAST ASIA-NORTH AMERICA AIR TRADE COMMODITIES

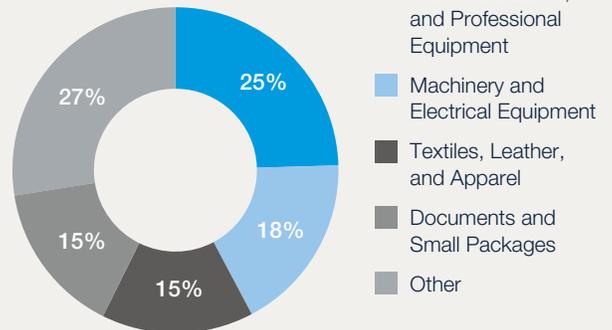
**Four commodity categories account for 73 percent of East Asia-to-North America air cargo traffic: apparel, computers and communication equipment, machinery and electrical equipment, and documents and small packages. In the opposite direction, 76 percent of traffic falls within five categories: office and communication equipment, documents and small packages, machinery and electrical equipment, vegetable and animal products, and chemical materials.**

East Asian exports to North America experienced growth in 2017. The apparel category grew 14.1 percent between 2016 and 2017, while the machinery and electrical equipment category grew 19.4 percent in the same year. Computers and communication equipment, meanwhile, remained virtually unchanged at about 25 percent.

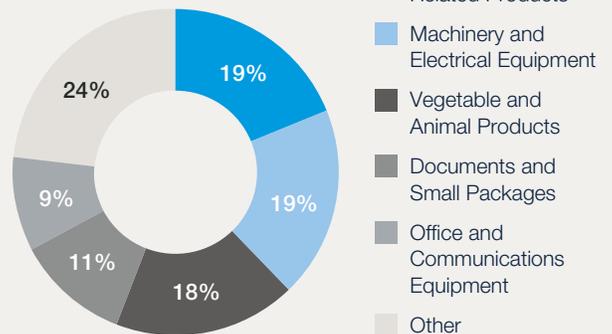
In the opposite direction, most commodity categories declined in 2016 before rebounding in 2017: office and communication equipment fell 3.9 percent before growing 3.3 percent; chemical materials fell 9.7 percent then grew 21.1 percent; machinery and electrical equipment fell 2.1 percent then grew 9.8 percent; and documents and small packages fell 6.3 percent then grew 5.2 percent. Vegetables and animal products, however, grew 1.5 percent in 2016 but contracted 0.6 percent in 2017.

### CONSUMER GOODS DRIVE EASTBOUND TRANSPACIFIC FLOW; MANUFACTURING MATERIALS DRIVE WESTBOUND FLOW

**EAST ASIA TO NORTH AMERICA  
2,769,000 TONNES**



**NORTH AMERICA TO EAST ASIA  
1,647,000 TONNES**



Source: IHS Markit, US DOC

# EAST ASIA AND NORTH AMERICA

## EAST ASIA-NORTH AMERICA FORECAST

**Air trade in both directions across the Pacific is forecast to grow an average of 4.7 percent 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 4.6 percent per year; the opposite flow is projected to grow at a slightly higher rate of 4.8 percent.**

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, with more than 960 million people living in cities and personal disposable income increasing 55 percent in real terms in the next decade. As a result of these developments, China will continue its transition from a manufacturing to a consumption- and service-driven economy.

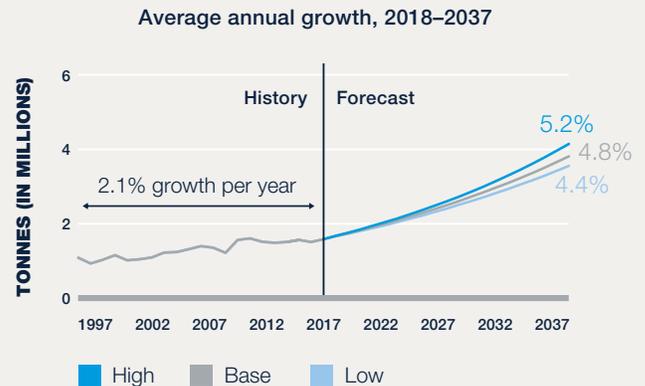
Future growth of the East Asia-to-North America air cargo market will also be affected by additional factors, including the Vietnamese economy. During the past five years, the country's air cargo exports to North America grew an average of 22.5 percent, bolstered by Vietnam's lower manufacturing costs 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's foreign direct investment is at a 10-year high, with most of the investment from East Asian countries such as Japan, South Korea, Singapore, and even China, which became the fourth largest investor in Vietnam in 2017. Opportunities for Vietnam include not only traditional sectors such as footwear and textiles but now also include electronics and other high-tech industries.

### EAST ASIA-TO-NORTH AMERICA AIR TRADE WILL GROW 4.6% PER YEAR



Source: Boeing

### NORTH AMERICA-TO-EAST ASIA AIR TRADE WILL GROW 4.8% PER YEAR



Source: Boeing

# EUROPE AND EAST ASIA

For the purposes of this forecast, we define Europe as all 28 member countries of the European Union (EU) plus Switzerland, Norway, Iceland, Turkey, Albania, Gibraltar, and all the countries of the former Yugoslavia. We define East Asia as Australia, Cambodia, China, Hong Kong, Indonesia, Japan, Macau, Malaysia, New Zealand, the Philippines, Singapore, South Korea, Taiwan, Thailand, and Vietnam.

## AIR CARGO TRAFFIC GROWTH REMAINS STRONG

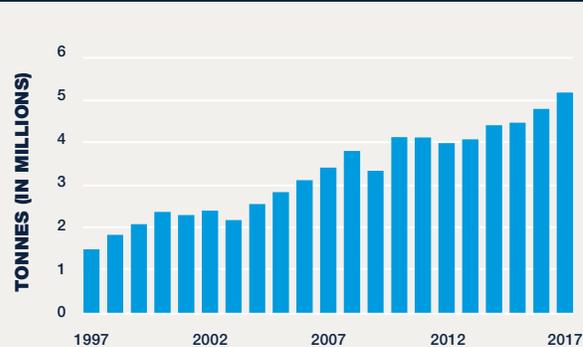
**The Europe–East Asia market comprises approximately 20.3 percent of the world’s air cargo traffic in tonne-kilometers and 10.1 percent in tonnage.**

Europe–East Asia air cargo traffic has averaged 6.4 percent growth per year since 1997. The market grew 7.1 percent in 2016 and 8.1 percent in 2017.

The Europe-to-East Asia flow grew 7.2 percent in 2016 and 7.5 percent in 2017, while in the East Asia-to-Europe direction, traffic grew 6.9 percent and 8.6 percent, respectively. In 2017, Europe’s exports exceeded imports by more than 80,000 tonnes.

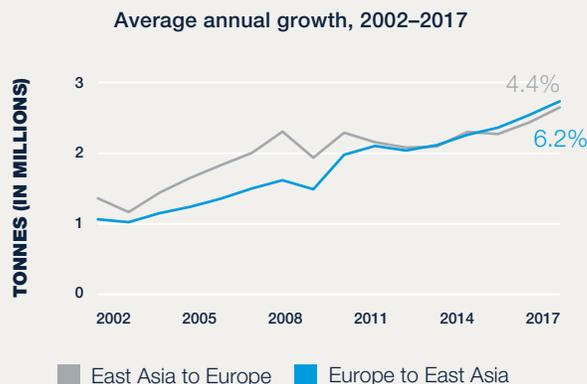
Long-term air cargo growth has maintained a steady 5.2 percent average annual rate since 2002. The air cargo market in the Europe-to-East Asia direction has grown 6.2 percent per year in the same 20-year period. In the East Asia-to-Europe direction, the market averaged 6.4 percent growth per year.

### EUROPE–EAST ASIA AIR CARGO MARKET TRAFFIC HAS GROWN 6.4% PER YEAR SINCE 1997



Source: Eurostat

### EUROPEAN AIR EXPORTS TO EAST ASIA ACCOUNT FOR 51% OF MARKET



Source: Eurostat

## EUROPE-EAST ASIA AIR TRADE COMMODITIES

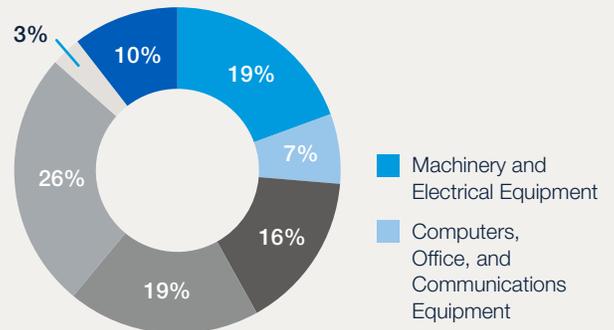
**In the Europe-to-East Asia direction, the top six commodity categories account for 90 percent of air cargo traffic.**

In descending order, the categories are perishables, such as fish, meat, fruits, and flowers; documents and small packages; machinery and electrical equipment; chemicals and related products; computers, office, and communication equipment; and textiles, leather, and apparel. In the East Asia-to-Europe direction, the top five commodity categories account for 86 percent of air trade. The categories are computers, office, and communication equipment; machinery and electrical equipment; documents and small packages; textiles, leather, and apparel; and chemicals and related products.

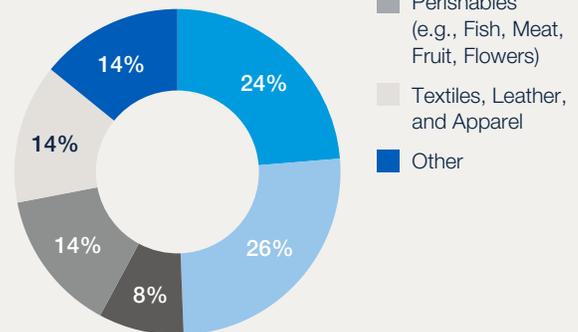
One particularly fast-growing market segment between Europe and East Asia has been documents and small packages, sometimes referred to as “traditional express traffic.” This trade flow has averaged 5.9 percent annual growth in daily shipment count in both directions since 2002, as the movement of business samples, legal documents, and other expedited small-batch items between Europe and East Asia has increased. The total bidirectional express market averaged 454,000 shipments per day in mid-2017.

### EUROPE-EAST ASIA EASTBOUND FLOWS ARE MORE DIVERSE THAN WESTBOUND FLOWS

**EUROPE TO EAST ASIA  
2,700,000 TONNES**



**EAST ASIA TO EUROPE  
2,600,000 TONNES**



Source: IHS Markit, Boeing

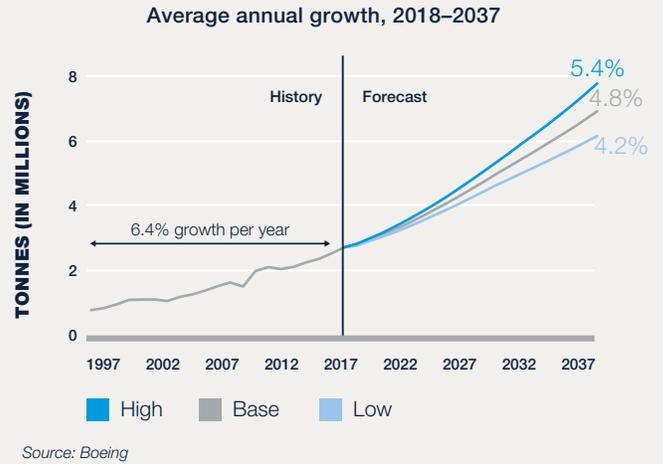
# EUROPE AND EAST ASIA

## EUROPE-EAST ASIA FORECAST

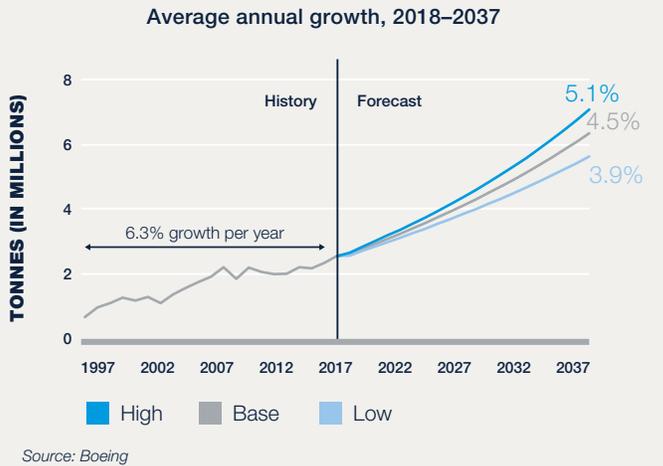
**Air trade flowing in both directions for the Europe-East Asia air cargo market is forecast to grow an average of 4.7 percent per year during the next 20 years. The flow from East Asia to Europe is forecast to grow at an average rate of 4.5 percent per year. The flow from Europe to East Asia is forecast to grow 4.8 percent per year during the next 20 years.**

East Asia's GDP will grow 3.6 percent per year during the next 20 years. China will continue to play a major role in East Asia, with the expected GDP growth of 5 percent per year during the next 20 years. China's economy currently accounts for 44 percent of East Asia's GDP and will increase to 57 percent by 2037. The established economies of Europe are expected to grow 1.8 percent per year.

### EUROPE-TO-EAST ASIA AIR TRADE WILL GROW 4.8% PER YEAR



### EAST ASIA-TO-EUROPE AIR TRADE WILL GROW 4.5% PER YEAR



# INTRA-EAST ASIA AND OCEANIA

For the purpose of this forecast, we define intra-East Asia and Oceania as Australia, Cambodia, China, Hong Kong, Indonesia, Japan, Macau, Malaysia, New Zealand, the Philippines, Singapore, South Korea, Taiwan, Thailand, and Vietnam.

NOTE: This section does not examine domestic flows within the nations of East Asia. Domestic flows for China may be found in the Domestic China chapter.

## SYNCHRONIZED GLOBAL ECONOMIC EXPANSION, WORLD TRADE CONTRIBUTE TO STRONG GROWTH

The intra-East Asia and Oceania air cargo market remains one of the largest global trade flows, accounting for nearly 16.5 percent of the world's air cargo traffic in tonnage and about 8.4 percent in tonne-kilometers. Despite several years of lagging economic and trade recovery in the region following the global economic downturn, the market started to quickly rebound in 2013. Since then, the region's market has sustained a strong uptick in air cargo demand, with a growth rate of almost 6 percent in the last five years, greatly exceeding the global average.

China continues to be an economic powerhouse for the region, accounting for almost 50 percent of the intra-East Asia and Oceania GDP. Its strong economic expansion has benefited the intra-East Asia and Oceania cargo trade, particularly with strong growth in perishables, e-commerce, and electronic goods for both exports and imports.

Meanwhile, economies and trade in other Asian countries have also shown strong growth, continuing to drive positive momentum in the intra-East Asia and Oceania trade outlook. Japan, South Korea, and Taiwan contribute significantly to the region's economy and trade with the export of high-value manufactured goods. Furthermore, Southeast Asia has emerged as a leading force behind the strong uptick in intra-East Asia and Oceania trade. Home to some of the world's fastest-growing economies and a rapidly expanding middle class, Southeast

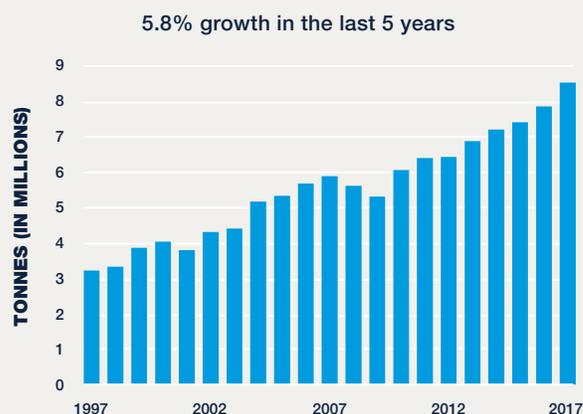
Asia is subsequently experiencing increased demand for various commodity goods such as garments, automotive parts, seafood, and other perishables.

Also, intraregional air cargo traffic receives support from the manufacturing sector, in which critical parts and subassemblies move through the supply chain to various industrial locations across East Asia before completion and export outside the continent. As a result of expansion in this sector, intraregional traffic now accounts for nearly half of the total intra-East Asia and Oceania trade volume.

## AIR CARGO DEVELOPMENT CLOSELY TIED TO UNIQUE REGIONAL MARKET CONDITIONS

Since Asia is the largest continent in the world, with numerous types of terrain over vast traveling distances, opportunities for ground transport can be limited. Ground infrastructure development varies by country and subregion. For example, Japan, South Korea, and Taiwan—which are relatively small in terms of territory but make up a significant share of the Asian trade volume—have well-developed ground infrastructure systems. However, geographical challenges strictly limit this infrastructure advantage

### CONTINUED STRONG GROWTH MOMENTUM IN INTRA-EAST ASIA AND OCEANIA AIR CARGO TRADE



Source: AAPA, IATA, IACO, CAAC, Airline data, Airport data, OAG, FlightGlobal

## INTRA-EAST ASIA AND OCEANIA

to their domestic markets. On the other hand, even though China and Southeast Asia have experienced rapid ground infrastructure development, including high-speed rail and freeway systems in recent years, their much-larger land areas and challenging terrains continue to be problematic for ground transport.

As a result, the region has continued to remain highly dependent on air transport for intraregional trade activities. Maritime shipment is typically an efficient alternative since regional manufacturing centers, particularly China, Japan, and South Korea, are separated by water. However, air cargo offers faster transit for high-value industrial goods and perishables.

Similar to East Asia's macroeconomic dynamics, which are often centered on a few countries with larger GDPs, intra-East Asia and Oceania air trade is highly concentrated on a few high-volume market segments. China, with Hong Kong as a transitional hub, leads regional air cargo commerce growth, largely driven by a massive economy that accounts for nearly 45 percent of the region's total GDP. Japan is also highly relevant, representing 27 percent of East Asia and Oceania's economy and producing high-value commodities such as electronics and automotive items. And South Korea, which shares robust air cargo traffic flows with both China and Japan, has capitalized on its electronics manufacturing capabilities and made significant investment (worth more than \$2.5 billion) toward the construction of various electronics production facilities in Southeast Asia.

In these three market segments, large dedicated freighters will continue to transport the vast majority of intraregional air cargo, though there is also ample lower-hold capacity on widebody passenger airplanes. In addition, more low-cost carriers (LCC) are utilizing their cargo space to transport goods within the region. As of 2017, LCCs comprised approximately 6 percent of the total cargo tonnage in East Asia, doubling their share from five years ago.

### TOP 10 ECONOMY PAIRS CONSTITUTE NEARLY HALF OF INTRA-EAST ASIA AND OCEANIA MARKET

Top economy pairs for intraregional air cargo traffic

1. China-Korea
2. Japan-Korea
3. Hong Kong-Korea
4. Hong Kong-Taiwan
5. China-Japan
6. Hong Kong-Japan
7. Japan-Taiwan
8. Australia-Singapore
9. Hong Kong-Singapore
10. Japan-Thailand



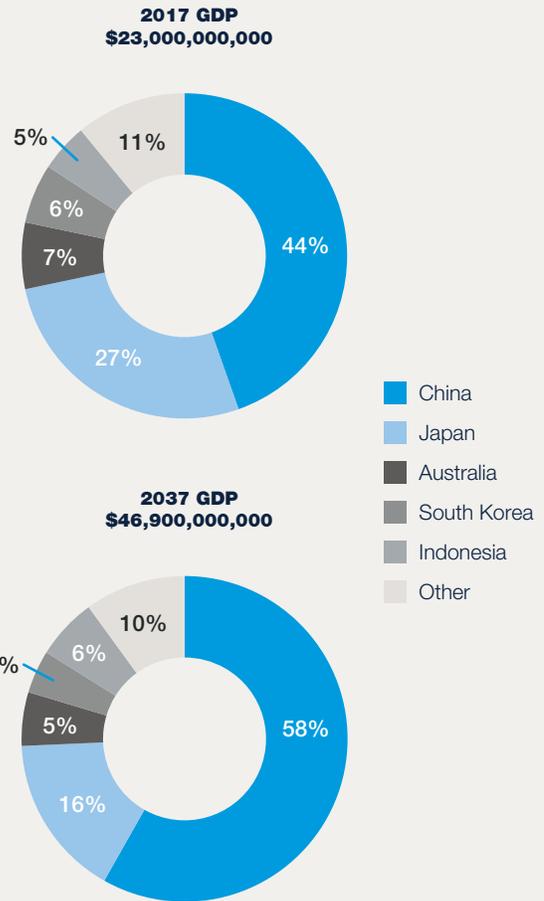
Source: AAPA, Airport data

## REGIONAL ECONOMIC PERFORMANCE, AIR CARGO DEMAND REMAIN POSITIVE

The region has a mix of mature and emerging markets in which economic growth rates are among the world's highest. Despite of the negative effects of political and economic uncertainty, such as depreciating currency, rising oil prices, and recent trade disputes, intra-East Asia and Oceania trade has continued to expand at well above the average world growth trend. Near-term projections show continuing growth in private consumption and regional market expansion.

The regional economy is projected to grow at an average annual rate of 3.9 percent, more than doubling its overall GDP in the next 20 years. China will continue to improve the aggregate outlook, as the country's GDP is expected to increase nearly 5 percent per year for the forecast period. Its influence in the region is expected to become even greater as it shifts further toward a consumption-driven economy and produces more higher-value manufactured goods, increasing its regional GDP share from nearly 45 percent in 2017 to nearly 60 percent by 2037. Overall, despite some potential challenges such as high reliance on foreign consumption, falling yields from increased competition, global trade imbalances, and political instability, the region's strong economic outlook will continue to support high air cargo demand.

### CHINA CONTINUES GROWTH AS EAST ASIA'S LEADING ECONOMIC FORCE

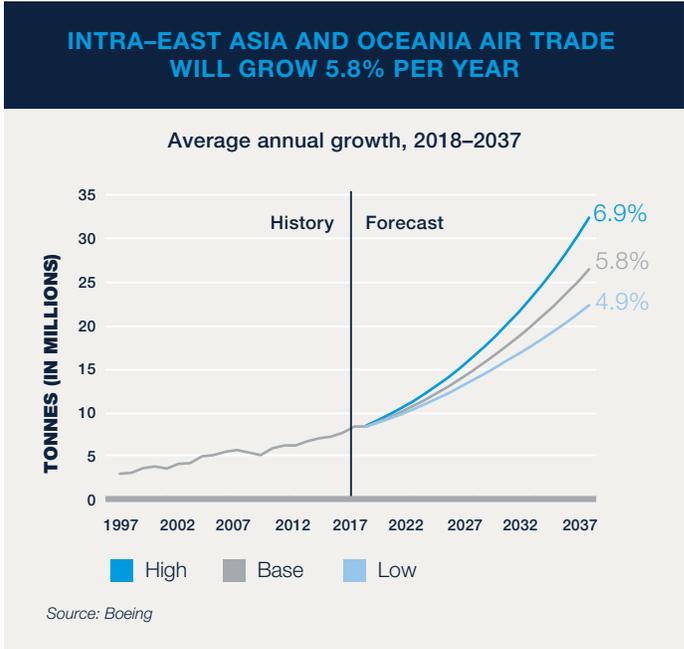


Source: IHS Markit

# INTRA-EAST ASIA AND OCEANIA

## INTRA-EAST ASIA AND OCEANIA FORECAST

Recent improvements in air cargo within the region demonstrate regional strength, while forecasts show improved trade and continued robust GDP growth, indicating regional air trade expansion. Increased consumption in the region combined with rapid middle-class expansion supports the forecast of 5.8 percent average annual air cargo growth, an improvement over the 5 percent annual growth from 1998 to 2017 but markedly better than the 3.8 percent rate from 2008 to 2017, which was significantly affected by the global economic downturn. Alternate GDP projections were assessed to provide low- and high-growth-rate scenarios, with ranges from 4.9 to 6.9 percent annual cargo growth in the next 20 years.





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.

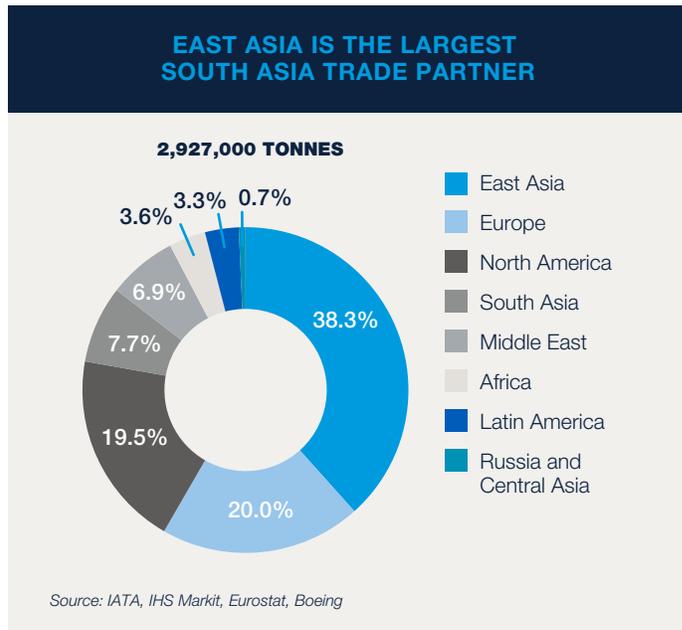
**SOUTH ASIA AIR CARGO FLOW EXCEEDS 2.9 MILLION TONNES PER YEAR**

**The South Asia air cargo market constitutes approximately 5.6 percent of the world’s air cargo traffic in tonnage and 5.5 percent in tonne-kilometers.**

South Asia continues to expand economically. The region’s GDP has grown 6.5 percent per year during the past decade. South Asia also continues to be one of the largest population centers in the world, with nearly one-quarter of the world’s population, more than 1.7 billion people. India is the international air trade hub of the region, with a population exceeding 1.3 billion and 1 of the 10 largest economies in the world.

The South Asia air cargo market stagnated in 2016, with 1.7 percent growth, because of a global downturn in industrial activity. Indian demonetization (abolishment of large denomination bills) caused panic and weakened the country’s economy. In 2017, the air cargo market recovered, growing 9.9 percent to 2.9 million tonnes. 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.

The three largest air cargo trade flows have accounted for about 80 percent of the total South Asia international air cargo market in the past decade. East Asia is South Asia’s leading air trade partner, increasing its share from 32 percent in 2007 to 38 percent in 2017. Meanwhile, Europe—South Asia’s second largest trade partner—lost some of its share, declining from 28 percent in 2007 to 20 percent in 2017. The majority of South Asia’s international air



## SOUTH ASIA

trade is conducted by India, with a 65 percent share, followed by Pakistan and Bangladesh.

Foreign carriers transport much of the cargo to and from this region. In India, the largest air cargo market in the South Asia region, foreign carriers transported more than 80 percent of all international cargo to and from the country. Many cargo flights between the Middle East, East Asia, and Europe incorporate intermediate stops in South Asia as an add-on service.

Overall air exports from the region are composed primarily of apparel, perishables (including fish and vegetables), and pharmaceutical goods. The leading air imports to South Asia are machinery and electrical equipment, metals, and vegetable products.

### SOUTH ASIA–EAST ASIA TRAFFIC

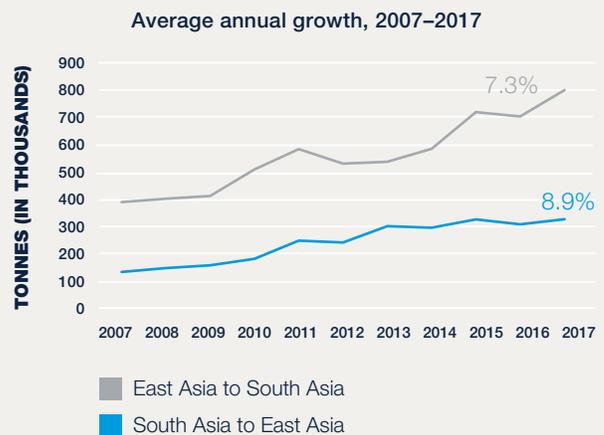
**South Asia's air trade with East Asia has grown 7.8 percent annually since 2007.**

Overall air trade between South Asia and East Asia grew at a steady pace for the past decade. The air cargo volume doubled from 532,000 tonnes to 1.1 million tonnes between 2007 and 2017.

Import air trade to South Asia grew 13.6 percent in 2017 after the 2016 recession. Export air trade recovered at a slower pace, 5.9 percent, expanding the imbalance in South Asia–East Asia air trade. In 2017, South Asia's total air import tonnage was 2.4 times as much as air export tonnage.

South Asia's air exports to East Asia consist primarily of fish, vegetable products, metals, and pharmaceutical goods. South Asia's leading air import commodities from East Asia are vegetable products, metals, and electrical machinery.

### SOUTH ASIA–EAST ASIA AIR TRADE GREW 7.8% PER YEAR



Source: IATA, IHS Markit, Eurostat, Boeing



## SOUTH ASIA–EUROPE TRAFFIC

**Air cargo tonnage between South Asia and Europe expanded 2.4 percent per year in the past decade to 584,000 tonnes in 2017.**

The air cargo market between South Asia and Europe continues to favor exports over imports. Air exports from South Asia to Europe include apparel and textiles, fish, vegetable products, and pharmaceutical goods. The leading air imports from Europe to South Asia are machinery and electrical equipment, chemicals and related products (including pharmaceutical goods), computers and professional equipment, and metals and metal products.

## DOMESTIC INDIA FORECAST

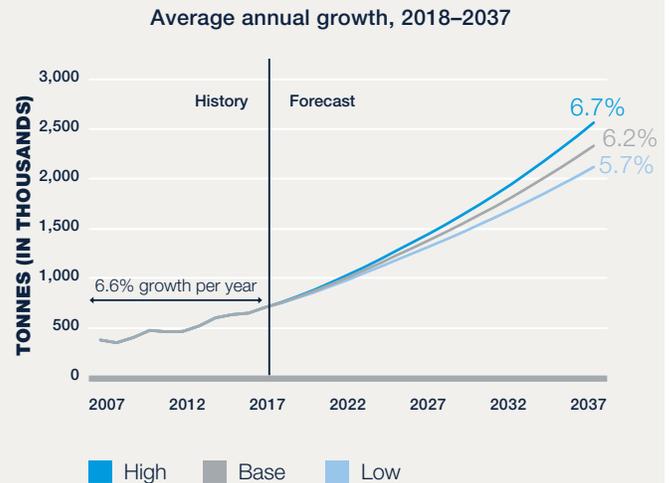
The India domestic market has grown rapidly in the past decade, paralleling the development of the Indian economy. From 2007 to 2017, the domestic India air cargo market expanded at a 6.6 percent average annual rate. In 2017, domestic Indian air cargo increased 9.2 percent. The expansion is projected to continue at a rate of 6.2 percent per year from 2017 to 2037, when it will reach 2.3 million tonnes.

### SOUTH ASIA–EUROPE AIR TRADE GREW 2.4% PER YEAR



Source: IATA, IHS Markit, Eurostat, Boeing

### DOMESTIC INDIA AIR TRADE WILL GROW 6.2% PER YEAR



Source: Boeing



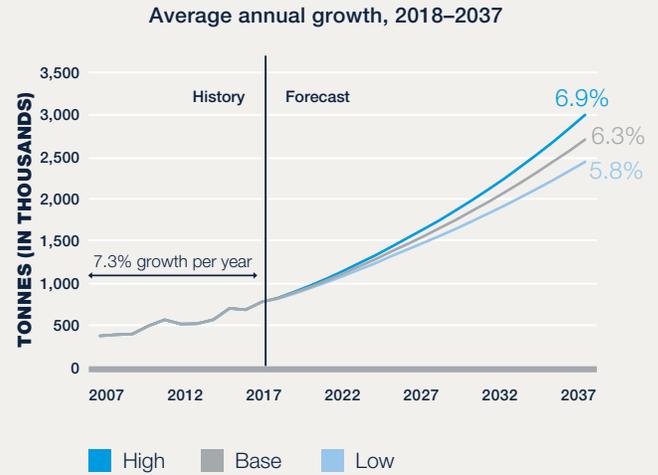
## SOUTH ASIA–EAST ASIA FORECAST

**Air trade with East Asia is expected to continue to expand as the South Asia economies continue to develop. South Asia’s GDP will grow 5.9 percent per year in the next 20 years.**

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

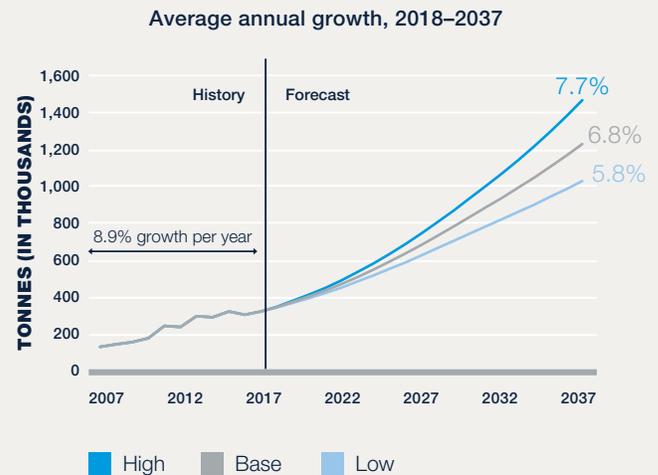
Flows from East Asia to South Asia will grow an average 6.3 percent per year in the base model. China will continue to be a leading air trade partner to South Asia. Flows from South Asia to East Asia will expand 6.8 percent per year for the forecast period. India will play a major role in exporting goods to East Asia as the Make in India initiative strives to transform India into a global design and manufacturing hub. Diversification into other industries bodes well for this trade lane.

### EAST ASIA–TO–SOUTH ASIA AIR TRADE WILL GROW 6.3% PER YEAR



Source: Boeing

### SOUTH ASIA–TO–EAST ASIA AIR TRADE WILL GROW 6.8% PER YEAR



Source: Boeing

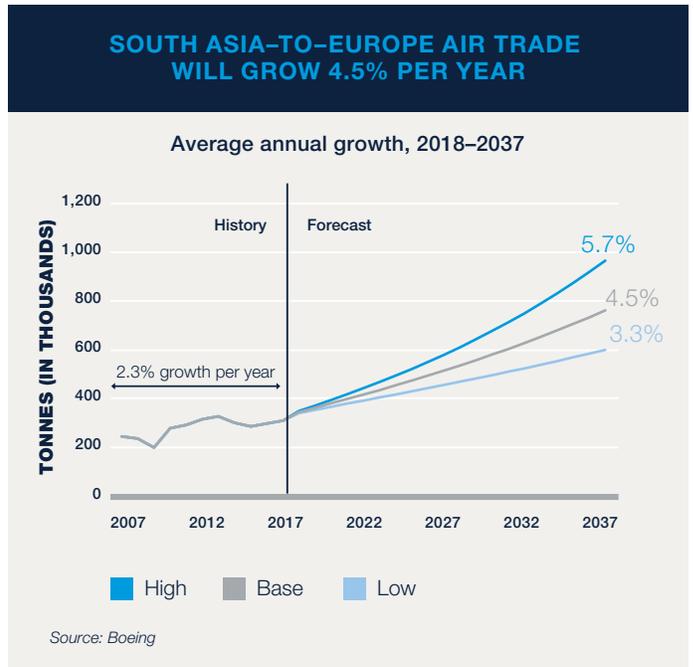
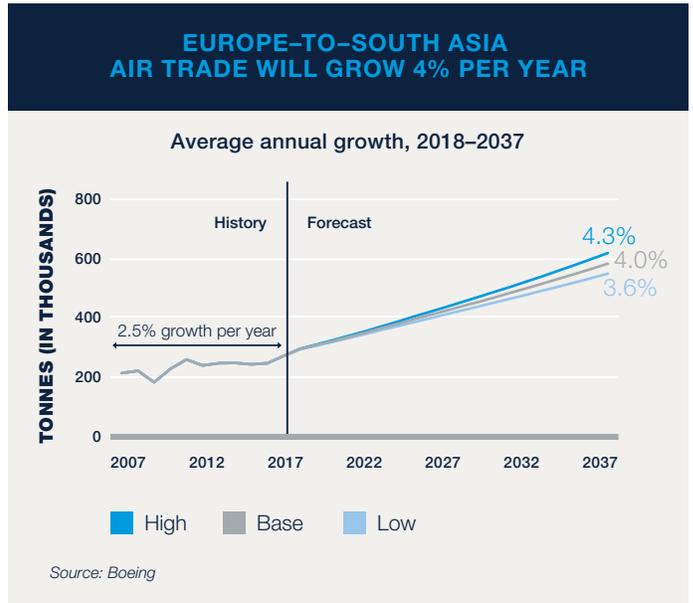


## SOUTH ASIA–EUROPE FORECAST

**Air trade between South Asia and Europe is expected to continue to grow, driven by continued strong growth of South Asia economies.**

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 percent below and above the baseline were assessed, and the results of these growth rates are reflected in the low- and high-growth scenarios.

Europe-to-South Asia flows are forecast to grow an average 4 percent per year in the base model. The growing population in South Asia will become moderately affluent, and eventually it is expected to demand increasing quantities and higher value of goods from Europe. South Asia-to-Europe flows will grow 4.5 percent per year during the forecast period. Continued privatization should make India's industry more cost competitive, leading to increased demand for South Asia's goods in Europe.



# RUSSIA AND CENTRAL ASIA

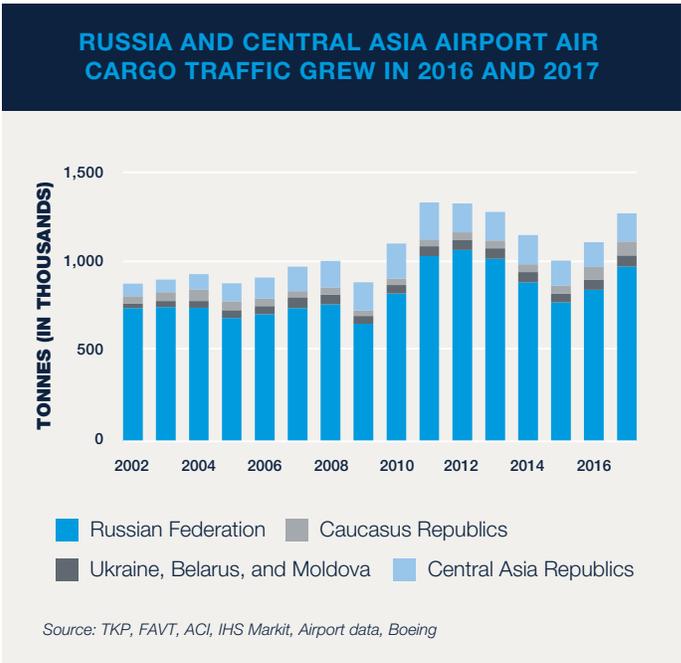
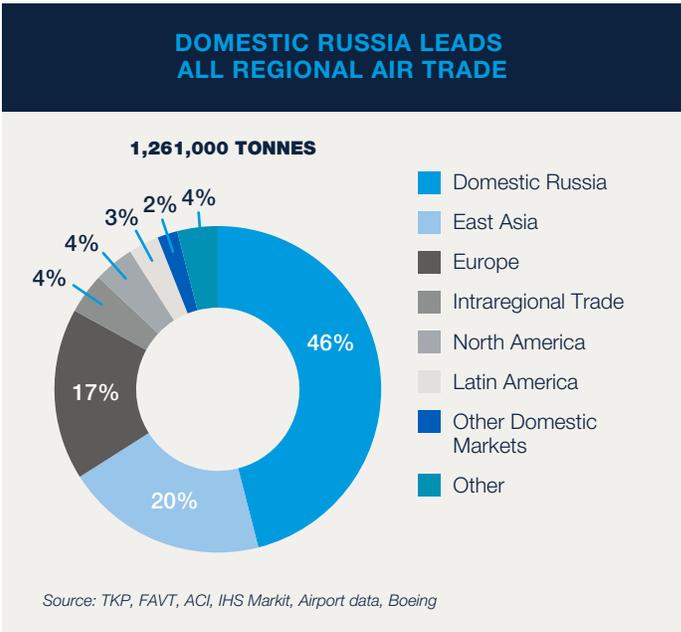
For the purposes of this forecast, Russia and Central Asia is defined as 12 of the 15 republics of the former Soviet Union, including Armenia, Azerbaijan, Belarus, Moldova, Georgia, Kazakhstan, Kyrgyzstan, the Russian Federation, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan. This region is bound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

## RUSSIA AND CENTRAL ASIA AIR TRADE REBOUNDED IN 2016 AND 2017

**The Russia and Central Asia market accounts for approximately 1.4 percent of the world’s total air cargo traffic in tonne-kilometers and 2.4 percent in tonnage.**

Air trade originating in or destined to Russia and Central Asia was estimated at 1.3 million tonnes in 2017, based on the region’s airport statistics. Growth averaged 2.7 percent from 2007 to 2017, based on tonnage handled at airports. Principal markets in the region include domestic Russia, East Asia, and Europe, with Russia commanding 76 percent 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 percent 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 percent and 14 percent in 2016 and 2017, respectively, as the world economy recovered, commodity prices stabilized, and Russia reoriented much of its international air trade toward East Asia rather than Europe.



## Domestic air trade

Domestic air trade is a vital part of commerce in this expansive region, particularly in Russia. In 2017, airports reported that Russian domestic air cargo comprised more than 579,000 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 Khabarovsk, Vladivostok, Novosibirsk, Ekaterinburg, and St. Petersburg. The domestic markets of the other 11 countries of this regional bloc totaled 24,800 tonnes, as reported by airports.

## International air trade

International trade accounts for 657,000 tonnes of regional air cargo. Of that, 388,000 tonnes flow to and from Russia. Kazakhstan, Azerbaijan, Ukraine, and Uzbekistan account for most of the remaining tonnage (269,000 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. By 2017, however, East Asia had eclipsed Europe as the region's biggest air trade partner, reaching an estimated 248,000 tonnes. Furthermore, e-commerce-related air imports, particularly into Russia from East Asia, were key drivers in the region's air cargo growth in 2016 and 2017.

## Imports to Russia and Central Asia

Demand for electronics, apparel, and other consumer goods—particularly from China, Japan, Korea, and Thailand—has helped make Russia and Central Asia–East

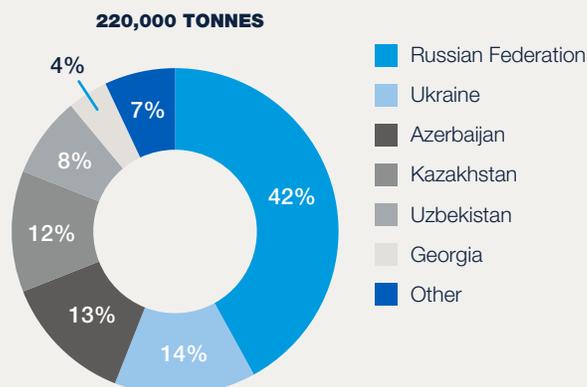
Asia traffic one of the region's strongest flows. However, in 2002, Russia implemented customs regulations that curbed direct air import to Russia from East Asia, leading some importers to transport Russia-bound freight to nearby countries by air before entering Russia by truck.

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 220,200 tonnes in 2017, of which about 167,600 tonnes were imports from Europe. Russia and Central Asia air imports consist primarily of luxury consumer goods and apparel, industrial machinery, automotive components, and pharmaceutical and medical products. Russia and Central Asia airborne exports to Europe totaled about 52,600 tonnes in 2017. Industrial machinery, industrial chemicals and metals, scientific instruments, and transportation equipment are the main products flown from Russia and Central Asia to Europe.

## Russia and Central Asia–domiciled carriers move considerable transit cargo

To accurately assess Russia and Central Asia air cargo traffic volumes, it is necessary to distinguish between true origin-and-destination traffic and cargo

### RUSSIA AND UKRAINE LEAD REGIONAL AIR TRADE WITH EUROPE



Source: IHS Markit, US DOC, Eurostat, Airport data

## RUSSIA AND CENTRAL ASIA

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 579,000 tonnes of transit or charter international cargo in 2017, representing approximately 69 percent 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 2017, Russian carriers transported about 339,000 tonnes between Europe and East Asia, transiting Russia without commercial stops inside the country.

### FORMER MILITARY FREIGHTERS CONTINUE TO BE USED FOR REGIONAL AIR TRADE

**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.

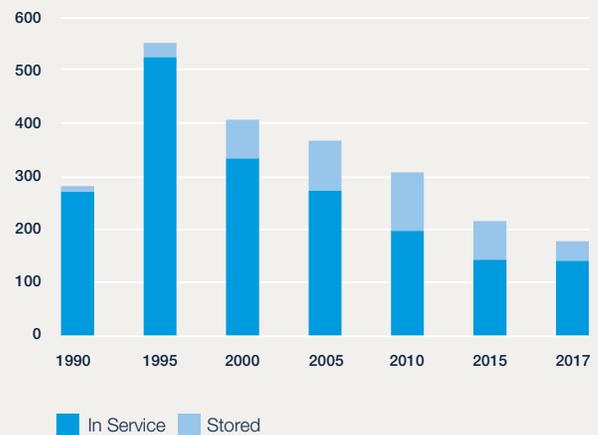
The unique loading capabilities of Russian- or Soviet-built freighters, coupled with their ability to operate from airports with lagging infrastructure investment, have allowed operators using charter flights to move freight that is dimensionally too large or too heavy for civilian widebody freighters. A select group of carriers

### RUSSIA-DOMICILED CARRIERS DEPEND ON INTERNATIONAL TRAFFIC FLOWS



Sources: TKP, Airline data, Boeing

### ABOUT 140 RUSSIAN- AND SOVIET-MANUFACTURED FREIGHTERS REMAIN IN COMMERCIAL SERVICE



Source: Ascend

## RUSSIA AND CENTRAL ASIA

in Russia and Ukraine use very large ramp-loading military freighter aircraft to serve this specialized sector, which accounts for about 53,000 tonnes of freight annually worldwide. Most of this outsize cargo traffic does not originate or terminate in Russia and Central Asia.

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 year-end 2017, about 140 locally built freighters were servicing cargo markets, a decline of approximately 380 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.

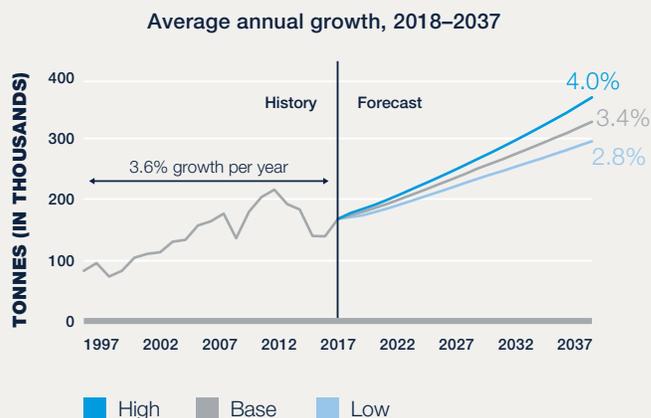
Russia and Central Asia-built aircraft still in service continue to be called upon for outsize cargo charter services around the world, predominately between Europe, North America, and East Asia. Typical industries and groups served by these flights include humanitarian aid efforts, oil and gas extraction, 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 3.4 percent for the next two decades.**

Russia and Central Asia air imports from Europe are forecast to grow 3.4 percent per year, expanding from 167,600 tonnes in 2017 to 326,500 tonnes by 2037. This growth will continue to depend on petroleum prices and the development of the region's middle class. If petroleum prices can maintain a forecast range of \$60 to \$80 per barrel, regional demand for European consumer goods, industrial

### EUROPE-TO-RUSSIA AND CENTRAL ASIA AIR TRADE WILL GROW 3.4% PER YEAR



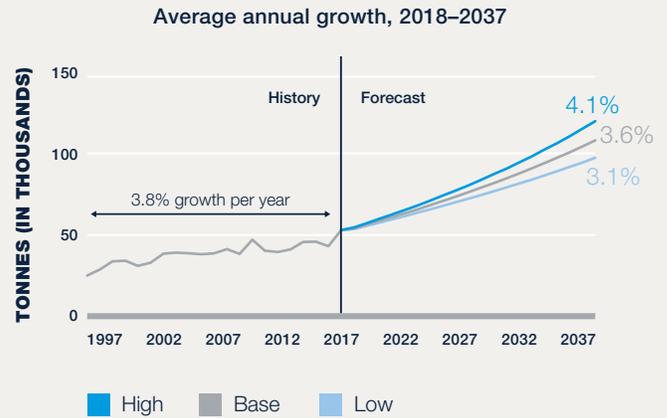
Source: Boeing

## RUSSIA AND CENTRAL ASIA

equipment and spare parts, and oil and gas extraction equipment will remain strong. 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 3.6 percent to reach 107,000 tonnes by 2037. European demand for Russia-produced specialty chemicals and industrial metals, specialized scientific equipment, 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 semimanufactured goods, leading to the high-growth projection. Conversely, continuing regional conflicts, laws and regulations adverse to new businesses, or renationalization of industries would impede air trade growth, leading to the low-growth projection.

### RUSSIA AND CENTRAL ASIA-TO-EUROPE AIR TRADE WILL GROW 3.6% PER YEAR



Source: Boeing

# REGIONAL MARKETS DOMESTIC CHINA

For the purposes of this forecast, we define domestic China as the mainland, commonly referred to as the People's Republic of China. The special administrative regions of Hong Kong and Macau are not examined in this section.

## DOMESTIC CHINA AIR CARGO TRAFFIC HAS GROWN 9.3 PERCENT ANNUALLY

**China's domestic air cargo traffic currently accounts for an estimated 8.9 percent of the world's total air cargo traffic by tonnage but only about 2.6 percent of the world market in tonne-kilometers.**

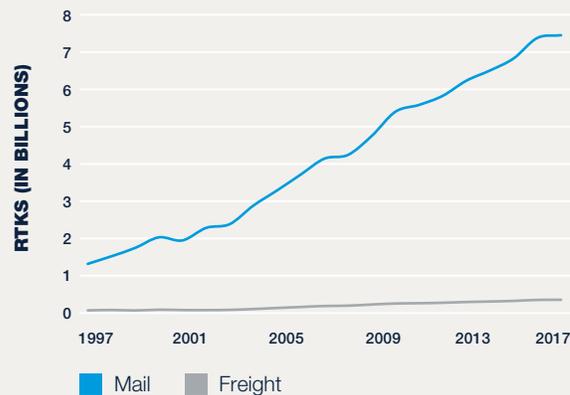
China has rapidly become the world's premier manufacturing center, with key industries producing commodities such as apparel and computing and telecommunication equipment. Most of these goods are intended for export and have traditionally been transported by air.

The tremendous increase in air trade with other countries throughout Asia, Europe, and North America has long been a major driver of growth in China's domestic air cargo traffic. During the past decade, consumer demand in China's rapidly developing large cities has become another important driver.

The types of goods transported on China's domestic routes vary by region. In the southeastern provinces, especially in the Pearl River Delta, domestic air cargo consists largely of apparel, home electronics, telecommunication equipment, and light industrial products. From the eastern provinces, goods transported by air include textiles, apparel, electronics, perishable foods, and live animals. In the northern regions, apparel, electronics, and precision instruments are the primary commodities. And in the western provinces, pharmaceuticals, cashmere, cut flowers, and industrial equipment constitute the bulk of the cargo flow.

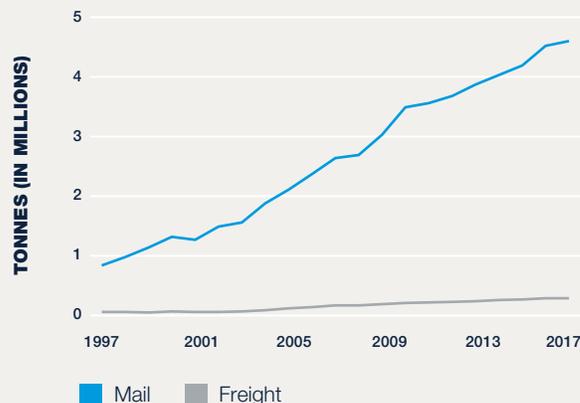
At 4.6 million tonnes transported annually, China's domestic air cargo market is second only to that of

## DOMESTIC CHINA AIR CARGO TRAFFIC HAS GROWN 9.3% PER YEAR SINCE 1997



Source: CAAC

## CHINA'S DOMESTIC AIR CARGO MARKET IS MORE THAN 4 MILLION TONNES



Source: CAAC

# DOMESTIC CHINA

the United States. Scheduled freight accounts for 94.1 percent of China's domestic air cargo traffic. Mail accounts for the remaining 5.9 percent. Air cargo activity is concentrated in the coastal and southern provinces, where the bulk of the country's 1.4 billion people and \$8.8 trillion economy are situated. Strong economic growth, rising foreign investment, and extremely competitive labor rates stimulated 21.3 percent average annual growth in domestic air cargo throughout the 1990s.

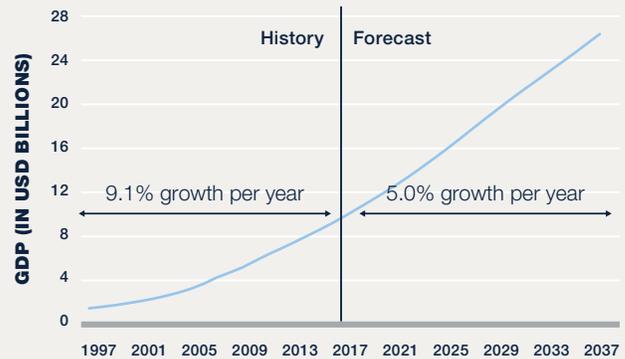
In 2017, China and world GDP grew 6.9 and 3.3 percent, respectively. While world air cargo grew 10.1 percent and the Chinese international air cargo market grew 15.1 percent, China's domestic air cargo market grew a lackluster 1.6 percent. One possible contributing factor to the low growth rate is the limited pace at which Chinese express carriers can add freighters to their fleets. It is also likely that the lower cargo holds of passenger aircraft do not complement the domestic express air cargo market, given that domestic express networks are active at night when there are few passenger flights.

## CHINA'S E-COMMERCE BOOM

**China boasts the world's largest e-commerce market, valued at approximately \$1.1 trillion. During the past seven years, its annual growth rate has been 43 percent, more than 2.8 times the US growth rate of 15 percent. E-commerce sales accounted for more than 20 percent of total sales in China in 2017 and are estimated to increase to more than 40 percent by 2021. By 2020, China's e-commerce market is predicted to be larger than the existing markets in the United States, United Kingdom, Japan, Germany, and France combined.**

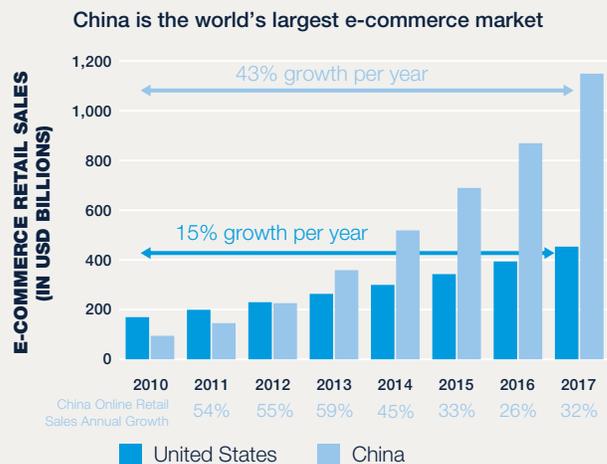
China is shifting to a consumption-driven economy. Chinese household consumption rose from 13 percent of the US level in 2007 to 34 percent in 2017. Additionally, China's middle class is rapidly growing.

## CHINA'S GDP IS EXPECTED TO INCREASE 2.6 TIMES OVER IN THE NEXT 20 YEARS



Source: IHS Markit

## CHINA ONLINE RETAIL SALES HAVE PASSED \$1 TRILLION



Source: US Census Bureau, National Bureau of Statistics of China

In 2012, 54 percent of China’s urban households were considered “mass middle” class (earning between \$9,000 and \$16,000 per year). By 2022, 54 percent will be classified as “upper middle” class (earning between \$16,000 and \$34,000 per year). In the next decade, personal disposable income is expected to increase 55 percent in real terms. The rising standard of living and China’s growing middle class drives increased consumption patterns.

Consumption has been the biggest driver of Chinese domestic economic growth, with household spending approaching 40 percent of GDP. Online shopping reflects a significant portion of the consumption. In 2017, Chinese consumers spent \$1.1 trillion online, an increase of 32 percent from \$869 billion in 2016, according to the National Bureau of Statistics of China. These spending levels outpaced the United States, the second largest e-retail market in the world, whose online sales totaled only \$453 billion in the same time period.

Alibaba Group Holding Ltd. reported a record \$25.3 billion of total value of goods sold during its 24-hour Singles’ Day shopping festival November 11, 2017—an increase of 42.1 percent over the previous year. In comparison, sales on Cyber Monday, the biggest online shopping day in the United States, recorded a mere \$6.6 billion. Black Friday—the day following Thanksgiving in the United States and regarded as the beginning of the Christmas shopping season, with promotional sales from most major retailers—recorded \$5 billion in 2017. Alibaba’s Singles’ Day sales also exceeded the total e-commerce sales in some countries for the entire year.

China domestic air express volume and revenue are also continuously expanding. The number of parcels shipped within the country grew 48 percent per year with revenue growth of 33 percent per year from 2012 to 2017. Regionally, eastern China constitutes the mainstay of the express delivery industry, with the



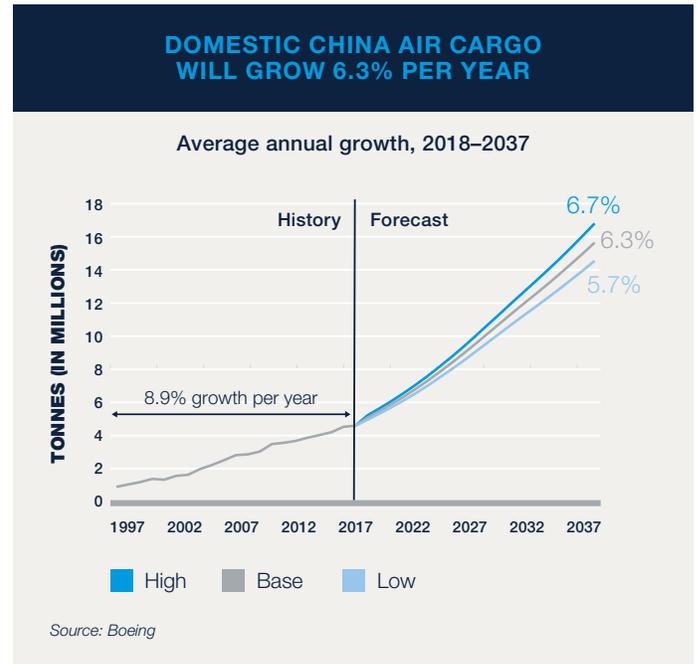
## DOMESTIC CHINA

business volume accounting for as high as 82 percent, while central and western China are responsible for 11.2 and 6.8 percent, respectively. The province with the highest express delivery business figures is Guangdong, followed by Zhejiang, Jiangsu, Shanghai, and Beijing—all of which hold a combined share of 69 percent of total business volume. Similarly, the five provinces with the highest express delivery revenues are Guangdong, Shanghai, Zhejiang, Jiangsu, and Beijing, constituting an aggregate of 69.6 percent of Chinese total express delivery revenue.

### DOMESTIC CHINA FORECAST

**China's GDP is projected to grow 5 percent per year, on average, in the next 20 years. Considering population growth predictions, per capita GDP is expected to exceed its current level by a factor of 2.6 by 2037.**

Overall air trade within China will grow 6.3 percent annually for the forecast period, with growth most rapid in the first decade of the forecast period.



# WORLD FREIGHTER FLEET

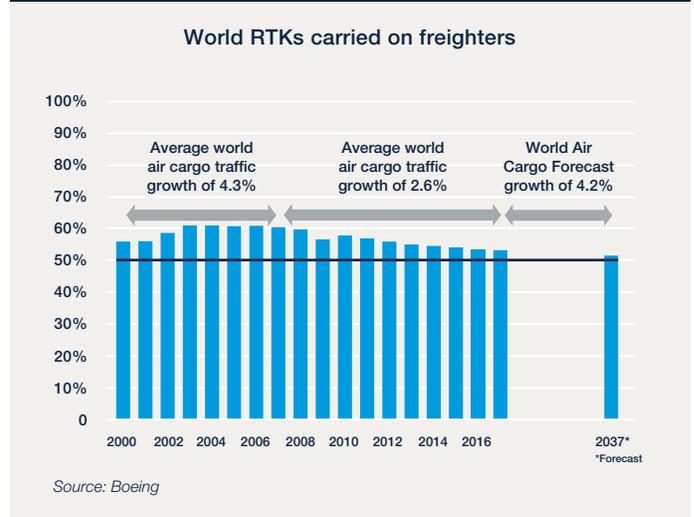
## AIR CARGO MARKET AND THE ROLE OF FREIGHTERS

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

- Dedicated freighter services offer control over timing and routing that is unmatched by lower-hold capacity.
- Reliability of air cargo services is measured in hours and minutes, not days, as it is in other modes of freight transport.
- Freighters offer speed to market for high-value, time-sensitive products such as electronics, pharmaceuticals, fashion goods, and perishable commodities.
- Certain types of cargo cannot be carried in the lower holds of passenger flights, for instance outsize items, hazardous materials, and cold-chain goods.
- Mistakes and disruptions occur in the supply chain, creating urgent needs for intermediate goods. Although inexpensive telecommunications and sophisticated software have mitigated these risks in recent years, the need for expedited shipments has not been eliminated.
- Many major centers of cargo traffic are located in places with little international passenger demand or service, and for such locations, freighters are the most efficient form of cargo transport.

Nearly 90 percent of all air cargo revenues are generated by airlines that operate freighters. Freighters augment an airline's cargo operations, helping the airline compete more effectively.

**DEDICATED FREIGHTERS CARRY—AND WILL CONTINUE TO CARRY—MORE THAN HALF OF AIR CARGO TRAFFIC**



# WORLD FREIGHTER FLEET

## FLEET FORECAST METHODOLOGY

The freighter fleet forecast incorporates the results of the Boeing Commercial Market Outlook 2018 ([www.boeing.com/commercial/market/commercial-market-outlook/](http://www.boeing.com/commercial/market/commercial-market-outlook/)) and adds Boeing cargo traffic forecasts, allocating traffic (measured in revenue tonne-kilometers, or RTKs) to main-deck and lower-hold services, then to airlines and domicile 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. Inputs include airline cargo traffic data from multiple sources, current business intelligence, and the strategic direction of key players in the industry. Our forecast allows for changes in market structure and the strategies of industry players; it is not a simple extension of current trends.

## TYPES OF FREIGHTERS

**The freighter fleet forecast categorizes airplanes by capacity, as 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 channels, with the product mix influenced by operator requirements as well as feedstock availability.

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

### FREIGHTER FLEET WILL INCREASE BY MORE THAN HALF; STANDARD-BODY FREIGHTERS GAIN SHARE



Source: Boeing

### WORLD FREIGHTER FLEET SIZE CATEGORIES

STANDARD BODY (< 45 TONNES)	MEDIUM WIDEBODY (40-80 TONNES)	LARGE (> 80 TONNES)
707	767 series	747 series
727 series	787	777 series
737 series	A300 series	A350
757	A310 series	An-124
A320 series	A330 series	Il-96T
BAe 146	DC-10 series	MD-11
DC-8 series	Il-76TD	
DC-9 series		
MD-80 SF		
Tu-204		

Source: Boeing

# WORLD FREIGHTER FLEET

## FREIGHTERS FOR REPLACEMENT AND GROWTH

**The freighter fleet forecast calls for 3,260 airplanes in service by 2037, an increase of 70 percent over the in-service 2017 fleet of 1,870.**

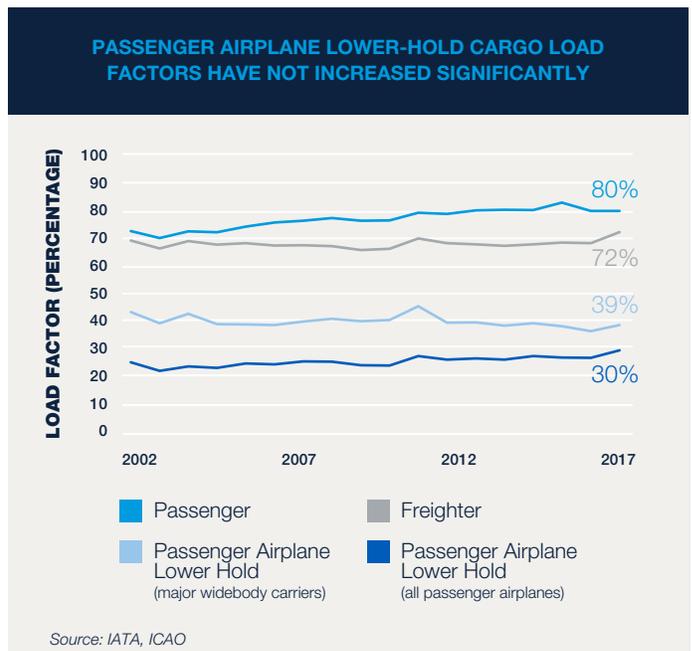
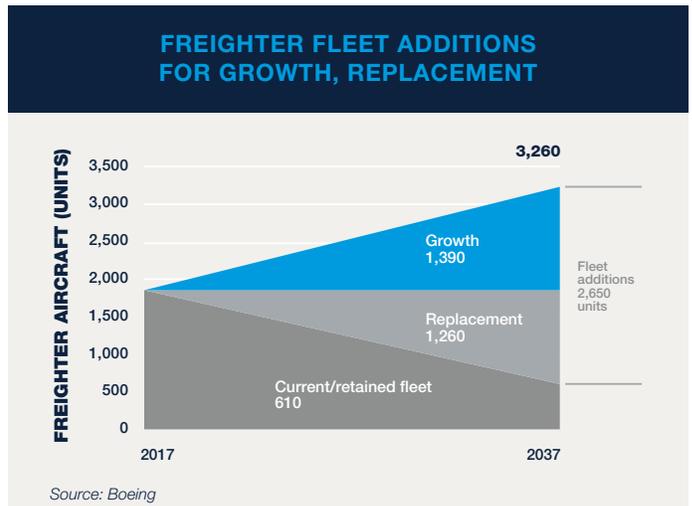
During the forecast period, we expect 1,260 retirements of older and less-efficient types, which will create demand for replacement by new conversions and production airplanes.

In addition, we forecast that 1,390 airplanes will be required for growth. Demand for air cargo has recovered from an extended period of slow growth following the global economic downturn. Longer term, we expect an increasingly connected world in which goods and people will move more freely than they do today. Passenger lower-hold capacity is an imperfect substitute for the critical advantages of freighter services, and the need for dedicated freighters will continue.

## 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 oversized 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.



## WORLD FREIGHTER FLEET

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.

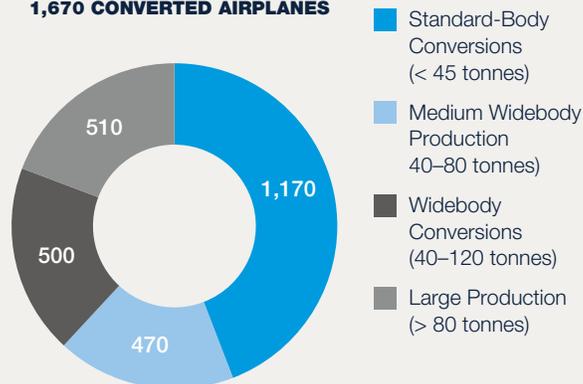
### CARGO AIRLINES: EXPRESS

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 the general freight operators. The time-definite services provided by express carriers provide higher yields, and utilization rates (flight hours per day) can be very low without impacting 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 morning deliveries. Much of this flying is domestic, or within defined trading blocs, rather than on long-haul international routes.

Because payload density and fleet 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

### FREIGHTER MARKET WILL REQUIRE 2,650 ADDITIONAL FREIGHTERS

980 NEW AND  
1,670 CONVERTED AIRPLANES



Source: Boeing

## WORLD FREIGHTER FLEET

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.

### 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.

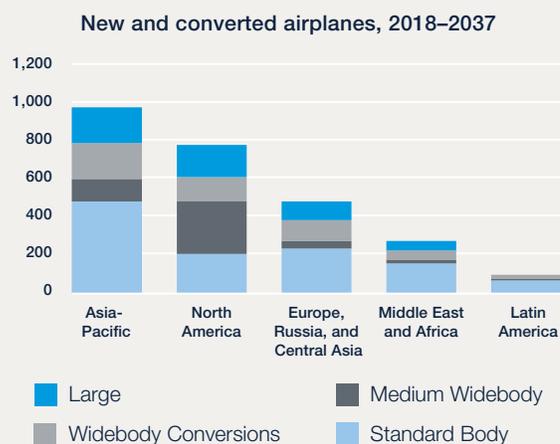
### REGIONAL OUTLOOK

As the engine of global economic growth, the Asia-Pacific region will be the largest market for new and converted freighters in the next 20 years. Notable developments include the build-out of express networks within China, fueling demand for standard-body freighter conversions, as well as the continued importance of cargo-intensive international routes, supporting the need for large freighters, for growth and the replacement of existing fleet. Most of these will be new, purpose-built aircraft.

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 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.

Large freighter demand in Europe, Russia and Central Asia, and the Middle East is supported by several

#### FREIGHTER DELIVERIES VARY BY REGION



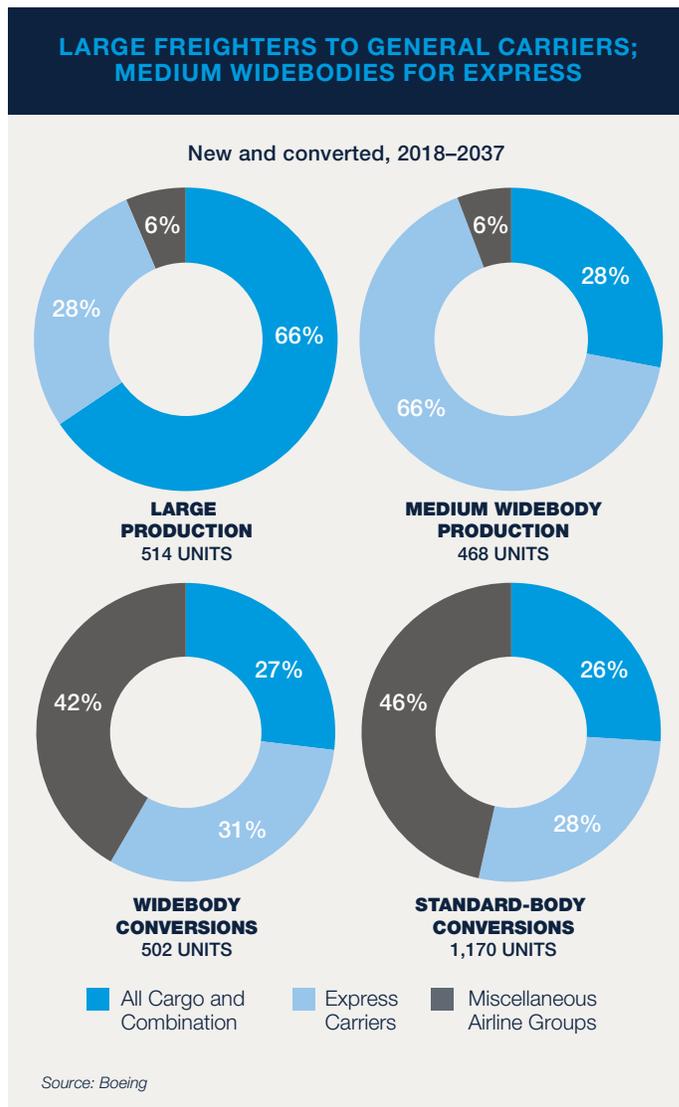
Source: Boeing

## WORLD FREIGHTER FLEET

all-cargo and combination carriers domiciled in these regions, who provide sixth freedom freight services and operate networks that are global in scope.

### FUTURE OF FREIGHTERS

Although the air cargo industry suffered setbacks in the aftermath of the global economic downturn, growth has returned. The future should be viewed within the larger context of the way the world, its economies, and its production systems are developing. “On-demand” provision of goods and services is becoming the standard in entertainment (streaming video), mobility (ride-sharing services), and small retail items (same-day delivery of online orders). Goods and services are increasingly internationalized—smartphones are designed in the United States, manufactured in China, and sold throughout the world, while call centers in India and the Philippines handle increasing shares of customer service and technical support needs. In such a world—faster paced, more international, more dependent on connections between regions—air cargo will remain a vital service for global business. If the cargo networks of the future are to be fast, reliable, and effective, they must, as they do today, include freighters.



# FORECAST METHODOLOGY

## FORECAST METHODOLOGY

Boeing publishes the World Air Cargo Forecast (WACF) on a biennial basis 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

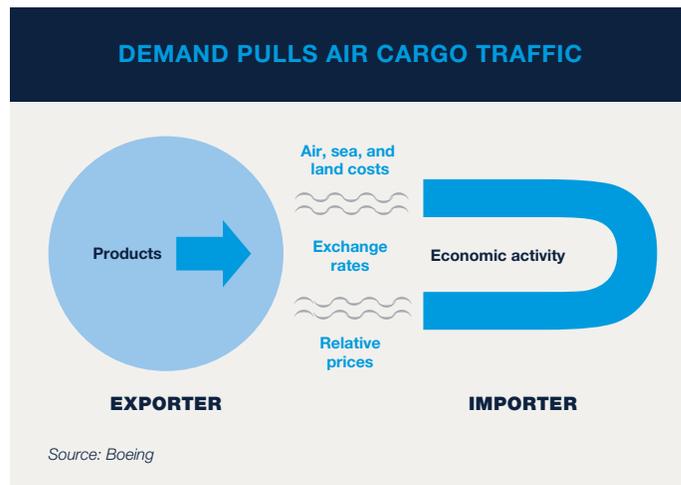
Econometric modeling helps determine the overall importance of underlying economic factors, such as GDP, and provides forecasts that are linked to expectations of those factors. This method is useful for medium- and long-range forecasts in regional markets.

## 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. However, extrapolation from a small base with large growth can produce unrealistic results.



## DATA SOURCES

Data represented as historical in this document were compiled from many sources including, but not limited to, Cargo Facts Consulting, Airports Council International (ACI), Airlines for America (A4A), Association of Asia Pacific Airlines (AAPA), Association of European Airlines (AEA), Boeing Foreign Trade Database (TRADE), Eurostat, IHS Markit, Oxford Economics, United Nations Council on Trade and Development (UNCTAD), Clarkson Research Services Limited (CRSL), Drewry Maritime Research, International Air Transport Association (IATA), International Civil Aviation Organization (ICAO), Civil Aviation Administration of China (CAAC), Official Airline Guide (OAG), FlightGlobal/Diio, US Department of Transportation (DOT), US Department of Commerce (DOC), Federal Agency for Air Transport (FAVT) of Russia, Transport Clearing House (TKP) of Russia, Airports Authority of India (AAI), and India Directorate General of Civil Aviation (DGCA).

# GLOSSARY

**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 and/or people.

**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 tons) and combining weight with distance (e.g., revenue tonne-kilometers and revenue ton-miles). 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 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. It is 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 (FTK) but can include passenger weight for total revenue.

**Scheduled operations:** Aircraft flights operated on a pre-determined 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" or "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 airlines by region of domicile

RTKs in millions

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017*
<b>Africa</b>											
Scheduled freight	2,334	2,003	1,889	2,537	2,498	2,920	2,979	3,170	3,177	3,178	3,980
Charter freight	247	350	287	339	346	180	98	125	142	139	179
Mail	51	47	49	55	57	62	79	77	75	111	134
<b>Total**</b>	<b>2,632</b>	<b>2,400</b>	<b>2,224</b>	<b>2,931</b>	<b>2,902</b>	<b>3,162</b>	<b>3,156</b>	<b>3,372</b>	<b>3,393</b>	<b>3,428</b>	<b>4,293</b>
<b>East Asia and Oceania</b>											
Scheduled freight	71,701	67,499	62,921	77,806	74,969	70,203	70,011	75,197	77,183	78,807	85,075
Charter freight	679	289	520	843	627	1,094	778	571	831	850	1,005
Mail	1,613	1,757	1,729	1,891	2,019	2,022	2,224	2,509	2,657	2,718	2,989
<b>Total**</b>	<b>73,993</b>	<b>69,545</b>	<b>65,170</b>	<b>80,540</b>	<b>77,614</b>	<b>73,320</b>	<b>73,013</b>	<b>78,277</b>	<b>80,672</b>	<b>82,375</b>	<b>89,070</b>
<b>Europe</b>											
Scheduled freight	39,545	38,517	32,770	37,649	39,565	41,088	41,383	42,143	41,058	43,134	47,110
Charter freight	5,133	4,389	3,563	4,087	4,051	1,346	1,371	1,249	1,263	1,463	2,037
Mail	1,082	1,079	1,036	945	1,016	1,054	1,139	1,184	1,232	1,216	1,259
<b>Total**</b>	<b>45,760</b>	<b>43,984</b>	<b>37,369</b>	<b>42,682</b>	<b>44,632</b>	<b>43,488</b>	<b>43,892</b>	<b>44,576</b>	<b>43,553</b>	<b>45,813</b>	<b>50,406</b>
<b>Latin America</b>											
Scheduled freight	5,111	4,865	4,042	4,392	4,481	4,741	5,773	5,943	5,944	5,916	6,280
Charter freight	572	228	204	230	134	80	70	74	47	73	134
Mail	112	79	46	54	93	132	130	146	133	84	115
<b>Total**</b>	<b>5,796</b>	<b>5,171</b>	<b>4,292</b>	<b>4,675</b>	<b>4,708</b>	<b>4,953</b>	<b>5,972</b>	<b>6,163</b>	<b>6,124</b>	<b>6,072</b>	<b>6,529</b>
<b>Middle East</b>											
Scheduled freight	11,737	12,570	12,801	16,226	17,656	20,165	22,683	24,983	28,129	29,629	32,128
Charter freight	248	437	155	146	148	148	217	150	168	195	102
Mail	186	225	242	266	161	132	158	224	331	440	554
<b>Total**</b>	<b>12,171</b>	<b>13,231</b>	<b>13,198</b>	<b>16,638</b>	<b>17,966</b>	<b>20,445</b>	<b>23,058</b>	<b>25,358</b>	<b>28,628</b>	<b>30,264</b>	<b>32,785</b>

\*Complete for airline reports received as of September 2018.

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

## APPENDIX

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017*
<b>North America</b>											
Scheduled freight	44,281	41,900	36,367	41,294	41,438	40,974	40,677	42,895	42,785	43,903	47,782
Charter freight	6,492	6,851	5,427	7,066	7,743	8,832	8,527	7,894	8,076	8,240	9,799
Mail	2,195	2,320	1,942	1,911	1,907	1,827	1,855	1,686	1,758	1,643	1,878
<b>Total**</b>	<b>52,968</b>	<b>51,070</b>	<b>43,736</b>	<b>50,271</b>	<b>51,089</b>	<b>51,633</b>	<b>51,060</b>	<b>52,476</b>	<b>52,618</b>	<b>53,786</b>	<b>59,459</b>
<b>Russia and Central Asia</b>											
Scheduled freight	2,356	2,612	2,758	3,870	4,481	5,023	5,203	5,631	6,490	7,960	9,820
Charter freight	1,626	1,712	1,405	1,737	1,516	1,075	818	698	607	601	772
Mail	57	60	69	86	98	113	119	131	131	142	202
<b>Total**</b>	<b>4,039</b>	<b>4,384</b>	<b>4,232</b>	<b>5,693</b>	<b>6,095</b>	<b>6,211</b>	<b>6,141</b>	<b>6,461</b>	<b>7,229</b>	<b>8,703</b>	<b>10,794</b>
<b>South Asia</b>											
Scheduled freight	1,814	2,038	1,948	2,565	2,563	2,389	2,516	2,543	2,466	2,399	3,011
Charter freight	0	0	0	0	0	0	0	0	0	0	0
Mail	57	76	87	86	61	55	52	63	68	68	86
<b>Total**</b>	<b>1,871</b>	<b>2,114</b>	<b>2,036</b>	<b>2,650</b>	<b>2,624</b>	<b>2,444</b>	<b>2,568</b>	<b>2,606</b>	<b>2,534</b>	<b>2,466</b>	<b>3,098</b>
<b>World</b>											
Scheduled freight	178,878	172,003	155,497	186,339	187,651	187,503	191,226	202,506	207,232	214,925	235,186
Charter freight	14,997	14,255	11,561	14,448	14,565	12,756	11,878	10,762	11,134	11,560	14,028
Mail	5,354	5,643	5,199	5,294	5,413	5,397	5,756	6,021	6,385	6,423	7,218
<b>Total**</b>	<b>199,229</b>	<b>191,902</b>	<b>172,256</b>	<b>206,081</b>	<b>207,629</b>	<b>205,657</b>	<b>208,860</b>	<b>219,289</b>	<b>224,751</b>	<b>232,907</b>	<b>256,433</b>

\*Complete for airline reports received as of September 2018.

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



## **Boeing Commercial Airplanes**

Market Analysis

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Seattle, WA 98124-2207

[www.boeing.com/commercial/market/cargo-forecast/](http://www.boeing.com/commercial/market/cargo-forecast/)



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