
Federal Aviation
Administration
FAA AEROSPACE
FORECAST
Fiscal Years 2020-2040
TC20-0011

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Forecast Highlights (2020–2040)

Since its deregulation in 1978, the U.S. commercial air carrier industry has been characterized by boom-to-bust cycles. The volatility that was associated with these cycles was thought by many to be a structural feature of an industry that was capital intensive but cash poor. However, the great recession of 2007-09 marked a fundamental change in the operations and finances of U.S Airlines. Since the end of the recession in 2009, U.S. airlines revamped their business models to minimize losses by lowering operating costs, eliminating unprofitable routes, and grounding older, less fuel-efficient aircraft. To increase operating revenues, carriers initiated new services that customers were willing to purchase and started charging separately for services that were historically bundled in the price of a ticket. The industry experienced an unprecedented period of consolidation with three major mergers in five years. The results of these efforts have been impressive: 2019 marks the eleventh consecutive year of profitability for the U.S. airline industry. Looking forward, there is confidence that U.S. airlines have finally transformed from a capital intensive, highly cyclical industry to an industry that generates solid returns on capital and sustained profits.

Fundamentally, over the medium and long term, aviation demand is driven by economic activity, and a growing U.S. and world economy provides the basis for aviation to grow over the long run. The 2020 FAA forecast calls for U.S. carrier domestic passenger growth over the next 20 years to average 2.0 percent per year. The uptick in passenger growth since 2014 will continue into 2020 driven by positive economic conditions in the U.S. Oil prices averaged $60 per barrel in 2019 were forecasted to fall to $53 in 2020, and our forecast assumes they will increase beginning in 2022 to reach $104 by the end of the forecast period.

Global economic conditions weakened in 2019 although the experience was considerably different for the U.S. as compared to the rest of the world. GDP growth in the U.S. slowed from the strong rate in 2018 but remained above its estimated long-term trend, while in Europe, Germany and Italy flirted with recession and Asia saw high-growth China and India slow markedly. Political instability and trade wars dampened activity but by the end of the year, those headwinds appeared to be lessening. In their place, however, the January 2020 coronavirus (COVID-19) outbreak in China gained the world's attention and in February began appearing outside Asia. As of the preparation of this forecast, the virus and its economic impacts were just emergent, and the range of possible outcomes too wide to include meaningfully in the forecast.

Global economic growth accelerates in 2021 after slowing in 2019-20. Trade disputes should be mending, the worst of Brexit uncertainty should be past, Japan's tax-hike shock should be fading, and oil prices, and inflation generally, should be subdued. Over the early years of the 2020's, economies are expected to return to their long-run trend rates of growth.

System traffic in revenue passenger miles (RPMs) is projected to increase by 2.5 percent a year between 2020 and 2040. Domestic RPMs are forecast to grow 2.3 percent a year while International RPMs are

forecast to grow significantly faster at 3.0 percent a year. System capacity as measured by available seat miles (ASMs) is forecast to grow in line with the increases in demand. The number of seats per aircraft is growing, especially in the regional jet market, where we expect the number of 50 seat regional jets to fall to just a handful by 2030, replaced by 70-90 seat aircraft.

Although the U.S. economy saw solid growth in 2019, economic activity around the world slowed, and labor costs rose, resulting in profits for U.S. airlines subsiding further from 2016's record levels. Nevertheless, the FAA expects U.S. carrier profitability to remain steady as solid demand fed by a stable economy offsets rising labor costs. Over the long term, we see a competitive and profitable aviation industry characterized by increasing demand for air travel and airfares growing more slowly than overall inflation, reflecting growing U.S. and global economies.

The long-term outlook for general aviation is relatively stable, as growth at the high-end offsets continuing retirements at the traditional low end of the segment. The active general aviation fleet is forecast to decline slightly by 0.9 percent between 2020 and 2040 (rounding up to an average of 0 percent change annually). While steady growth in both GDP and corporate profits results in continued growth of the turbine and rotorcraft fleets, the largest segment of the fleet – fixed wing piston aircraft continues to shrink over the forecast. Against the marginally declining fleet, the number of general aviation hours flown is projected to increase by 16 percent (an average of 0.7 percent per year) during the same period, as growth in turbine, rotorcraft, and experimental hours more than offset a decline in fixed wing piston hours.

With increasing numbers of regional and business jets in the nation's skies, fleet mix changes, and carriers consolidating operations in their large hubs, we expect increased activity growth that has the potential to increase controller workload. Operations at FAA and contract towers are forecast to grow 0.9 percent a year over the forecast period with commercial activity growing at approximately four times the rate of non-commercial (general aviation and military) activity. The growth in U.S. airline and business aviation activity is the primary driver. Large and medium hubs will see much faster increases than small and non-hub airports, largely due to the commercial nature of their operations.

Review of 2019

Solid economic activity in the U.S. more than compensated for broad slowdowns throughout the rest of the world, making 2019 yet another good year for U.S. commercial aviation. Airlines posted their eleventh consecutive year of profits in spite of lower revenue compared to a year earlier as expenses fell further. The U.S. airline industry contained expenses by continuing to shift its focus from gaining market share to seeking returns on invested capital as well as benefitting from lower fuel prices. U.S. airlines are continually updating their successful strategies for capturing additional revenue streams such as charging fees for services that used to be included in airfare (e.g. meal service), charging for services that were not previously available (e.g. premium boarding and fare lock fees), as well as for maximizing fare revenue with more sophisticated revenue management systems. At the same time, the U.S. airline industry has become nimbler in adjusting capacity to seize opportunities or minimize losses, helping to raise yields for the first time in four years. These efforts combined with relatively low fuel prices secured industry profitability in 2019 even as new labor contracts lifted labor costs higher.

Demand for air travel in 2019 slowed slightly after surging in 2018 as economic growth in the U.S. moderated. In 2019, system traffic as measured by revenue passenger miles (RPMs) increased 4.3 percent while system enplanements grew 4.1 percent. Domestic RPMs were up 4.5 percent while enplanements were up by 4.2 percent. International RPMs increased 3.9 percent and enplanements grew by 3.8 percent. The system-wide load factor was 84.5 percent, up seven tenths of a percent from the 2018 level.

System nominal yields increased again in 2019. In domestic markets, expansion by ultra-low cost carriers such as Spirit and Allegiant, as well as by mainline carriers such as United, was partially offset by the MAX grounding, giving carriers some pricing power in the solid demand environment. International yield declined 0.8 percent as both the Atlantic and Pacific regions declined but the Latin region posted a small gain.

Despite rising labor costs and higher capacity, U.S. airlines remained solidly profitable in FY 2019. Data for FY 2019 show that the reporting passenger carriers had a combined operating profit of $22.6 billion (compared to a $21.0 billion operating profit for FY 2018). The network carriers[1] reported combined operating profits of $9.9 billion while the low cost carriers[2] reported combined operating profits of $4.6 billion as all carriers posted profits.

The general aviation industry recorded a modest increase of 1.4 percent in deliveries of U.S. manufactured aircraft in 2019, with pistons up by 6.5 percent and turbines, due

[1] Network carriers are: Alaska Airlines, American Airlines, Delta Air Lines, and United Air Lines.

[2] Low cost carriers are: Allegiant Air, Frontier Airlines, JetBlue Airways, Southwest Airlines, Spirit Air Lines, Sun Country Airlines.

to a decline in turboprop segment, down by 3.2 percent. As the higher priced turbojet deliveries improved by 6.3 percent, U.S. billings increased by 20.5 percent to a record $14.0 billion. General aviation activity at FAA and contract tower airports had a 3.3 percent increase in 2019 as local activity rose 6.1 percent and itinerant operations went up by 0.8 percent. In local GA activity, this was the highest increase recorded in more than 20 years.

Total operations in 2019 at the 520 FAA and contract towers were up 2.9 percent compared to 2018. This marks the fifth consecutive years of positive growth starting 2015. Last time there were at least four consecutive years of growth was FY 1997-2000. Air carrier activity increased by 3.2 percent, while air taxi operations increased by 1.5 percent. General aviation rose 3.3 percent and military activity decreased 1.9 percent. Activity at large and medium hubs rose by1.8 percent and 1.9 percent, while small hub airport activity was up 1.6 percent in 2019 compared to the prior year.

Glossary of Acronyms

Acronym	Term
ANG	FAA Office of NextGen
ARP	FAA Office of Airports
ASMs	Available Seat Miles
AST	FAA Office of Commercial Space Transportation
ATO	FAA Air Traffic Organization
ATP	Air Transport Pilot
AUVSI	Association for Unmanned Vehicle Systems International
BVLOS	Beyond Visual Line of Sight
CAPS	COA Application Processing System
CBP	Customs and Border Patrol
CFR	Code of Federal Regulations
COAs	Certification of Authorizations
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
CRS	Commercial Resupply Services
CY	Calendar Year
DARPA	Defense Advanced Research Projects Agency
DHS	Department of Homeland Security
DoD	Department of Defense
DoE	Department of Energy
DoI	Department of Interior
FAA	Federal Aviation Administration
FY	Fiscal Year
GA	General Aviation
GAMA	General Aviation Manufacturers Association
GC	Grand Challenge
GDP	Gross Domestic Product
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
IMF	International Monetary Fund
ISS	International Space Station
LAANC	Low Altitude Authorization and Notification Capability
LCC	Low Cost Carriers
LSA	Light Sport Aircraft
lUAS	Large Unmanned Aircraft System(s)
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NDAA	National Defense Authorization Act
NOTAM	Notices to Airmen
NPRM	Notice of Public Proposed Rulemaking
PCE	Personal Consumption Expenditure
PDARS	Performance Data Analysis and Reporting Systems
RAC	Refiners' Acquisition Cost
RLV	Reusable Launch Vehicle
RP	Remote Pilot
RPA	Remote Pilot Authorization
RPMs	Revenue Passenger Miles

RTMs	Revenue Ton Miles
sUAS	Small Unmanned Aircraft System(s)
SpaceX	Space Exploration Technologies Corp.
TRACON	Terminal Radar Approach Control
TRB	Transportation Research Board
TSA	Transportation Security Administration
UAM	Urban Air Mobility
UAS	Unmanned Aircraft System(s)
UASFM	UAS facility maps
USD	United States Dollar
VFR	Visual Flight Rules

Acknowledgements

This document was prepared by the Forecasts and Performance Analysis Division (APO-100), Office of Aviation Policy and Plans, under the direction of Roger Schaufele and Michael Lukacs.

The following people may be contacted for further information:

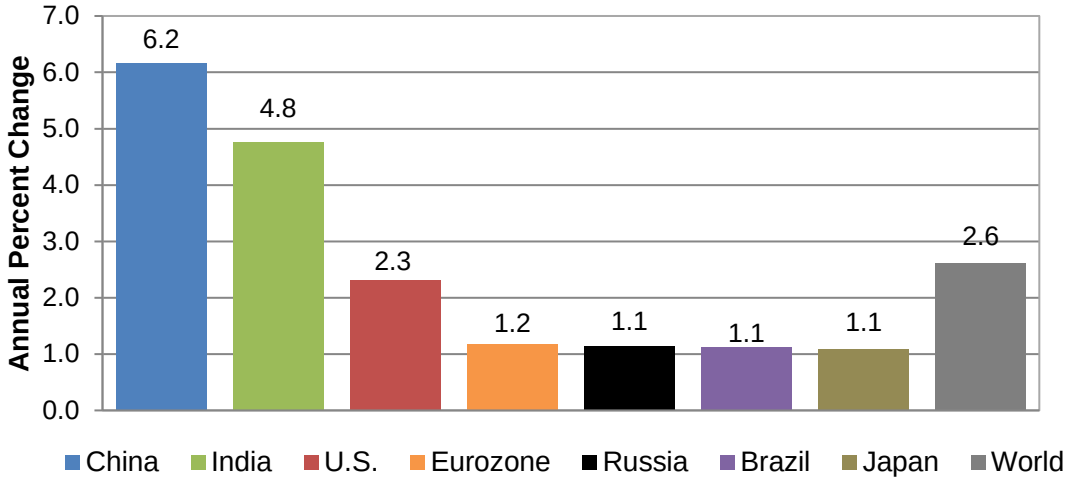
Section	Contact Name	Phone Number
Economic Environment	Jonathan Corning	(202) 267-8388
Commercial Air Carriers		
• Passenger	Jonathan Corning	(202) 267-8388
• Fleet	Akira Kondo	(202) 267-3336
General Aviation		
• Forecasts	H. Anna Barlett	(202) 267-4070
• Survey data	H. Anna Barlett	(202) 267-4070
FAA Workload Measures		
• Forecasts	Chia-Mei Liu	(202) 267-3602
• Data	Chia-Mei Liu	(202) 267-3602
Commercial Space	Thomas Marotta	(202) 267-0427
	LaVada Strickland	(202) 267-3855
Unmanned Aircraft Systems	Michael Lukacs	(202) 267-9641
	Dipasis Bhadra	(202) 267-9027
	W. Gavin Ekins	(202) 267-4735
Programming Analysis	Jared Teeter	(202) 267-2813
APO Websites		
• Forecasts and Statistical publications	http://www.faa.gov/data_research/aviation_data_statistics/	
• APO databases	http://aspm.faa.gov	
Email for APO staff	First name.last name@FAA.gov	

FAA Aerospace Forecasts
Fiscal Years 2020-2040

Economic Environment

In the near term, IHS Markit projects that world economic growth will hold steady at about its 2019 rate of 2.6 percent after falling markedly from 3.2 percent in 2018. Economies will require several years to return to their long-run trend growth rates and in the meantime growth is projected at 2.5 percent in 2020 and 2.7 percent in 2021. Strong consumer spending continues to drive the U.S. economy and is expected to be sustained even as the effects of the recent fiscal stimulus wear off. European growth suffered in 2019 as Germany and Italy weakened considerably and political uncertainty impacted confidence, but moderate growth in France, reduced uncertainty about Brexit, and improved financial conditions appear to be restraining the slowdown. Japan's economic growth is projected to slow sharply due to an increase in the consumption tax at the end of 2019 but fiscal stimulus and rising employment should mitigate the effects over the coming years. In emerging markets, China's growth rate continues to gradually decelerate through 6 percent, though braced by government efforts, while other countries such as Brazil and Russia feel the drag from China and headwinds of falling commodity prices and modest demand from advanced economies. India is expected to post growth rates of about 5 percent in the near-term as high debt levels and a need for structural reforms restrains activity.

China and India Led World Economic Growth in 2019



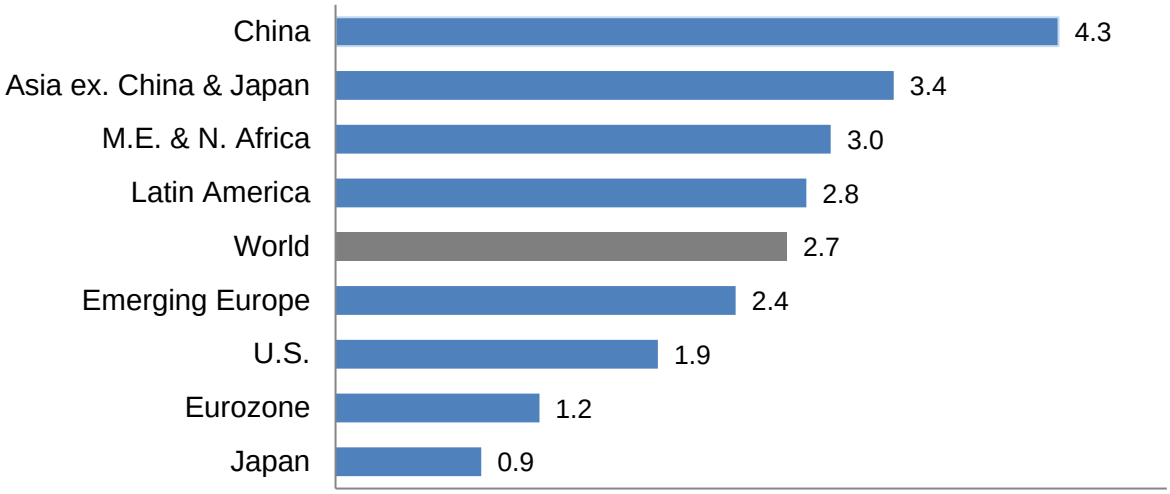
Source: IHS Markit

IHS Markit forecasts world real GDP to grow at 2.7 percent a year between 2020 and 2040. Emerging markets, at 4.0 percent a year, are forecast to grow above the global average but at lower rates than in the early 2000's. Asia (excluding Japan), led by India and China, is projected to have the fastest growth followed by Africa and Middle East, Latin America, and Eastern Europe. Growth in the more mature economies (1.6 percent a year) will be lower than the global trend with the fastest rates in the U.S. followed by

Europe. Growth in Japan is forecast to be very slow at 0.9 percent a year reflecting deep structural issues associated with a shrinking and aging population.

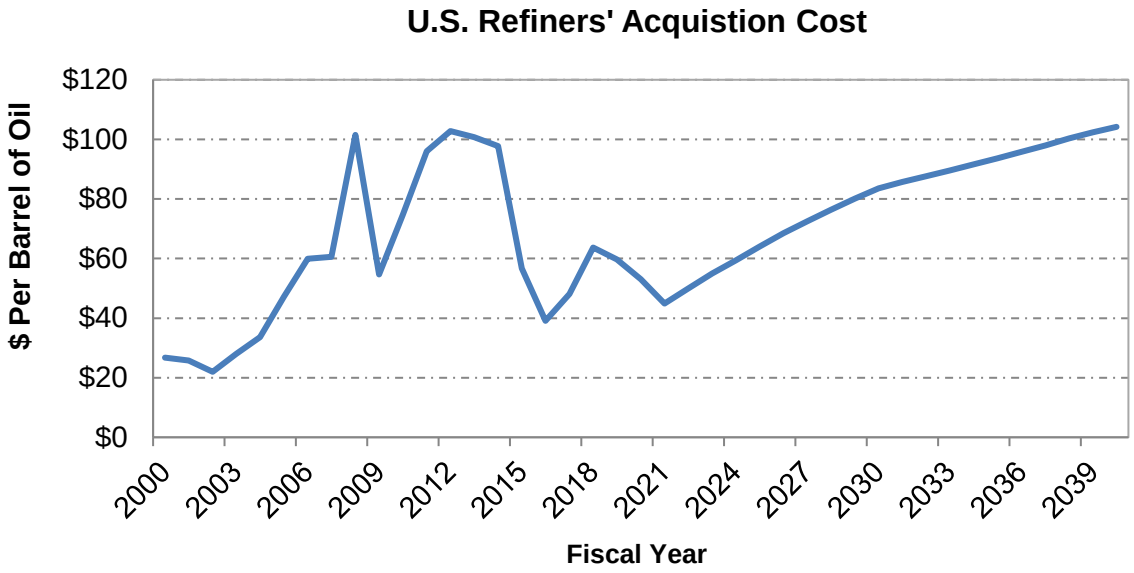
Asia and Middle East/N. Africa Lead Global Economic Growth

(annual GDP percent growth 2020-2040)



Source: IHS Markit, Dec 2019 World Forecast

The average crude oil price in 2019 was down 6 percent from the year before to about $60 per barrel, partially offsetting the increases seen in 2017 and 2018. IHS Markit is projecting continued moderation in prices in 2020 and 2021 due to slowing global demand combined with modest non-OPEC supply growth. The price of oil is projected to increase over the long run due to growing global demand and higher costs of extraction. IHS Markit forecasts U.S. refiner's acquisition cost of crude to cross the $100 per barrel mark just before the end of the forecast in 2040.



Source: IHS Markit

U.S. Airlines

Domestic Market

Mainline and regional carriers[3] offer domestic and international passenger service between the U.S. and foreign destinations, although regional carrier international service is confined to the border markets in Canada, Mexico, and the Caribbean.

The commercial air carrier industry in 2020 will respond to four trends already underway: (1) selective capacity expansion; (2) steady growth of seats per aircraft, whether through up-gauging or reconfiguring existing aircraft; (3) increasing competitive pressure due to ultra-low-cost carrier expansion; and (4) increasing price discrimination[4] through ancillary revenues and revenue management systems.

Following the 2007-09 recession, the U.S. airline industry underwent considerable restructuring that has resulted in an unprecedented period of capacity discipline, especially in domestic markets. Since 2009, U.S. domestic ASMs have increased at an average rate of 2.6 percent per year while RPMs have grown 3.2 percent per year. Although those average rates of growth since the recession are modest, they conceal the fact

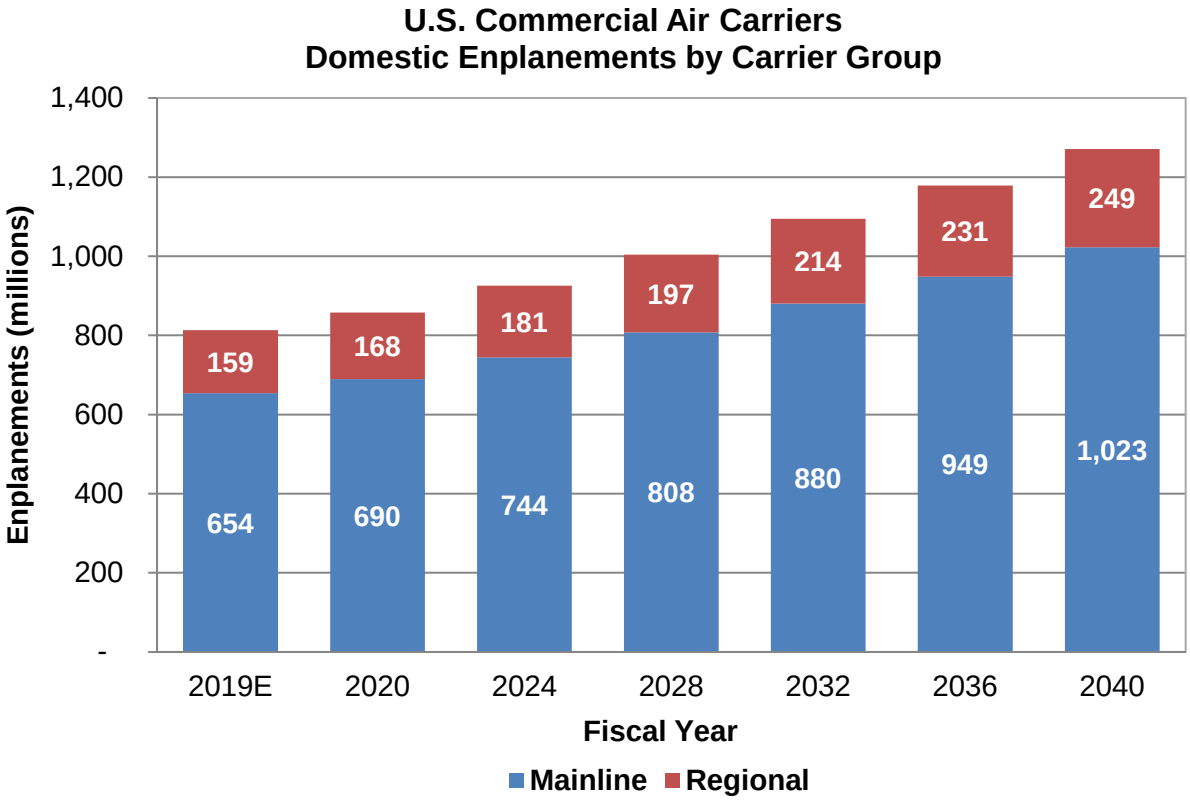
[3] Mainline carriers are defined as those providing service primarily via aircraft with 90 or more seats. Regionals are defined as those providing service primarily via aircraft with 89 or fewer seats and whose routes serve mainly as feeders to the mainline carriers.

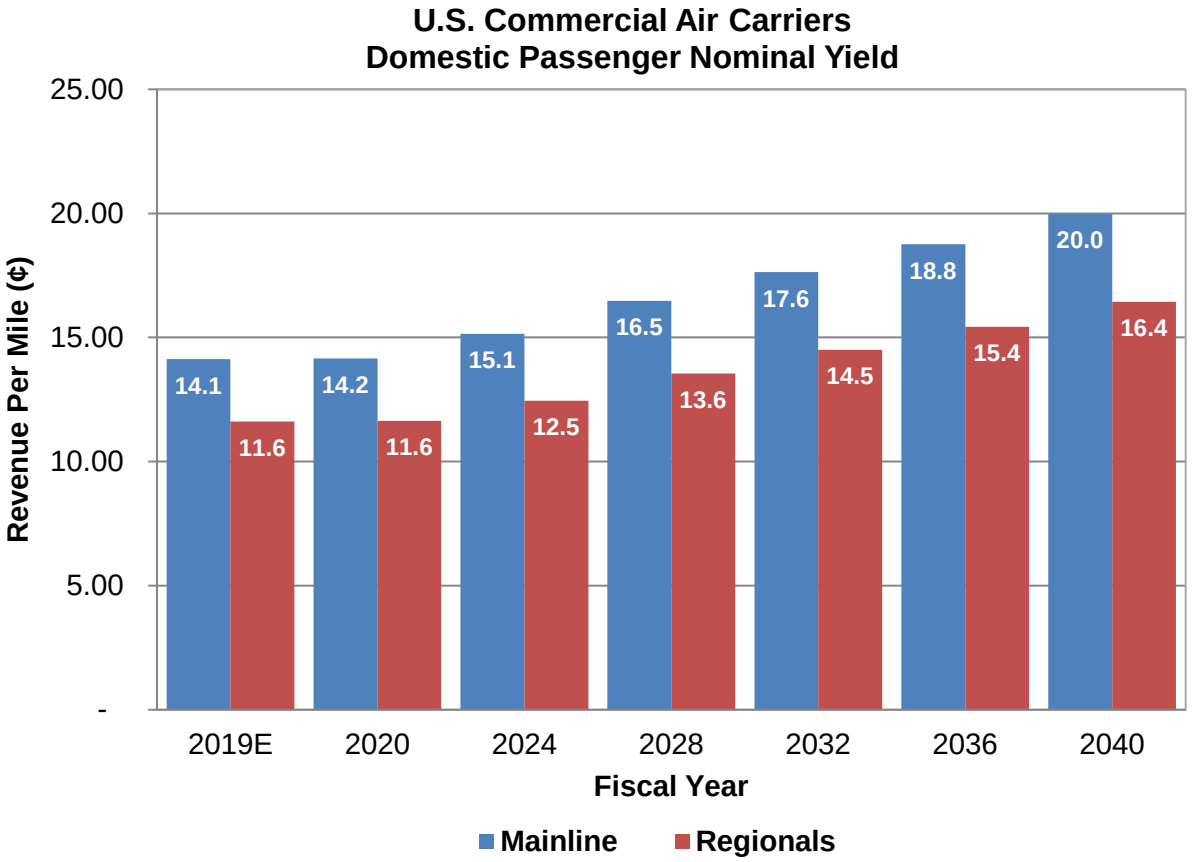
[4] Simply defined as the business strategy of selling largely similar products to different customers at different prices.

that growth has been picking up over the period (4.4 percent and 4.6 percent a year since 2014, respectively). ASM growth has risen due to a variety of factors including upgauging, and the expansion of ultra-low-cost carriers and the competitive response by major carriers, driven in large part by low fuel prices. Looking ahead to the near-term, the acceleration of growth in ASM is likely to continue as some carriers have indicated plans to open new routes and potential new entrants have announced plans to begin operations. As new service begins, competitors may respond defensively by adding their own new routes, thus further boosting ASM growth.

The period of domestic capacity restraint since 2007 has not been shared equally between the mainline carriers and their regional counterparts. In 2019, the mainline carrier group provided 19.2 percent more capacity than in 2007 while carrying 22.8 percent more passengers. Capacity flown by the regional group has risen 5.1 percent over the same 12-year period (with passengers carried up 2.1 percent).

The regional market has continued to lose ground as the regionals compete for even fewer contracts with the remaining dominant carriers; this has meant paltry growth in enplanements and yields.





The regionals have less leverage with the mainline carriers than they have had in the past as the mainline carriers have negotiated contracts that are more favorable for their operational and financial bottom lines. Furthermore, the regional airlines are facing some pilot shortages. Their labor costs are increasing as they raise wages to combat the pilot shortage while their capital costs have increased in the short-term as they continue to replace their 50 seat regional jets with more fuel-efficient 70 seat jets. The move to the larger aircraft will prove beneficial in the future, however, since their unit costs are lower.

Growing seats per aircraft has been a longstanding trend for regionals that saw this measure rise by more than 55 percent over the decade from 1997 to 2007. The trend has slowed more recently, however, as regional seats per aircraft rose 17 percent over the ten years ending in 2019.

Mainline carriers have also been increasing the seats per aircraft flown although the trend has been accelerating – the reverse of regionals' behavior. From 1997-2007, mainline seats per aircraft expanded just one-half of one percent. Since 2009, this measure has grown 10 percent.

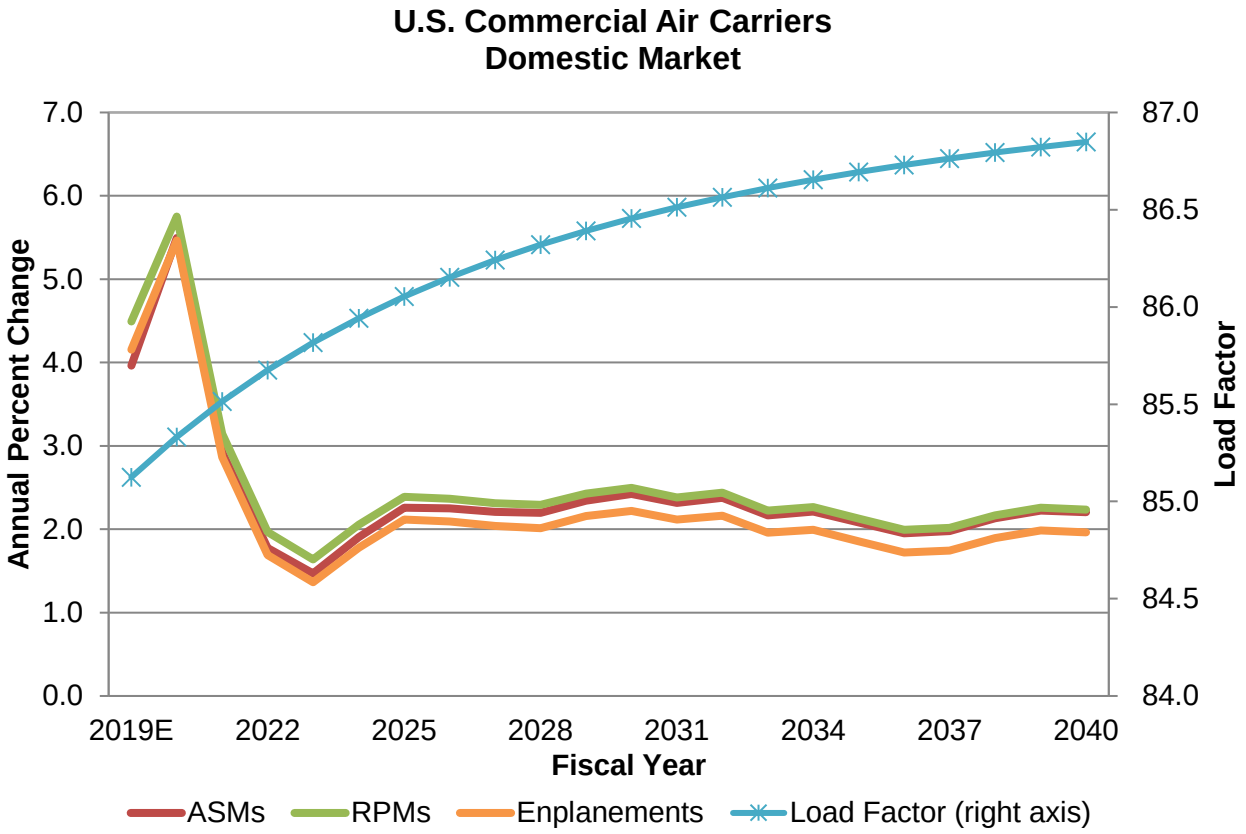
Another continuing trend is that of ancillary revenues. Carriers generate ancillary revenues by selling products and services beyond that of an airplane ticket to customers. This includes the un-bundling of services previously included in the ticket price such as

checked bags, on-board meals and seat selection, and by adding new services such as boarding priority and internet access. After posting record net profits in 2015, U.S. passenger carrier profits declined in the subsequent three years on rising fuel and labor costs, and flat yields. Nevertheless, profits remain solid and supported by ancillary revenues and the implementation of increasingly sophisticated revenue management systems. These systems enable carriers to price fares optimally for each day and time of flight and minimize foregone revenue. Besides this method of price discrimination, airlines are continuing to implement plans to further segment their passengers into more discreet cost categories based on comfort amenities like seat pitch, leg room, and access to social media and power outlets. In 2015, Delta introduced "Basic Economy" fares that provided customers with a main cabin experience at lower cost in exchange for fewer options. By the end of 2017 these fares were available in 100% of Delta's domestic network. In February 2017, American began offering its version, and had expanded to the entire domestic network by September. United deployed its version of Basic Economy fares across its domestic network in May 2017, but quickly pulled back the scale of deployment across its domestic network as negative revenue impacts were more than anticipated.

The offering of Basic Economy fares has been part of an effort by network carriers to protect market share in response to the rapid growth low cost carriers (LCC) have achieved in recent years. While mainline enplanements have increased almost 23 percent since 2007, and regionals' have risen 2 percent, low cost carrier enplanements have grown by 39 percent. RPMs over the same period show a similar pattern with mainline RPMs up almost 27 percent, regional RPMs up 11 percent and LCC RPMs fully 48 percent higher.

U.S. commercial air carriers' total number of domestic departures rose for the second year in a row in 2019, leaving them about 15 percent below the 2007 level. ASMs, RPMs and enplanements, however, all grew in each of the past nine years; these trends underlie the expanding size of aircraft and higher load factors.[5] In 2019, the domestic load factor bumped up to 85.1 percent – a new historic high. Load factor is forecast to rise and peak around 86.8 percent in the future due to the logistical difficulties inherent in matching supply perfectly with demand.

[5] Commercial air carriers encompass both mainline and regional carriers.



System (the sum of domestic plus international) capacity increased 3.4 percent to 1.236 trillion ASMs in 2019 while RPMs increased 4.3 percent to 1.044 trillion. During the same period system-wide enplanements increased 4.1 percent to 916.7 million. In 2019, U.S. carriers continued to prioritize the domestic over the international market in terms of allocating capacity as domestic capacity increased 4.0 percent while international capacity was up just 2.1 percent. U.S. carriers' domestic capacity growth will exceed their international capacity growth in 2020 but carriers will start expanding capacity in international markets faster than domestic markets beginning in 2022 and this trend is projected to continue through 2040 as the domestic market continues to mature.

U.S. mainline carrier enplanement growth in the combined domestic and international market was 4.3 percent in 2019 while regional carriers carried 3.5 percent more passengers.

In the domestic market, mainline enplanements increased for the ninth consecutive year, up 4.3 percent, marking the first time since 2000 that the industry recorded nine consecutive years of passenger growth in the domestic market. Mainline passengers in international markets posted the tenth year of growth, up 4.1 percent. Domestic mainline enplanement growth is forecast to remain strong, increasing at 5.5 percent in 2020 before slowing as economic activity cools and averaging 2.0 percent annually over the forecast. After slowing during the early part of

the forecast, international mainline enplanements are expected to accelerate to an average of 3.2 percent through the forecast horizon.

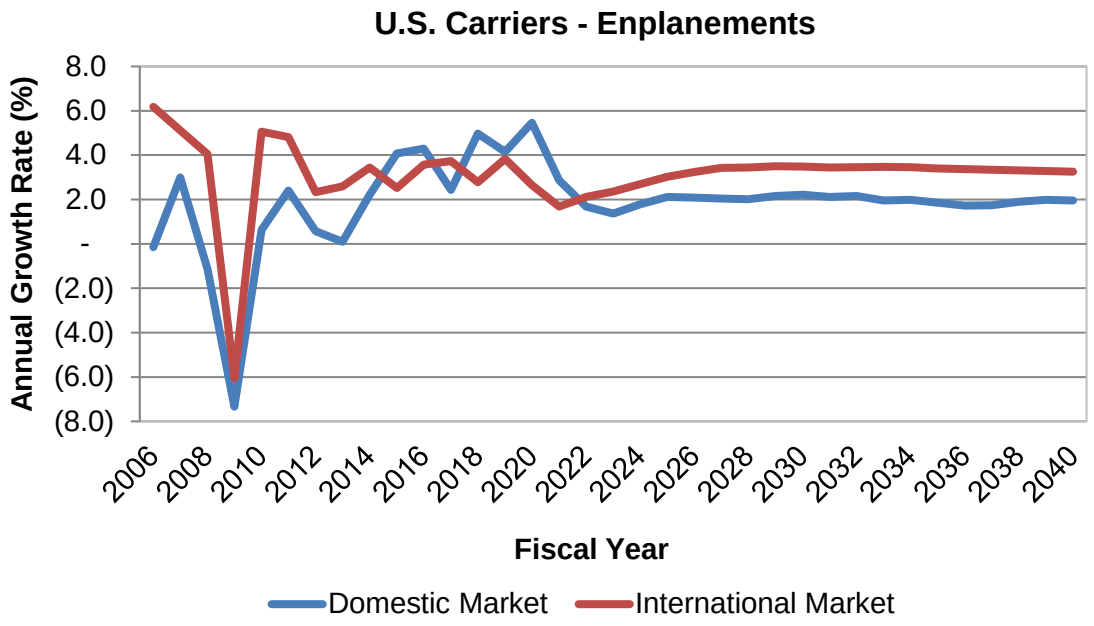
With relatively robust demand, industry capacity growth was up 3.4 percent in 2019 after a 4.4 percent increase in 2018. The increased passenger volume and traffic offset slow yield growth and along with higher ancillary revenues and relatively low fuel prices, U.S. carriers were solidly profitable in 2019. Domestic mainline capacity is expected to match the pattern of enplanements with strong 5.7 percent growth in 2020, followed by more moderate growth at about the long term trend. International mainline enplanements are forecast to slow somewhat over the next two years before picking up and returning to growth of about 3.4 percent through the remainder of the forecast.

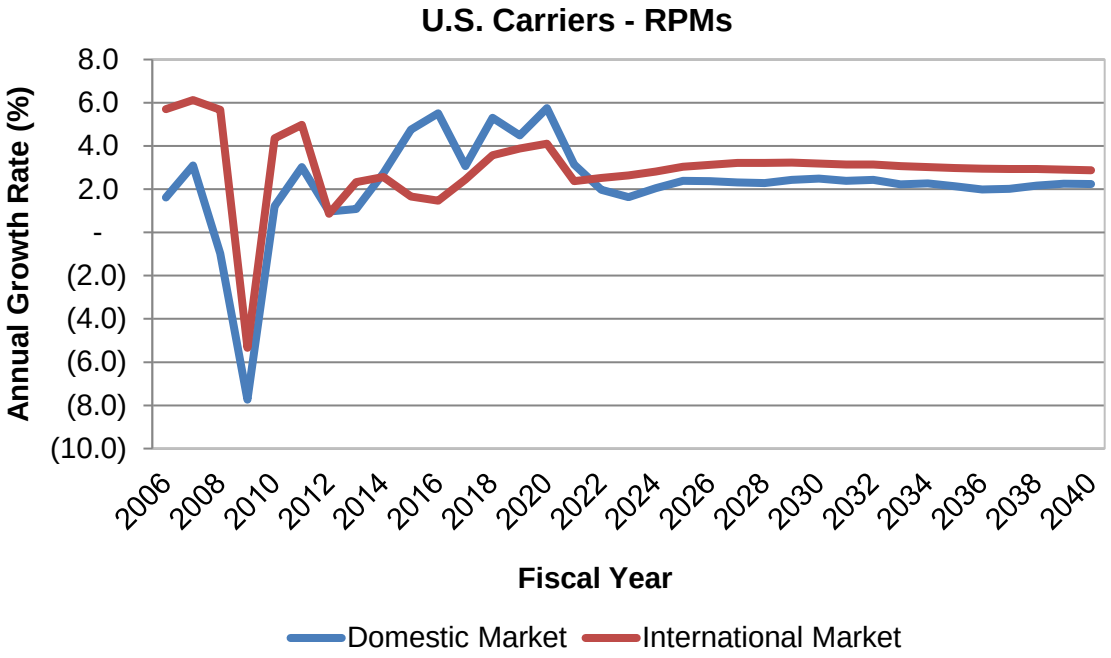
System load factor rose by seven tenths of a percentage point while trip length increased 2.2 miles (0.2 percent) in 2019, even as seats per aircraft mile increased by 0.9 percent; again reflecting the trend towards using larger aircraft. Seats per aircraft mile system-wide increased to 157.5 seats (up 1.3 seats per aircraft mile), the highest level since 1990.

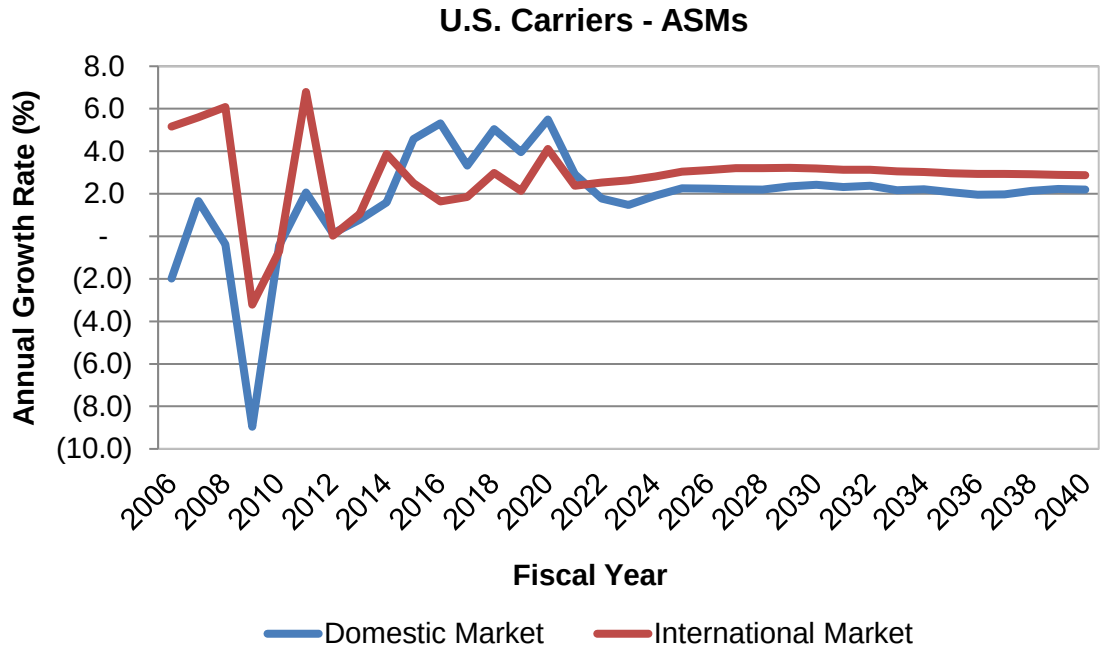
International Market

Over most of the past decade, the international market has been the growth segment for U.S. carriers when compared to the mature U.S. domestic market. In 2015 and 2016, growth in the domestic market surged, outpacing international markets. However, in 2017 enplanement growth in international markets exceeded that in domestic markets, only to be reversed again in 2018 and 2019. Domestic enplanement growth is expected to outpace that of international markets for the next couple of years when longer term economic trends begin to reassert themselves. The average annual growth rate (FY 2020-2040) of the international market (comprised of mainline and regional carriers) for enplanements is forecast to be 3.1 percent and, RPM and ASM are both forecast at 3.0 percent.

Growth of major global economies has begun to slow from the above-trend rates of recent years. Several moderating factors are at work, including dampened credit growth, reduced global trade, and political stresses. The European and Japanese economies are generally seeing slow but positive growth, in part due to weak trade with Asia. In turn, this has been driven by trade disputes as well as China's continuing gradual slowdown which has been managed by the government and is unlikely to decline sharply. Overall, global conditions appear to be on a stable path but one with growth rates that are closer to long-term trends than the higher rates of the recent past. Nevertheless, combined with moderate oil prices, this presents a supportive environment for air travel demand.



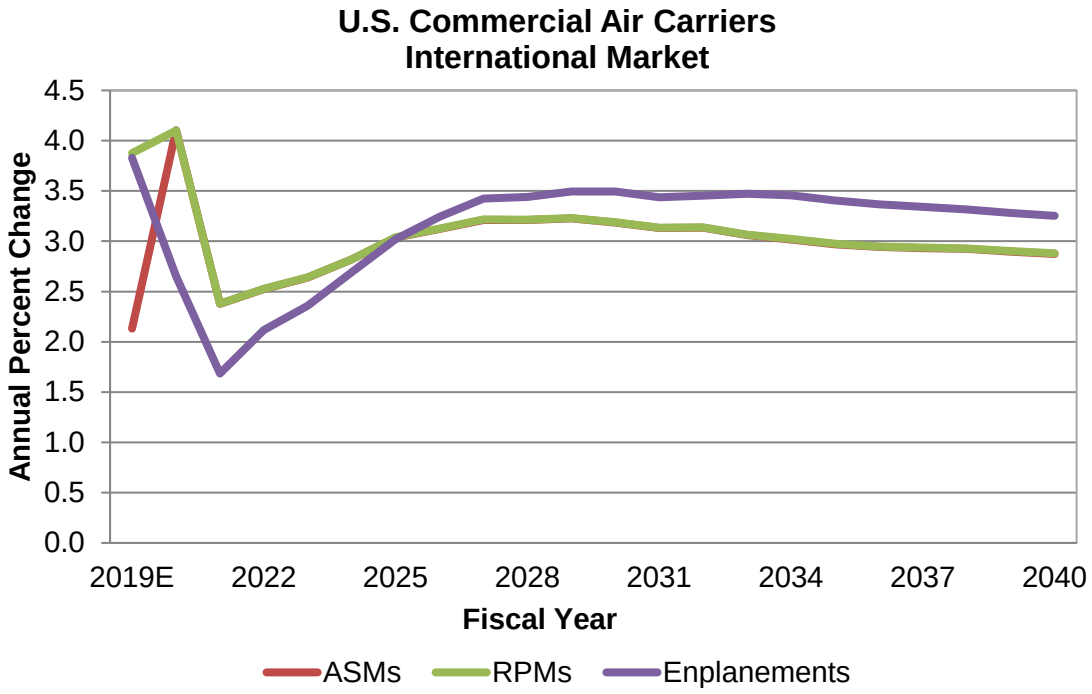




As of the preparation of this forecast, growth rates of international activity for U.S. carriers in 2020 were expected to be solid at 2.7, 4.1, and 4.1 percent a year for enplanements, RPMs, and ASMs, respectively. This performance is predicated on strong U.S. economic fundamentals combined with nascent upturns in foreign economies but does not include impacts from the novel coronavirus.

Following the early part of the forecast, demand growth picks up to average about 3.0 percent for each measure. Airlines will continue to match capacity growth with traffic

growth and load factor is expected to stabilize around 82.9%. This surpasses the previous record high load factor seen in 2013.

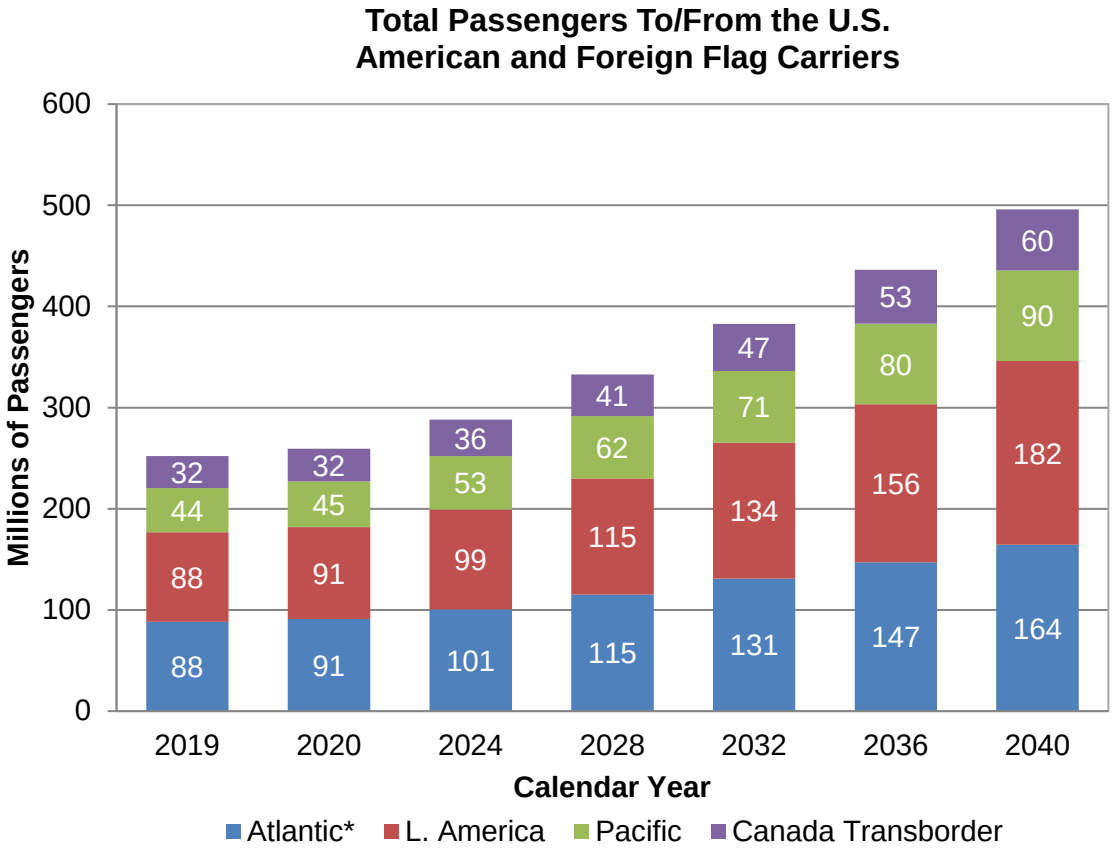


For U.S. carriers, Latin America remains the largest international destination despite the recent economic and political crises in Venezuela and Brazil. Enplanements in 2019 grew an estimated 4.0 percent while RPMs increased 2.2 percent. Growth is projected to ease considerably in 2020 and 2021 as U.S. carriers trim capacity expansion to support yields. Enplanements and RPMs are forecast to increase 0.6 and 1.1 percent, respectively, in 2020. Over the twenty-year period 2020-2040, Latin America enplanements are forecast to increase at an average rate of 3.8 percent a year while RPMs grow 4.0 percent a year.

The Pacific region is the smallest in terms of enplanements despite the economic growth and potential of air travel to the region's emerging markets. In 2019, U.S. carriers saw enplanements decline 0.9 percent from their 2018 levels, mainly due to a sharp slowdown in travel between the U.S. and China and India, markets that had recently posted very strong growth. Meanwhile, traffic (RPMs) increased by just 0.4 percent. Although the region is forecast to have the highest economic growth of any region over the next 20 years, led by China and India, U.S. carrier enplanements and RPMs for the Pacific region are forecast to grow a modest 2.2 and 2.3 percent a year, respectively. Traffic growth is relatively moderate in part because U.S. carriers continue to have a majority of their service in the region to Japan as opposed to faster growing countries.

After contracting in 2015 and 2016, the Atlantic region has accelerated steadily in recent years. By 2019, enplanements grew of

7.0 percent as and RPMs expanded by 7.7 percent. This growth has been supported by U.S. demand as well as growth of Middle East and African markets, even as the European economies slowed in 2019. While Western Europe is a mature area with moderate economic growth, the economically smaller Middle East and Africa areas are expanding rapidly with GDP growth rates more than twice that of Europe. As a result, a larger share of the forecast aviation demand in the Atlantic region is linked to those two areas, particularly in the second half of the forecast period. Over the twenty-year period from 2020 to 2040, enplanements in the Atlantic region are forecast to grow at an average annual rate of 2.2 percent a year while RPMs grow 2.5 percent a year.



Source: US Customs & Border Protection data processed and released by Department of Commerce; data also received from Transport Canada

* Per past practice, the Mid-East region and Africa are included in the Atlantic category.

Total passengers (including Foreign Flag carriers) between the United States and the rest of the world increased an estimated 3.2 percent to 252 million in 2019 as all regions posted gains led by a 4.1 percent increase in the Atlantic region.

FAA projects total international passenger growth of 2.9 percent in 2020 as global economic growth remains modest with the highest passenger growth expected in the Atlantic and Pacific regions. Moderate global economic growth averaging 2.9 percent a year over the next 20 years (2020-2040) is the foundation for the forecast growth of international passengers of 3.3 percent a year, as levels almost double from 252 million to 496 million.

The Latin American region is the largest international market and is projected to grow at the fastest rate (3.5 percent a year) of any region over the forecast period. Within the region, Mexico and Dominican Republic are the two largest markets and are expected to post average annual growth rates of 3.6 percent and 4.4 percent, respectively.

Powered by economic growth and rising incomes in China, India and South Korea, total passengers in the Pacific region are forecast to more than double to 90 million by 2040. From 2020 to 2040, passengers between the United States and the Pacific region are forecast to grow 3.5 percent a year.

Both the Atlantic and Canada regions are more mature markets and are projected to have somewhat slower growth than the Latin or Pacific regions. The Atlantic region is forecast to grow at an average rate of 3.0 percent a year as an increasing share of the passengers in this region come from the Middle East and Africa markets. Though sizable and comparable to Mexico in passenger traffic, the Canadian transborder market is considerably smaller than the Atlantic region. With solid North American economic growth, Canada transborder passengers are forecast to grow at an annual average of 3.2 percent a year over the next 20 years.

Cargo

Air cargo traffic includes both domestic and international freight/express and mail. The demand for air cargo is a derived demand resulting from economic activity. Cargo moves in the bellies of passenger aircraft and in dedicated all-cargo aircraft on both scheduled and nonscheduled service. Cargo carriers face price competition from alternative shipping modes such as trucks, container ships, and rail cars, as well as from other air carriers.

U.S. air carriers flew 42.9 billion revenue ton miles (RTMs) in 2019, up just 0.2 percent from 2018 with domestic cargo RTMs increasing 2.8 percent to 16.2 billion while international RTMs contracted 1.3 percent to 26.6 billion. Air cargo RTMs flown by all-cargo carriers comprised 80.3 percent of total RTMs in 2019, with passenger carriers flying the remainder. Total RTMs flown by the all-cargo carriers increased 2.3 percent in 2019 while total RTMs flown by passenger carriers fell by 7.2 percent.

U.S. carrier international air cargo traffic spans four regions consisting of Atlantic, Latin, Pacific, and 'Other International.'

Historically, air cargo activity tracks with GDP. Other factors that affect air cargo growth are fuel price volatility, movement of real yields, globalization and trade.

The forecasts of revenue ton miles rely on several assumptions specific to the cargo industry. First, security restrictions on air cargo transportation will remain in place. Second, most of the shift from air to ground transportation has occurred. Finally, long-term cargo activity depends heavily on economic growth.

The forecasts of RTMs derive from models that link cargo activity to GDP. Forecasts of domestic cargo RTMs use real U.S. GDP as the primary driver of activity. Projections of international cargo RTMs depend on growth in world and regional GDP, adjusted for inflation. FAA forecasts the distribution of RTMs between passenger and all-cargo carriers based on an analysis of historic trends in shares, changes in industry structure, and market assumptions.

After increasing by just 0.2 percent in 2019, total RTMs are expected to recover and grow 4.5 percent in 2020. Because of steady U.S. and world economic growth in the long term, FAA projects total RTMs to increase at an average annual rate of 3.5 percent for the balance of the forecast period (from 2020 to 2040).

Following a 2.8 percent increase in 2019, domestic cargo RTMs are projected to grow 1.9 percent in 2020 as the global trade slowdown impacts domestic activity. Between 2020 and 2040, domestic cargo RTMs are forecast to increase at an average annual rate of 1.9 percent. In 2019, all-cargo carriers carried 90.9 percent of domestic cargo RTMs. The all-cargo share is forecast to grow modestly to 92.2 percent by 2040 based on increases in capacity for all-cargo carriers.

International cargo RTMs fell 1.3 percent in 2019 after posting a 10.0 percent increase in 2018. Trade disputes and slower economic growth around the world have materially impacted global trade. Growth in international RTMs recover in 2020, growing at 6.2 percent as foreign economies regain their footing and some trade disputes are resolved. For the forecast period (2020-2040), international cargo RTMs are expected to increase an average of 4.2 percent a year based on projected growth in world GDP with the Other International region having the fastest growth (5.0 percent), followed by the Pacific (4.7 percent), Atlantic (3.1 percent), and Latin America regions (1.3 percent).

The share of international cargo RTMs flown by all-cargo carriers is forecast to increase from 73.8 percent in 2019 to 79.0 percent by 2040.

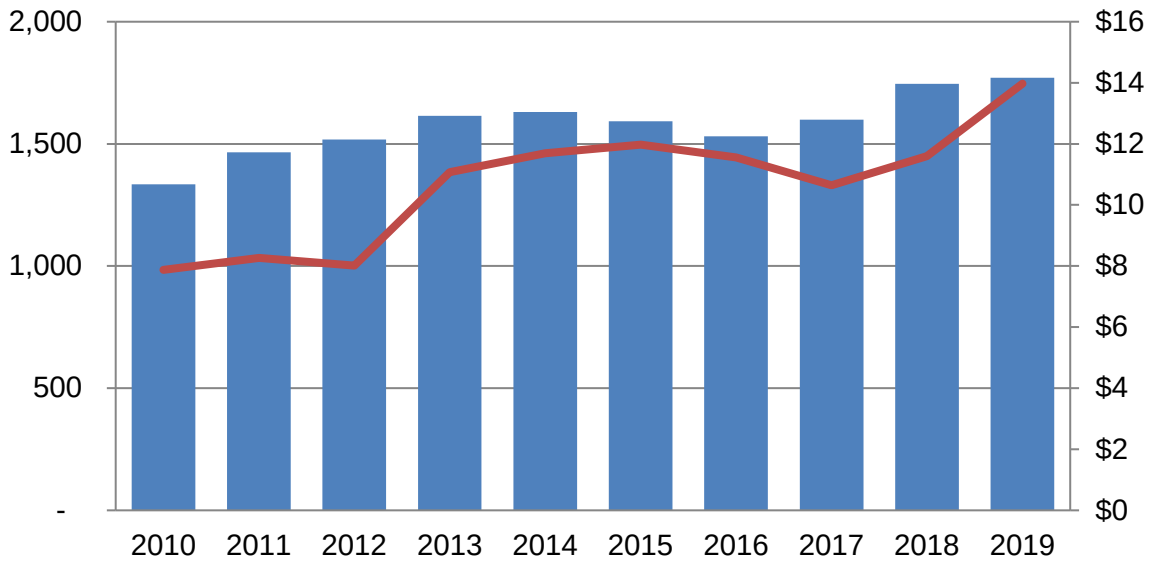
General Aviation

The FAA uses estimates of fleet size, hours flown, and utilization rates from the General Aviation and Part 135 Activity Survey (GA Survey) as baseline figures to forecast the GA fleet and activity. Since the survey is conducted on a calendar year (CY) base and the records are collected by CY, the GA forecast is done by CY. Forecasts of new aircraft deliveries, which use the data from General Aviation Manufacturers Association (GAMA), together with assumptions of retirement rates, produce growth rates of the fleet by aircraft categories, which are applied to the GA Survey fleet estimates. The forecasts are carried out for "active aircraft,"[6] not total aircraft. The FAA's general aviation forecasts also rely on discussions with the industry experts conducted at industry meetings, including Transportation Research Board (TRB) meetings of Business Aviation and Civil Helicopter Subcommittees conducted twice a year in January and June.

The results of the 2018 GA Survey, the latest available, were consistent with the results of surveys conducted since 2004 improvements to the survey methodology. The active GA fleet was estimated to be 211,749 aircraft in 2018 (0.0 percent change from 2017), as increases in fixed wing piston, fixed wing turbine, and experimental aircraft were offset by declines in rotorcraft and other aircraft (gliders and lighter than air). Total hours flown were estimated to be 25.5 million, up 1.2 percent from 2017. Increases in fixed wing piston and fixed wing turbine aircraft more than offset sharp declines in rotorcraft and experimental aircraft.

In 2019, deliveries of the general aviation aircraft manufactured in the U.S. increased slightly to 1,771, 1.4 percent higher than in CY 2018. Deliveries of single-engine piston aircraft were up 7.0 percent while multi-engine piston deliveries were flat. Business jet deliveries were up by 6.3 percent, but turboprop deliveries were down by 13.3 percent. Overall piston deliveries were up 6.5 percent while turbine shipments were down by 3.2 percent. Based on figures released by GAMA, they amounted to $14.0 billion in factory net billings, a record for the U.S. industry.

[6] An active aircraft is one that flies at least one hour during the year.



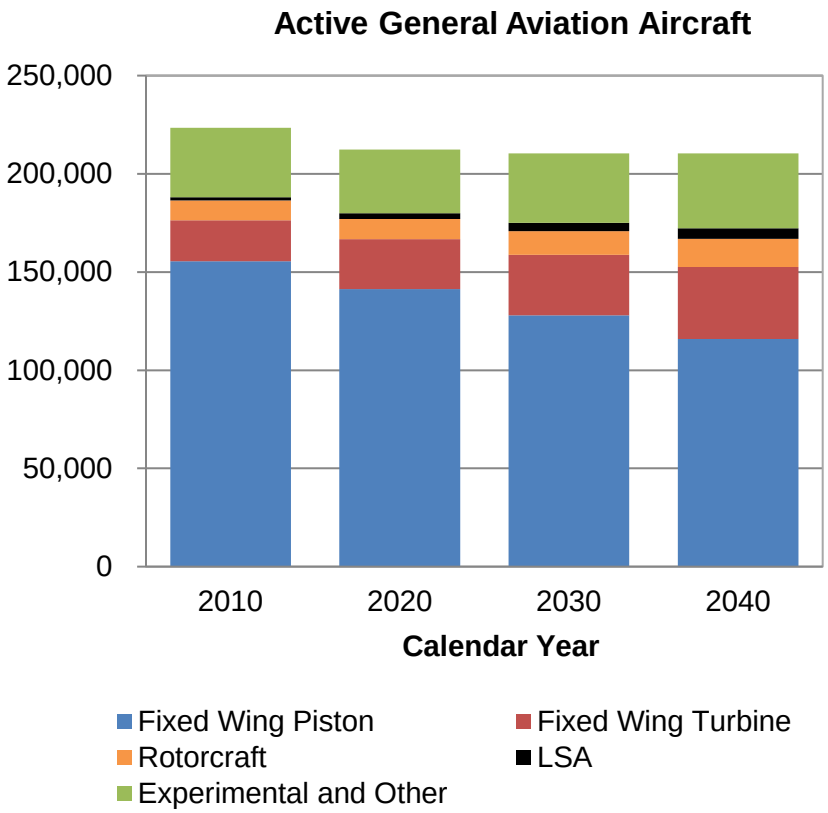
GAMA and industry experts reported the rotorcraft deliveries declined in 2019 in both piston and turbine segments.

Against these current conditions, the long-term outlook for general aviation, driven by turbine aircraft activity, remains stable. The active general aviation fleet is projected to decrease slightly from its current level, as the declines in the fixed-wing piston fleet remain just above the increases in the turbine, experimental, and light sport fleets. The total active general aviation fleet changes from an estimated 212,335 in 2019 to 210,380 aircraft by 2040 (a small decline of 0.9 percent).

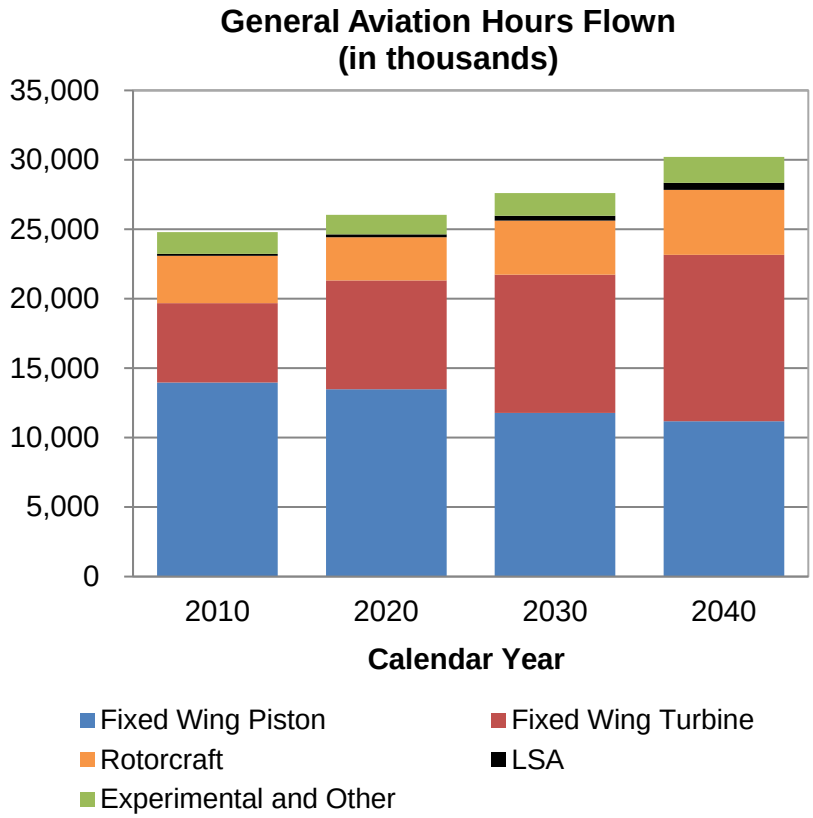
The more expensive and sophisticated turbine-powered fleet (including rotorcraft) is projected to grow by 14,640 aircraft -- an average rate of 1.8 percent a year between 2019 and 2040, with the turbojet fleet increasing 2.3 percent a year. The growth in U.S. GDP and corporate profits are catalysts for the growth in the turbine fleet.

The largest segment of the fleet, fixed wing piston aircraft, is predicted to shrink over the forecast period by 26,365 aircraft (an average annual rate of -1.0 percent). Unfavorable pilot demographics, overall increasing cost of aircraft ownership, availability of much lower cost alternatives for recreational usage, coupled with new aircraft deliveries not keeping pace with retirements of the aging fleet are the drivers of the decline.

On the other hand, the smallest category, light-sport-aircraft (created in 2005), is forecast to grow by 3.4 percent annually, adding about 2,730 new aircraft by 2040, more than doubling its 2018 fleet size.



Although the total active general aviation fleet is projected to marginally decline, the number of general aviation hours flown is forecast to increase an average of 0.7 percent per year through 2040 from 25.5 million in 2018 to 30.2 million, as the newer aircraft fly more hours each year. Fixed wing piston hours are forecast to decrease by 1.0 percent, the same rate as the fleet decline. Countering this trend, hours flown by turbine aircraft (including rotorcraft) are forecast to increase 2.2 percent yearly between 2019 and 2040. Jet aircraft are expected to account for most of the increase, with hours flown increasing at an average annual rate of 2.7 percent over the forecast period. The large increases in jet hours result mainly from the increasing size of the business jet fleet.



Rotorcraft activity, which was not as heavily impacted by the previous economic downturn as other aircraft and rebounded earlier, faces the challenges brought by lower oil prices, a trend which has been continuing. The low oil prices impacted utilization rates and new aircraft orders both directly through decreasing activity in oil exploration, and also through a slowdown in related economic activity. While significant use in other activities such as air medical, training, air taxi and tours continues, the 2018 GA Survey showed a 5.0 percent decrease in the active fleet and a 12.0 percent decrease in hours flown. The fleet is projected to grow at a similar rate to previous year's forecast, although starting from a lower base and at a slower pace in the piston segment. Rotorcraft hours are projected to grow by 2.1 percent annually over the forecast period.

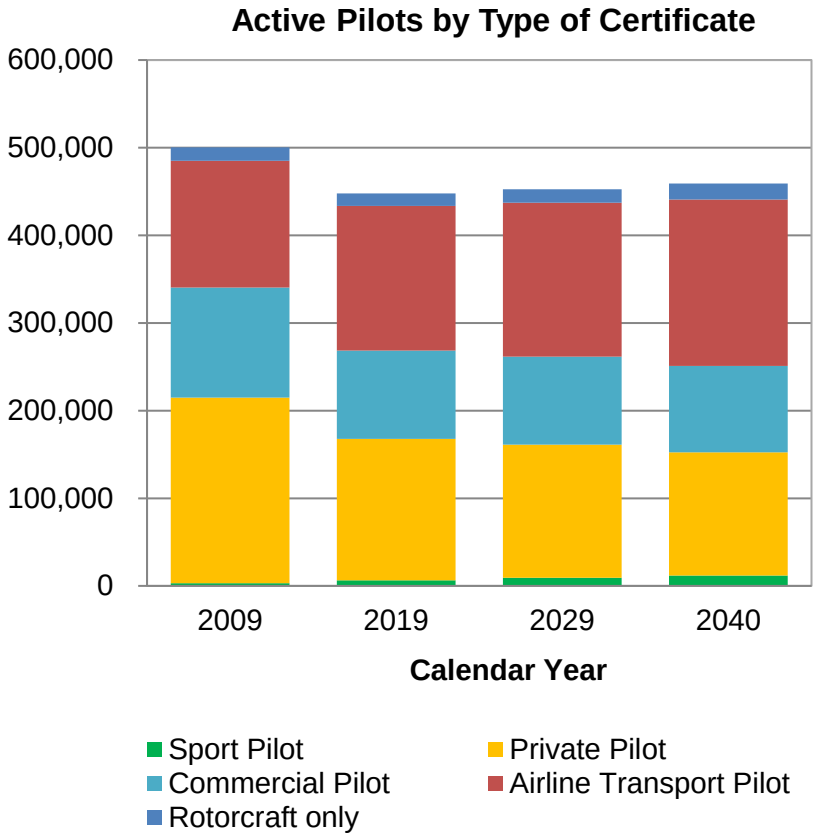
Lastly, the light sport aircraft category is forecasted to see an increase of 4.2 percent a year in hours flown, primarily driven by growth in the fleet.

The FAA also conducts a forecast of pilots by certification categories, using the data compiled by the Administration's Mike Monroney Aeronautical Center. There were 664,565 active pilots certificated by FAA at the end of 2019. The number of certificates in most pilot categories continued to increase, with the exception of private, rotorcraft only and recreational certificates. The FAA has suspended the student pilot forecast for the third consecutive year. The number of student pilot certificates has been affected by a regulatory change that went into effect in April 2016 and removed the expiration date on the new student pilot certificates. The number of student pilots jumped from 128,501 at the end of 2016 to 149,121 by the end of 2017,

and to 197,665 at the end of 2019. The 2016 rule change generates a cumulative increase in the certificate numbers and breaks the link between student pilot and advanced certificate levels of private pilot or higher. There is no sufficient data yet to perform a reliable forecast for the student pilots.

Commercial and air transport pilot (ATP) certificates have been impacted by a legislative change as well. The Airline Safety and Federal Aviation Administration Extension Act of 2010 mandated that all part 121 (scheduled airline) flight crew members would hold an ATP certificate by August 2013. Airline pilots holding a commercial pilot certificate and mostly serving at Second in Command positions at the regional airlines could no longer operate with only a commercial pilot certificate after that date, and the FAA data initially showed a faster decline in commercial pilot numbers, accompanied by a higher rate of increase in ATP certificates. The number of both commercial pilot and ATP certificates have been increasing for the last three years, to 100,863 and 164,947, respectively by the end of 2019.

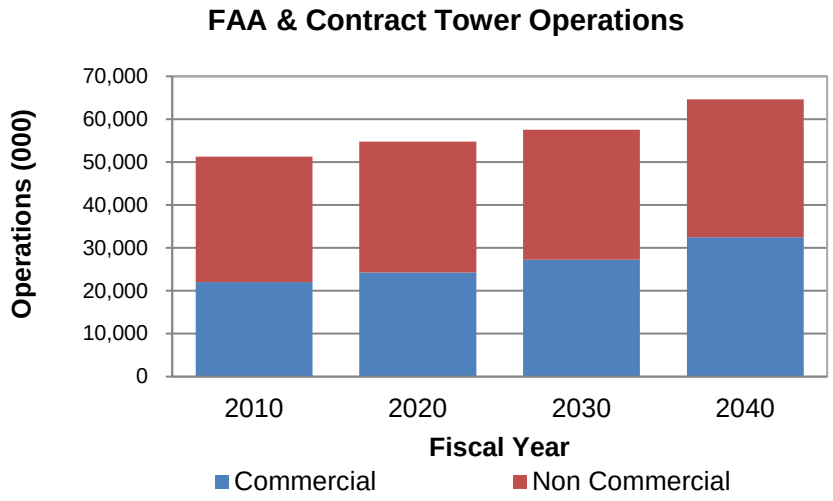
The number of active general aviation pilots (excluding students and ATPs) is projected to decrease about 12,120 (down 0.2 percent yearly) between 2019 and 2040. The ATP category is forecast to increase by 25,150 (up 0.7 percent annually). The much smaller category of sport pilots are predicted to increase by 2.9 percent annually over the forecast period. On the other hand, both private and commercial pilot certificates are projected to decrease at an average annual rate of 0.6 and 0.1 percent, respectively until 2040.


Active Pilots by Type of Certificate
600,000
500,000
400,000
300,000
200,000
100,000
0
2009
2019
2029
2040
Calendar Year
Sport Pilot
Private Pilot
Commercial Pilot
Airline Transport Pilot
Rotorcraft only

FAA Operations

The growth in air travel demand and the business aviation fleet will drive growth in operations at FAA facilities over the forecast period. Activity at FAA and contract towers is forecast to increase at an average rate of 0.9 percent a year through 2040 from 53.3 million in 2019 to close to 64.6 million in 2040. Commercial operations[7] at these facilities are forecast to increase 1.6 percent a year, approximately four times faster than non-commercial operations. The growth in commercial operations is less than the growth in U.S. airline passengers (1.6 percent versus 2.2 percent) over the forecast period due primarily to larger aircraft (seats per aircraft mile) and higher load factors. Both of these trends allow U.S. airlines to accommodate more passengers without increasing the number of flights. General aviation operations (which accounted for 51.4 percent of operations in 2019) are forecast to increase an average of 0.4 percent a year as increases in turbine powered activity more than offset declines in piston activity.

The growth in operations at towered airports is not uniform. Most of the activity at large and medium hubs[8] is commercial in nature, given that these are the airports where most of the passengers, about 88 percent in 2019, in the system fly to.



[7] Sum of air carrier and commuter/air taxi categories.

[8] Large hub is defined to have 1 percent or more of total U.S. revenue passenger enplanements in FY 2019. There are 30 airports in this category. Medium hub is defined to have at least 0.25 percent but less than 1 percent of total U.S. revenue passenger enplanements in FY 2019. There are 31 airports classified as medium hubs.

Given the growth in airline demand and most of that demand is at large and medium hubs, activity at the large and medium hubs is forecast to grow substantially faster than small towered airports including small FAA towers[9] and FAA contract towers[10]. The forecasted annual growth is 1.7 percent at large hubs, 1.6 at medium hubs, 0.5 percent at small FAA towers and FAA contract towers between 2019 and 2040.

Among the 30 large hubs, the airports with the fastest annual growth forecast are those located along the coastal sections of the country where most large cities are located. Large cities have historically shown to generate robust economic activity, which in turn drives up the airline demand. On the other hand, the airports forecast to have slower annual growth tend to be located in the middle of the country.

FAA Tracon (Terminal Radar Approach Control) Operations[11] are forecast to grow slightly faster than at towered facilities. This is in part a reflection of the different mix of activity at Tracons. Tracon operations are forecast to increase an average of 1.1 percent a year between 2019 and 2040. Commercial operations accounted for approximately 60 percent of Tracon operations in 2019 and are projected to grow 1.5 percent a year over the forecast period. General aviation activity at these facilities is projected to grow only 0.25 percent a year over the forecast.

The number of IFR aircraft handled is the measure of FAA En-Route Center activity. Growth in airline traffic and business aviation is expected to lead to increases in activity at En-Route centers. Over the forecast period, aircraft handled at En-Route centers are forecast to increase at an average rate of 1.5 percent a year, with commercial activity growing at the rate of 1.7 percent annually. Activity at En-Route centers is forecast to grow faster than activity at towered airports and FAA Tracons because more of the activity at En-Route centers is from the faster growing commercial sector and high-end (mainly turbine) general aviation flying.[12] In 2019, the share of commercial IFR aircraft handled at FAA En-Route centers is about 82 percent, which is greater than the 60 percent share at Tracons or the 44 percent share at FAA and Contract Towers.

[9] Small FAA towers are defined as towered airports that are neither large or medium hubs nor FAA contract towers.

[10] FAA contract towers are air traffic control towers providing air traffic control services under contract with FAA, staffed by contracted air traffic control specialists.

[11] Tracon operations consist of itinerant Instrument Flight Rules (IFR) and Visual Flight Rules (VFR) arrivals and departures at all airports in the domain of the Tracon as well as IFR and VFR overflights.

[12] Much of the general aviation activity at towered airports, which is growing more slowly, is local in nature, and does not impact the centers.

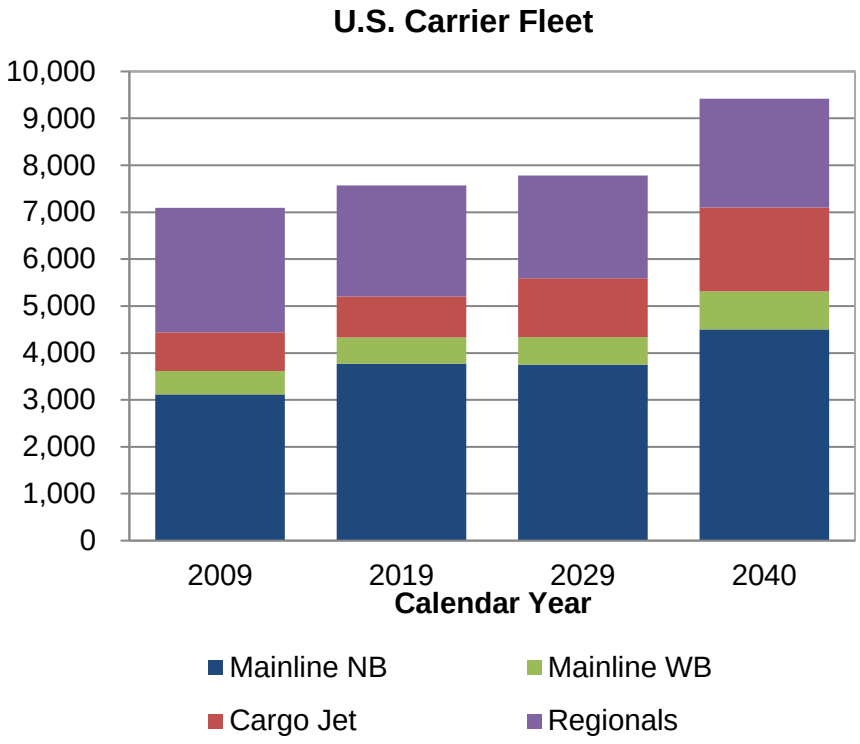
U.S. Commercial Aircraft Fleet

The number of aircraft in the U.S. commercial fleet is forecast to increase from 7,628 in 2019 to 9,421 in 2040, an average annual growth rate of 1 percent a year. Increased demand for air travel and growth in air cargo is expected to fuel increases in both the passenger and cargo fleets.

Between 2019 and 2040 the number of jets in the U.S. mainline carrier fleet is forecast to grow from 4,388 to 5,310, a net average of 44 aircraft a year as carriers continue to remove older, less fuel efficient narrow body aircraft. The narrow-body fleet (including E-series aircraft as well as A220-series at JetBlue and A220-series at Delta) is projected to grow 35 aircraft a year as carriers replace the 757 fleet and current technology 737 and A320 family aircraft with the next generation MAX and Neo families. The wide-body fleet grows by an average of 12 aircraft a year as carriers add 777-8/9, 787's, A350's to the fleet while retiring 767-300 and 777-200 aircraft. In total the U.S. passenger carrier wide-body fleet increases by 1.8 percent over the forecast period.

The regional carrier fleet is forecast to decline from 2,361 aircraft in 2019 to 2,320 in 2040 as the fleet shrinks by 1.7 percent (41 aircraft) between 2019 and 2040. Carriers remove 50 seat regional jets and retire older small turboprop and piston aircraft, while adding 70-90 seat jets, especially the E-2 family after 2020. By 2031 only a handful of 50 seat regional jets remain in the fleet. By 2040, the number of jets in the regional carrier fleet totals 2,192, up from 1,846 in 2019. The turboprop/piston fleet is forecast to shrink by 71% from 515 in 2019 to 128 by 2040. These aircraft account for just 5.5 percent of the fleet in 2040, down from 21.8 percent in 2019.

The cargo carrier large jet aircraft fleet is forecast to increase from 879 aircraft in 2019 to 1,791 aircraft in 2040 driven by the growth in freight RTMs. The narrow-body cargo jet fleet is projected to increase by 11 aircraft a year as 757's and 737-800's are converted from passenger use to cargo service. The wide body cargo fleet is forecast to increase 33 aircraft a year as new 747-800, 777-200, and new and converted 767-300 aircraft are added to the fleet, replacing older MD-11, A300/310, and 767-200 freighters.


U.S. Carrier Fleet
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
2009
2019
2029
2040
Calendar Year
Mainline NB
Mainline WB
Cargo Jet
Regionals

Commercial Space

The FAA's Office of Commercial Space Transportation (AST) licenses and regulates U.S. commercial space launch activities including launch and reentry of vehicles and operation of non-federal launch and reentry sites authorized by Executive Order 12465 and Title 51 U.S. Code, Subtitle V, Chapter 509 (formerly the Commercial Space Launch Act). Title 51 and the Executive Order also direct the U.S. Department of Transportation to encourage, facilitate, and promote U.S. commercial launches. The FAA's mission is to license and regulate commercial launch and reentry operations and non-federal launch sites to protect public health and safety, the safety of property, and the national security and foreign policy interests of the United States. With its dual mission of regulating and facilitating the emerging commercial space transportation industry, FAA faces unique challenges.

The FAA licenses launches or reentries carried out by U.S. persons inside or outside the United States. The FAA does not license launches or reentries the U.S. Government carries out for the Government (such as those owned and operated by NASA or the Department of Defense). FAA does not license or grant permits for amateur-class rockets[13].

To accomplish its mission, the FAA performs the following major functions:

- Maintains an effective regulatory framework for commercial space transportation activities,
- Provides guidance to prospective commercial operators on how to comply with regulatory requirements for obtaining an authorization and operating safely,
- Evaluates applications for licenses, experimental permits, and safety approvals for launch and reentry operations and related commercial space transportation activities,
- Evaluates applications for licenses for launch and reentry site operations,
- Monitors and enforces regulatory compliance through safety inspections of launches, reentries, sites, and other regulated commercial space activities,
- Provides U.S. Government oversight of investigations associated with the mishap of an FAA authorized launch or reentry,
- Facilitates the integration of commercial space launch and reentry operations into the National Airspace System (NAS) by coordinating airspace use and regulatory oversight with air traffic management and Federal launch ranges,

[13] Per 14 CFR Chapter 1, Part 1, section 1.1: Amateur rocket means an unmanned rocket that is propelled by a motor or motors having a combined total impulse of 889,600 Newton-seconds (200,000 pound-seconds) or less; and cannot reach an altitude greater than 150 kilometers above the earth's surface.

- Coordinates research into the safety, environmental, and operational implications of new technologies and the evolving commercial space transportation industry,

- Conducts outreach to the commercial space transportation industry by hosting working groups and conferences,

- Collaborates with Government partners, such as NASA, Defense Advanced Research Projects Agency (DARPA), and the U.S. Air Force to assure consistent approaches to regulations, policy, and standards, and

- Conducts outreach to international counterparts to promote the U.S. regulatory framework across the world.

In addition to AST headquarters offices in Washington, D.C., AST maintains staff with assigned duty locations near active launch ranges to facilitate communication with space launch operators and to implement FAA's regulatory responsibilities more efficiently. AST personnel are currently assigned to duty locations in close proximity to: Kennedy Space Center in Florida, Johnson Space Center in Texas, and Vandenberg Air Force Base and the Mojave Air and Space Port in California. FAA also directly supports NASA's commercial space initiatives by providing on-site staff at both the Johnson Space Center and Kennedy Space Center to coordinate the FAA's regulatory and enforcement activities with NASA's development and operational requirements for commercial space.

Regulatory Safety Oversight Activities of FAA

The business cycle from the time a firm first contacts FAA until the last launch of a licensed operation can be several years. There are many activities performed by FAA during this cycle. The most notable activities are described here.

Pre-Application Consultation for Licenses, Experimental Permits and Safety Approvals

Prospective applicants seeking commercial space transportation licenses, experimental permits, or safety approvals are required by regulation to consult with FAA before submitting their applications. During this period, FAA assists them in identifying potential obstacles to authorization issuance and determining potential approaches to regulatory compliance. In addition, many new operators are seeking to incorporate new technologies, vehicle types, or operational models creating challenges for FAA in determining the applicable regulations or approach to regulatory compliance.

Licenses, Permits and Safety Approvals

FAA authorizes commercial space transportation activities via the issuance of licenses, permits, and safety approval. Though many licenses authorize multiple launches (for mature launch systems), the need remains for FAA to also issue individual launch licenses for systems that are still maturing towards a high level of reliability. Furthermore, with the dynamic commercial space transportation industry, FAA often evaluates launch and reentry systems and operations that are evolving and changing, which may ultimately require license modifications or issuance of new licenses.

Inherent in the review process is the requirement to conduct policy reviews and payload reviews. When conducting a policy review,

FAA determines whether the proposed launch, reentry, or site operation presents any issues that would jeopardize public health and safety or the safety of property, adversely affect U.S. national security or foreign policy interests, or be inconsistent with international obligations of the United States. If not otherwise exempt from review, FAA reviews a payload proposed for launch or reentry to determine whether the payload would jeopardize public health and safety, the safety of property, U.S. national security or foreign policy interests, or the international obligations of the United States. The policy or payload determination becomes part of the licensing record on which FAA's licensing determination is based.

FAA also reviews and issues launch and reentry site operator licenses and license renewals. FAA also reviews and evaluates launch site license applications for launch sites located in foreign countries but operating with U.S.-licensed launch or reentry systems. FAA coordinates range planning among Federal, state, and local governments and with the commercial range operators or users. As part of the evaluation of applications for launch licenses, reentry licenses, and site operator licenses, FAA also conducts environmental reviews consistent with its responsibilities under the National Environmental Policy Act.

FAA anticipates issuing a growing number of safety approvals for space launch systems equipment, processes, technicians, training and other supporting activities. FAA reviews, evaluates, and issues safety approvals to support the continued introduction of new safety systems, safety operations applications, and safety approval renewal applications.

Safety Analyses

FAA conducts flight safety, system safety, maximum probable loss, and explosive safety analyses to support the evaluation and issuance of licenses and permits. FAA also evaluates and analyzes the performance of safety-critical space flight personnel to determine how they affect public safety risk. In the near future, as commercial firms become more involved with human space flight activity, AST and the FAA's Office of Aerospace Medicine may evaluate, analyze, and determine the health risks to the space flight participants (crew and space flight participants) due to natural and flight-induced launch and reentry environments, as well as any hazardous ground operations directly associated with the flight.

Inspections and Enforcement

FAA currently conducts as many as 400 preflight/ reentry, flight/ reentry, and post-flight/ reentry safety inspections per year. Inspections often occur simultaneously at any of the 11 licensed U.S. and international commercial space launch sites, as well as at 4 Federal launch ranges and 3 exclusive-use launch sites. The establishment of non-federal launch sites requires additional inspections in areas such as ground safety that have traditionally been overseen by the U.S. Air Force at Federal ranges. At spaceports and launch sites with high launch rates (e.g., Cape Canaveral Air Force Station, Vandenberg Air Force Base, the Mid-Atlantic Regional Spaceport, and Spaceport America), at least 80 percent of the inspections will be conducted by locally-based field inspectors in order to respond to a dynamic operational tempo, minimize cost, and increase efficiency.

Mishap Investigations

Mishap events have demonstrated that FAA needs to have the capacity to investigate at

least two space launch or reentry mishaps or accidents simultaneously anywhere in the world, and to lead/oversee as many as six investigations during a single year. FAA should have the capabilities and resources to safely perform the investigations lasting as long as 16 weeks at remote sites with limited infrastructure or facilities. FAA should have the capability and resources to efficiently review all applicant mishap plans and accident investigation procedures as part of the license and permit evaluation process.

NAS Integration

AST works in partnership with all FAA lines-of-business, notably the Air Traffic Organization (ATO) and Office of Airports (ARP) to support the safe and efficient integration of commercial launch and reentry operations into the NAS and its system of airports and air traffic managed by the ATO. This includes an increased presence at the Air Traffic Control System Command Center to assist in the strategic and tactical planning of launch and reentry operations, as well as to provide support during these operations. Further, AST works with the ATO as FAA develops technologies to facilitate safe and efficient integration of commercial launch and reentry operations into the NAS, including technologies to improve the integration of launch and reentry data into FAA air traffic control systems and technologies to improve the timely and accurate development and distribution of notices of aircraft hazard areas.

FAA's Operations Forecast

To improve its workforce planning process, in 2014, FAA adopted an approach to estimate its future staffing needs based on the ratio of regulatory safety oversight staff to a forecast of launch and reentry operations within the purview of the FAA mission. Although it was a modest improvement, this change set the groundwork for FAA to implement a more objective and transparent process for projecting staffing requirements and also necessitated development of credible operations forecasts. Since 2014, FAA has made several important improvements to its operations forecast:

- In 2015, FAA began using planned launch and reentry data collected from operators and prospective applicants as the starting point for its launch and reentry forecasts. This change enabled FAA to simplify and improve its forecasting methodology by tying launch and reentry forecasts directly to anticipated operations by commercial space transportation firms known to FAA, rather than to aggregate industry demand.

- Because commercial spaceflight is a highly dynamic and rapidly evolving industry, it was quickly determined that operator-provided data alone were not sufficient to reliably predict future activity. Consequently, a primary pillar of FAA's forecasting methodology is to take a conservative view of industry growth in the near term. Therefore, in 2016, FAA began refining its forecasting methodology by using observations about historical launch activity to establish better forecasting parameters for both new applicants and existing operators.

Based on proprietary information available to FAA, a steady increase in launch and reentry activities is expected in the coming years. There are several factors that magnify the challenges associated with predicting the number of launches and reentries to expect in a given year. They include:

- the list of firms intending to launch or actually launch is dynamic,
- the continued development of new technologies,
- launch rates for reusable launch vehicles,
- space tourism,
- dynamic nature of flight test programs, and
- mishaps.

For example, the number of firms actively communicating with FAA increased from 14 in 2014 to 65 in 2019, an increase of more than 360 percent. New technologies [e.g., reusable launch vehicles (RLVs)] allow a faster operational tempo, and at the same time, early use of these technologies can increase the probability of a mishap. A mishap can drastically impact launch plans for one or more firms. Investigations and subsequent "return to flight" for firms impacted by a mishap can take months to years.

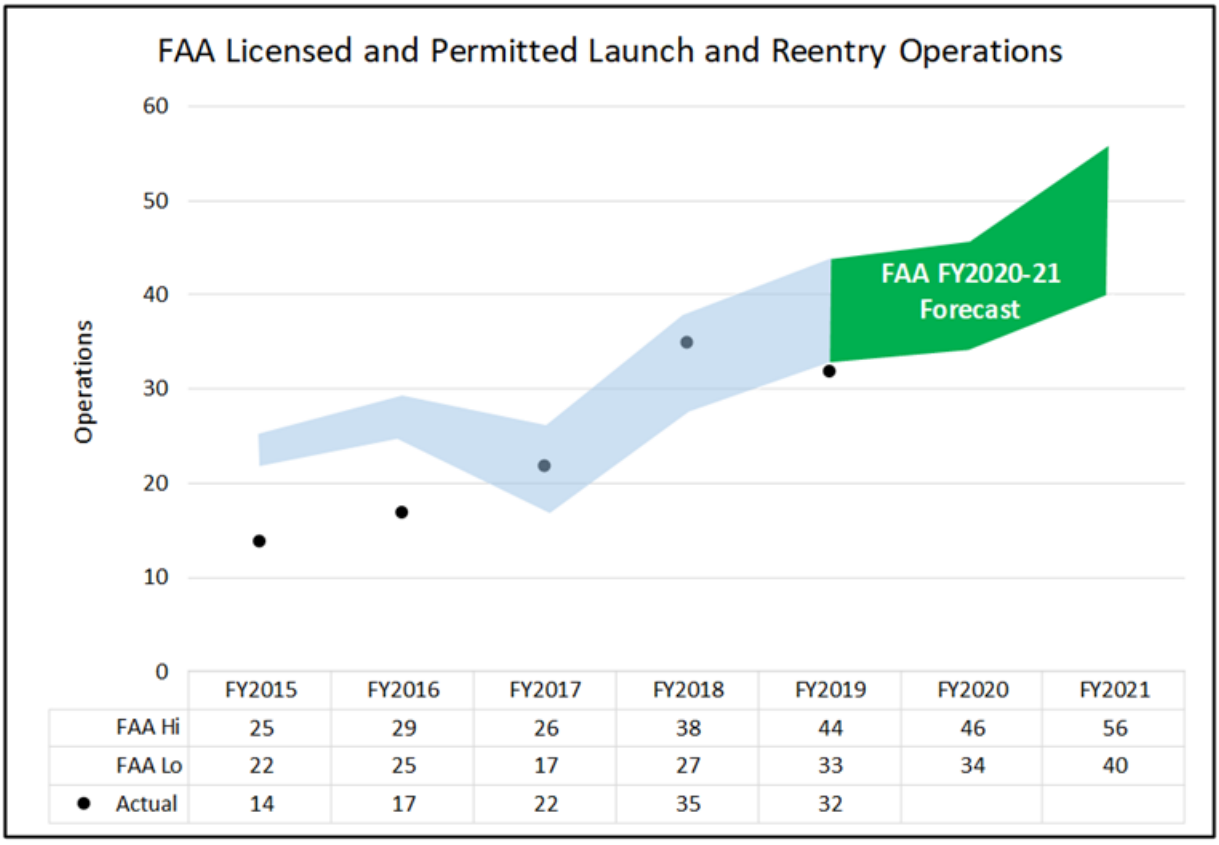
Taking these factors into account, the following table and graph provide industry's forecast through 2022, FAA's forecast through 2021, and historical activity. The commercial space transportation industry continues to evolve and innovate at such a rapid pace that it is currently impractical to generate a credible, conservative forecast beyond the end of fiscal year 2021.

Fiscal Year	*Industry Forecast*	*FAA Forecast*	*Actual*
2015	*37*	*22 – 25*	*14*
2016	*32*	*25 – 29*	*17*
2017	*78*	*17 – 26*	*22*
2018	*87*	*27 – 38*	*35*
2019	*89*	*33 – 44*	*32*
2020	*96*	*34 – 46*	
2021	*168*	*40 – 56*	
2022	*241*		

Notes:

1. FAA forecast entries represent the Low to High estimate.

2. Industry Forecast for 2015 follows COMSTAC methodology from 2014. Industry forecasts for all other years follow the same methodology.



	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021
FAA Hi	25	29	26	38	44	46	56
FAA Lo	22	25	17	27	33	34	40
● Actual	14	17	22	35	32		

Note: FAA FY2020-21 Forecast Range finalized the second quarter of FY2020.

It is important to note all FAA-authorized commercial space operations are included in this forecast, regardless of where they occurred in the world. That is, not all launch and reentry activity occurs at one location, for example, at Cape Canaveral, Florida. In the past year, FAA licensed launches and reentries throughout the National Airspace System (NAS) and beyond, including multiple reentries in the Pacific Ocean and six licensed launches from New Zealand. This forecast, however, does not include launch activity not authorized by the FAA (e.g. U.S. Department of Defense or NASA launches), launch activity for other nations, and this forecast is not tied exclusively to satellite demand.

Additional Factors Affecting Forecast Accuracy

Commercial space transportation is a rapidly evolving industry. The industry's growth through technological innovation and the development of new markets increases the challenges associated with forecasting commercial space transportation operations.

New Commercial Launch Technologies and Operations are Emerging on an Accelerated Basis

The commercial space transportation industry is exploring a variety of new technologies and new approaches to space launch and reentry. In late 2015, both Blue Origin and Space Exploration Technologies Corp. (SpaceX) successfully demonstrated the reusability of their vertically launched rockets,

a development that could significantly reduce the cost of operations and lead to an increase in the number of launch and reentry operations per year. Other U.S. commercial entities are also pursuing the development of reusable launch vehicles (RLVs). At the same time, state and local governments are joining with commercial firms to promote additional launch and reentry sites, and some firms are seeking to establish launch sites for their exclusive use. This added launch capacity sets the stage for simultaneous operations and an increase in the number operations per year.

New Markets for Commercial Space Transportation are Emerging

The continuing development of commercial space transportation technology has spurred new markets for commercial space transportation services. As private industry continues to develop and test new vehicles capable of taking space flight participants on suborbital and orbital flights, companies and organizations are proposing to offer human space flight training and several organizations have already begun to provide this service. States and municipalities have sought to open new spaceports to attract commercial space transportation and associated high-tech firms and create business hubs for research and development. Since 2008, NASA has managed the Commercial Resupply Services (CRS) program, which acquires transportation services from commercial providers to deliver cargo to and from the International Space Station (ISS). NASA is also working with commercial companies under its Commercial Crew Transportation Capabilities contract to develop vehicles that will provide transportation for astronauts and international partners to and from the ISS. Testing of Commercial Crew vehicles developed by SpaceX and Boeing has begun, and crewed operational launches licensed by the FAA may begin in 2020. NASA is also seeking proposals from industry for a program called Commercial Lunar Payload Services. The commercial vehicles used by NASA for cargo and crew transportation will have other commercial applications that increase the capabilities of the commercial space transportation industry as a whole.

Looking further afield, there are several companies in the regulatory pipeline seeking authority to land commercial vehicles on the Moon, establish private-sector space stations, service satellites on-orbit, and establish launch sites using non-traditional technologies like railguns and tube launchers. Extensive FAA resources will be needed to determine how these unprecedented commercial space ventures will impact public safety and U.S. national interests.

Unmanned Aircraft Systems

Over the past few years, unmanned aircraft systems (UAS) have been experiencing healthy growth in the United States and around the world. A UAS consists of an unmanned aircraft platform and its associated elements—including communication links, sensors, software and power supply—that are required for safe and efficient operation in the national airspace system (NAS). While introduction of UAS in the NAS has opened up numerous possibilities, it has brought operational challenges including safe integration into the NAS. Despite these challenges, the UAS sector holds enormous promise; potential uses include modelers experimenting with small UAS (sUAS) performing numerous functions such as aerial photography; recreational flying for personal uses; sUAS experimenting with package delivery on a commercial basis; delivery of medical supplies; and provision of support for search and rescue missions following natural calamities.

This section provides a broad landscape covering recreational and commercial unmanned aircraft[14] and their recent trends as gleaned from trends in registration, questionnaires, overall market, and operational information. Using these trends and insights from industry, the FAA has produced a number of forecasts. Forecasts reported in the sections below are driven primarily by the assumptions of continuing evolution of the regulatory environment, the commercial ingenuity of manufacturers and operators, and underlying. While continuing to enable the thriving UAS industry, these efforts will continue the safe integration of UAS into the NAS.

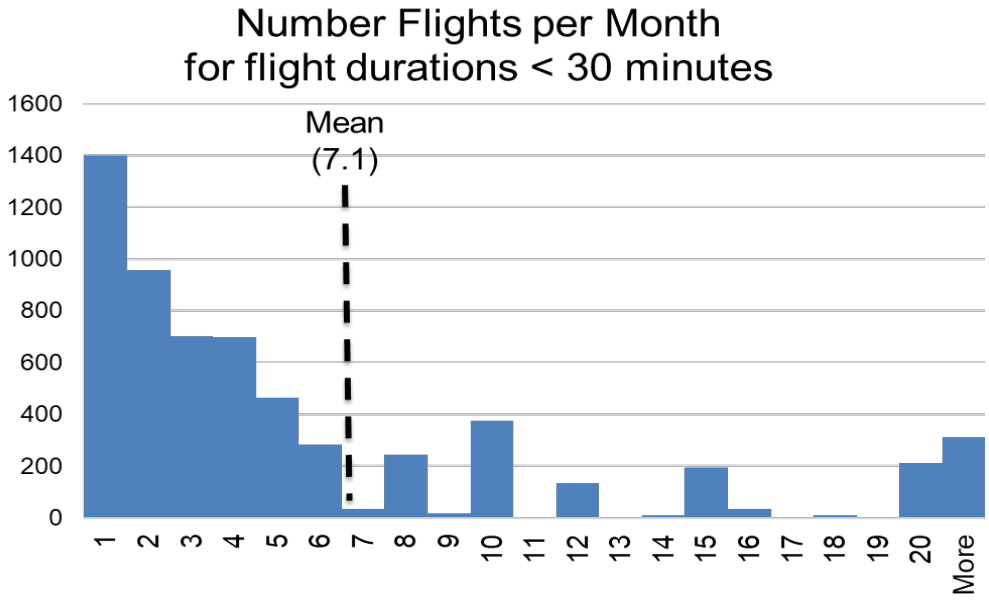
Questionnaire of Recreational/Model Registrations

Before presenting sUAS trends and forecast, this section briefly reviews the results of a proto-type questionnaire for recreational/model sUAS operations conducted during September and October of 2019. The well-tested questionnaire asked individuals registered as recreational sUAS operators under Section 349 about their flight behavior and activities, preferred method of communication from the FAA, and the UAS topics in which they are most interested. The questionnaire was anonymous, voluntary, and

[14] These are also called, interchangeably, hobby and non-hobby UAS, respectively. On October 5, 2018, the President signed the FAA Reauthorization Act of 2018 (Pub. L. 115-254). Section 349 of that Act repealed the Special Rule for Model Aircraft (section 336 of Pub. L. 112-95; Feb. 14, 2012) and replaced it with the new conditions to operate recreational small unmanned aircraft without requirements for FAA certification or operating authority. The Exception for Limited Recreational Operations of Unmanned Aircraft established by section 349 is codified as 49 U.S.C. 44809 [see https://www.federalregister.gov/documents/2019/05/17/2019-10169/exception-for-limited-recreational-operations-of-unmanned-aircraft for more details]. Recreational fliers, under Section 349, are referred to as recreational fliers or modeler community-based organizations in the last authorization [see https://www.faa.gov/uas/recreational_fliers/]. In previous notes including other documents of the Agency, these terms are often interchanged.

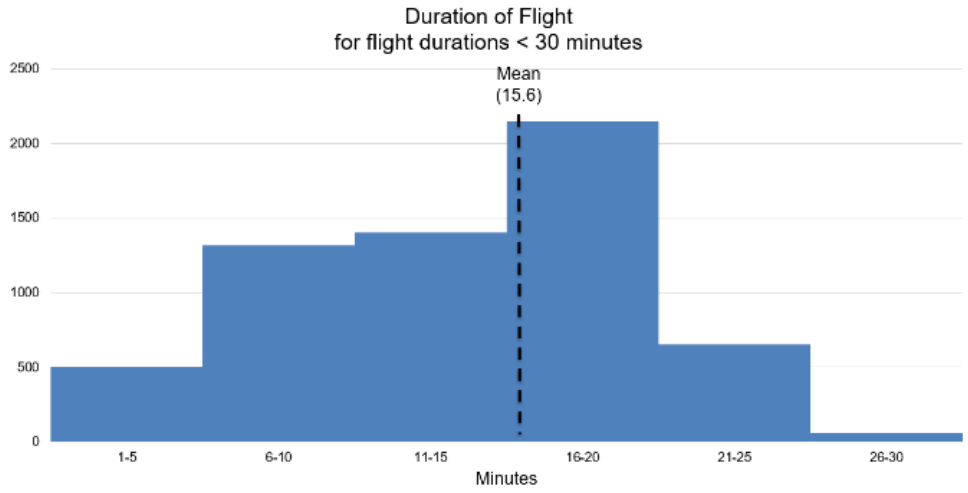
conducted over the internet. Of those registrants contacted to participate in the questionnaire, 15,482 individuals—about 6% of registrants—completed the questionnaire.

Respondents reported that, on average, they fly approximately seven flights per month after adjusting for measurement error.[15] While most respondents fly fewer than seven times per month, there are respondents who fly more often as well, with some reporting as high as 300 flights per month.

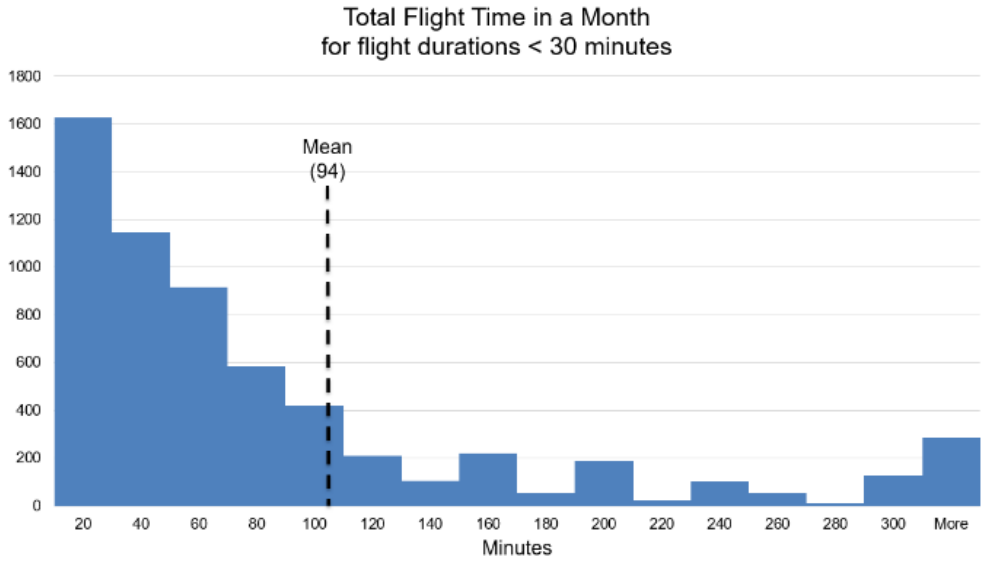


Recreational respondents tend to fly about 16 minutes per flight, on average. After adjusting for measurement error, we observe flight duration normally distributed around the mean of 15.6 minutes [see graph below].[16]

[15] Analysis of responses suggest that individuals who reported flying 30 minutes or more per flight misconstrued the scope of the questions. To reduce the measurement error, respondents with 30 minutes or more of flight time are removed from the sample.



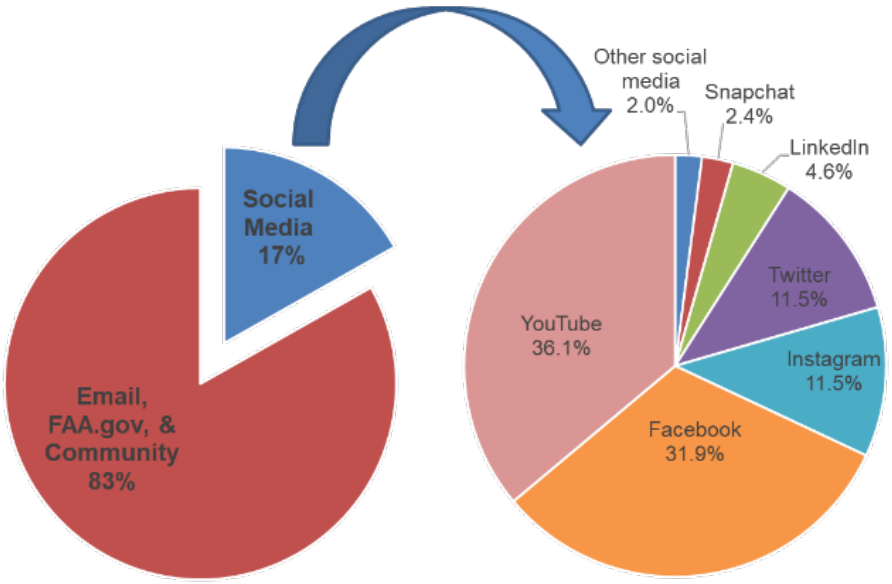
Respondents are estimated to fly, on average, 94 minutes per month [see graph below]. While most of the respondents log less flying time per month, between 20-40 minutes, quite a few respondents tally far more active flying time as well.



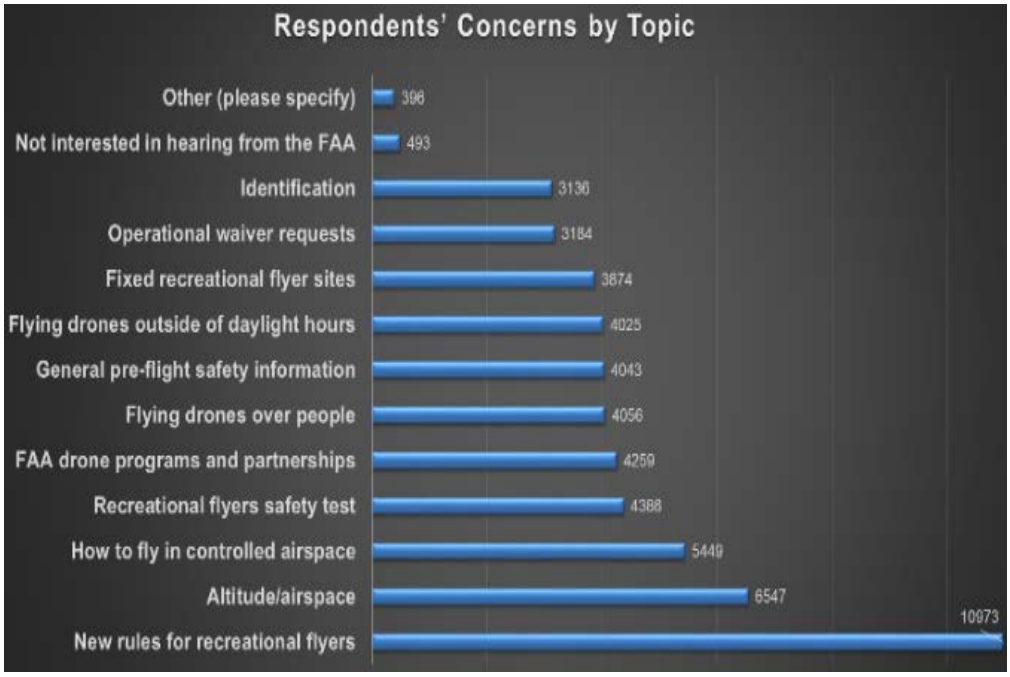
Generalizing the sampled individuals to all registrants, responses suggest that recreational sUAS operators log 1.5 million hours of flight time every month within the United States.

Turning our attention to communication preferences, respondents overwhelmingly receive communication from the FAA by email, with 74% of respondents reporting email among the sources of FAA information. The FAA website was a distant second at 28% of respondents. Only 17% of respondents reported some type of social media, with YouTube and Facebook as the preferred platforms. Only 6% of respondents reported receiving information about the FAA from community organizations. In the write-in section of the questionnaire, 3.4% of respondents reported preferring information by physical mail or mobile devices, either by text or app. The vast majority of respondents,

90%, reported finding information from the FAA helpful.



Overall, respondents were overwhelmingly interested in new rules for recreational flyers (73%). Operating in controlled airspace or in prohibited altitude/airspaces were the next most interesting topics, at 37% and 43% respectively. The remainder of the options garnered interest from 25% respondents, on average. A complete distribution of the responses on topics of their concerns is provided in the chart below.



Trends in Recreational/Model Aircraft and Forecast

FAA's online registration system for recreational/model sUAS went into effect on Dec. 21, 2015. This required all UAS weighing more than 0.55 pounds (250 grams) and fewer than 55 pounds (or 25 kilograms) to be registered using the on-line system (https://www.faa.gov/uas/getting_started/registration/) or the existing (paper-driven) aircraft registry. Following a temporary halt in registration due to an order from the U.S. Court of Appeals in Washington, D.C. in May, 2017, the registration requirement for all model aircraft was reinstated in December, 2017 with the National Defense Authorization Act (NDAA). Despite the temporary halt, registration pace continued beyond May, 2017. On October 5, 2018, the President signed the FAA Reauthorization Act of 2018 that formalized new conditions for recreational use of drones. [See https://www.faa.gov/news/updates/?newsId=91844 for more details].

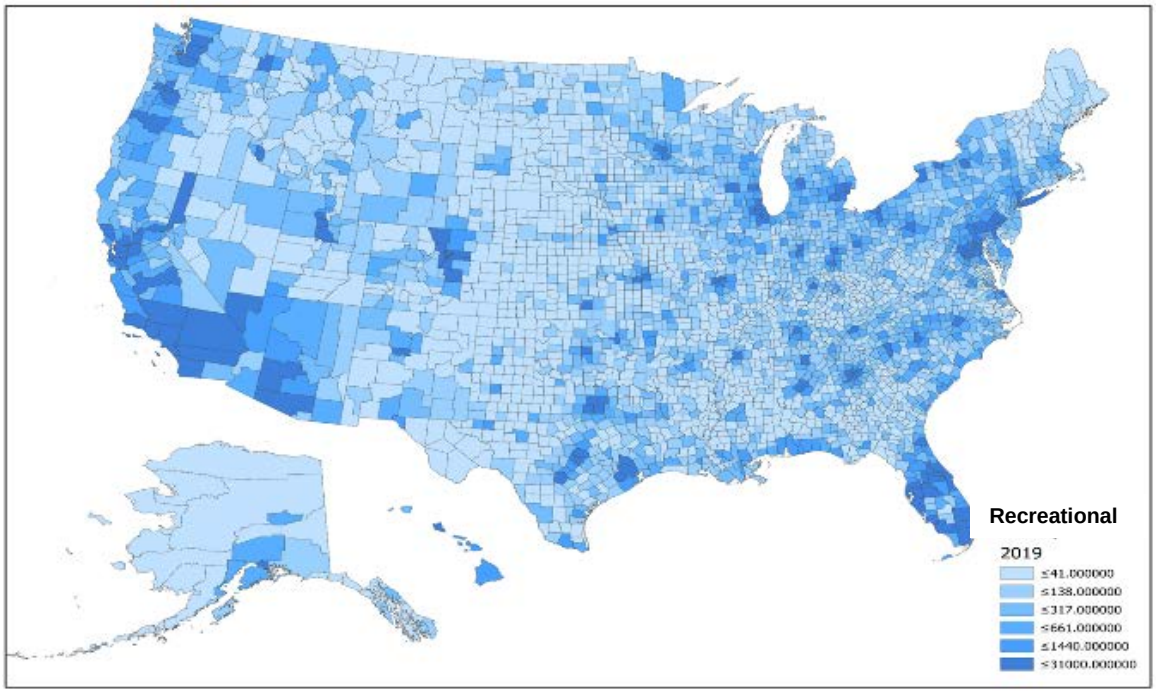
With the continuing registration, almost 990,000 recreational UAS owners had already registered with the FAA by December, 2019.[17] On average, owner registration stood at around 9,000 per month during January-December, 2019 with some expected peaks during the holiday seasons and summer.

[17] For our estimate and projections using registration database, applying to recreational, non-model or commercial and remote pilots, we use only those who are registered in the U.S. and the territories. Furthermore, we only use those registrants who are "active"; those whose registrations have been canceled or withdrawn are not part of the data we report in this document.

The pace of registration seems to have stabilized compared to last year in the same period; monthly owner registration during 2019 stands at around the same level as in 2018.

Recreational registration, and thus ownership of sUAS, is distributed throughout the country. Using the data as available in December 2019, a spatial distribution of ownership at a county level below demonstrates that sUAS continue to be distributed throughout the country with denser ownership mapping closely against the population centers of the country, as expected.[18]

[18] Registration data contains location of registrant by zip code. Registrants are mapped to counties by their reported zip code.



At present, the recreational ownership registration does not correspond one-to-one with aircraft in the system, the primary focus of the Agency. Unlike their commercial non-model counterparts, the registration rules for recreational operators do not require owners of recreational UAS to register each individual aircraft; only operators are registered. For each registration, therefore, one or more aircraft are possibly owned, with a few exceptions for no equipment ownership as well. Notwithstanding these challenges, there is

information available, both from industry and academia, allowing us to understand aircraft ownership. Furthermore, under the sponsorship of the UAS Integration Research Plan, the Agency has launched various research activities to understand the possible magnitude of the sector as well as implications on likely aircraft that may be used for recreational flying and safety implications of the UAS fleet from gradual integration into the NAS. Finally, the Agency has engaged outside consults to aid forecasting efforts for both the recreational and commercial UAS fleet in this past year as well. We use all these resources to analyze and forecast both UAS types' activities in the U.S.

With around 990,000 recreational operators registered as of December 31, 2019, we estimate that there are around 1.32 million fleet distinctly identified as recreational aircraft. Comparing with industry sales and otherdata noted above, we conclude that recreational

aircraft is almost 34% higher than ownership registration[19].

A comparison of last year's data (2018) with this year's (2019) shows the annual growth rate to be approximately 6.4%. Such a growth rate is expected due to the introduction of drones as a recreational UAS, which is facilitated by falling equipment prices, improved technology such as built-in cameras and higher capability sensors, and relatively easy maneuvering. However, similar to all technologies including hobby items, (e.g., cell phones and video game consoles; and prior to that, video cameras, and video players), the trend in recreational UAS has been slowing and is likely to slow down further as the pace of falling prices diminishes and the early adopters begin to experience limits in their experiments, or as eagerness plateaus.

Given the trend in registration and market developments, we forecast that the recreational UAS market will saturate at around 1.5 million units. However, there is still some upside uncertainty due to further changes in technology including battery, facilitating regulatory environment, and the likely event of continued falling prices. This yields to some larger upside uncertainty in the forecast. In contrast, there is relatively less low-side uncertainty. Hence, we provide a forecast base (i.e., likely) with high and low scenarios, provided in the table below.

	Total Recreation/Model Fleet (Million sUAS Units)		
year	Low	Base	High
2019	1.32	1.32	1.32
2020	1.36	1.38	1.42
2021	1.37	1.42	1.49
2022	1.38	1.45	1.54
2023	1.39	1.47	1.57
2024	1.39	1.48	1.59

Last year, we forecasted that the recreational UAS sector would have around 1.314 million sUAS in 2019, a growth rate exceeding 5.5% from the year before (2018). Actual data

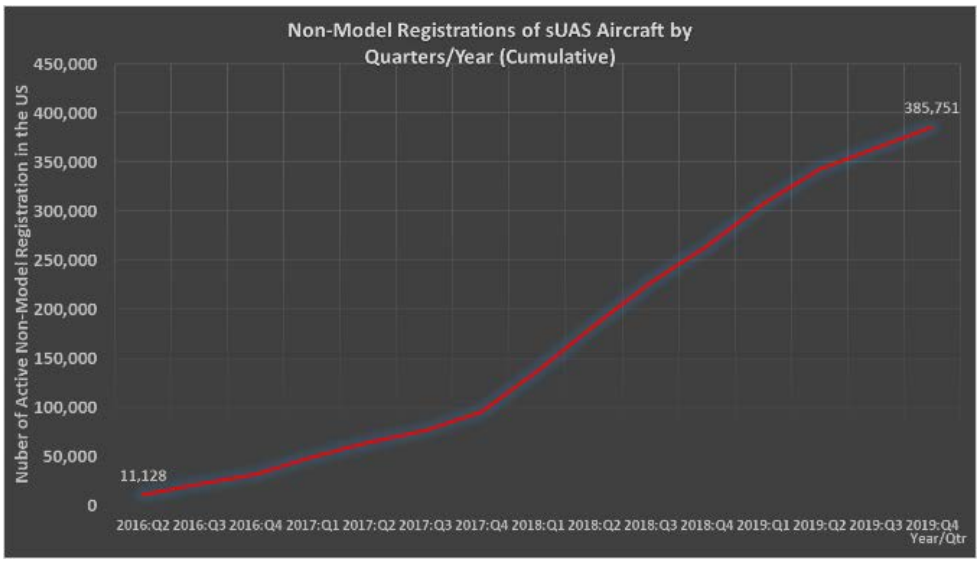
[19] This calculation involves taking into account retirement, redundancy, and loss of craft corresponding to ownership registration. As craft becomes sturdier and operators situationally aware, we expect this rate to change dynamically over time. Furthermore, with FAA regulations increasingly encouraging recreational drones to be registered, as opposed to ownership, registration would soon come to represent equipment like commercial counterpart.

came close to that projection with over 1.324 million aircraft already by the end of 2019. Thus, our forecast of recreational sUAS last year undershot by less than 1% (or, -0.78%) for 2019 (or 1.324 million actual aircraft vs 1.314 million aircraft that we projected last year).

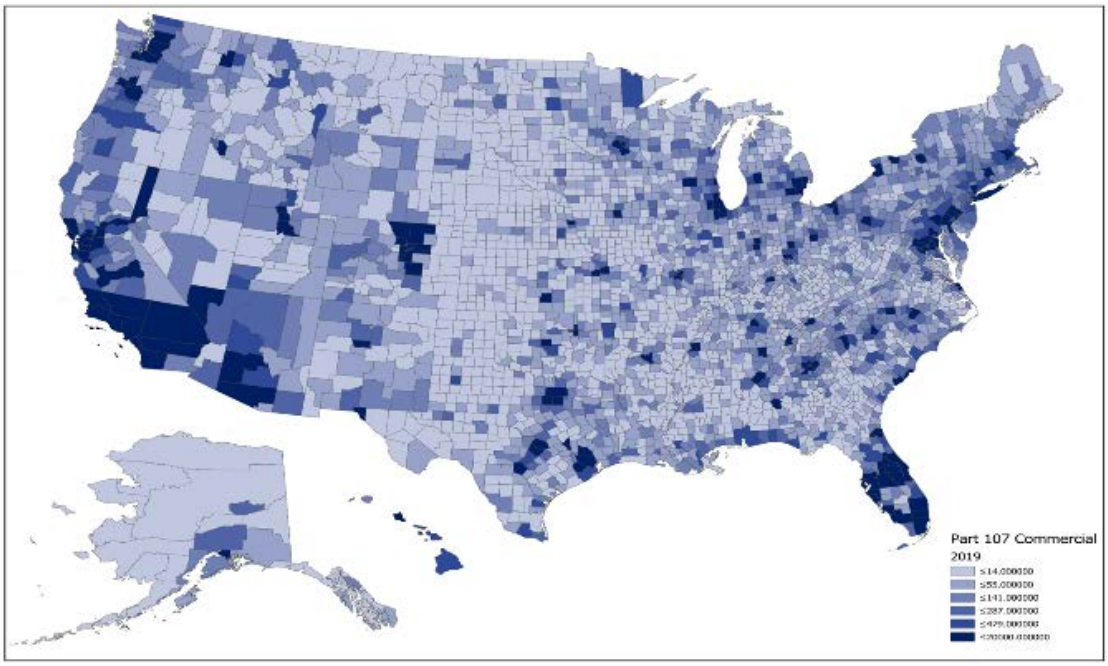
The FAA uses the trend observed in registrations, particularly over the past year; expert opinions collected in TRB annual workshops; review of available industry forecast; market/industry research; and a time-series model on registration trends fitted on monthly data. Using these, we forecast that the recreational UAS fleet will likely (i.e., base scenario) attain its peak over the next 5 years, from the present 1.32 million units to around 1.48 million units by 2024. The high scenario may reach as high as 1.59 million units with low-side scenario yielding around 1.39 million units over the next 5 years. As evident, the growth rates underlying these numbers are fairly steady in the initial years, but fade faster in the last 2-3 years. The gradual saturation that is projected in 5 years and beyond in the recreational UAS fleet parallels other consumer technology products and the Agency's projections from last year.

Trends in Commercial/Non-Model Aircraft and Forecast

Online registration for part 107 or commercial sUAS went into effect on April 1, 2016. Unlike recreational/model ownership, rules for commercial registration require owners to register each sUAS, thus creating a one-to-one correspondence between registration and aircraft. During the period of January-December, 2019, more than 108,000 commercial operators registered their equipment. The pace of monthly registration, slightly above 10,000, is still relatively high but lower than the same period in 2018. It appears that the pace of registration is slowing down in comparison to 2018, but it is still over 2.5 times higher than the pace at which commercial UAS owners registered their craft during the earlier period (i.e., April 2016 – November 2017). While the pace of recreational registration ownership has slowed down considerably, the pace of registration remains accelerated for their commercial counterparts. By the end of 2019, there were more than 385,000 commercial UAS registered since the registration opened.



For each month the registration has been available, over 4,600 aircraft/month were registered until November, 2017. This pace accelerated to 14,600 registered per month during 2018. This past year (2019), average monthly registration stood at around 10,100. The commercial UAS sector is dynamic and appears to be at an inflexion point, demonstrating powerful stages of growth. Unlike the recreational UAS sector, the FAA anticipates that the growth rate in this sector will remain high over the next few years. This is primarily driven by the clarity that part 107 has provided to the industry; e.g., proposed new rule changes. [See https://www.federalregister.gov/documents/2019/02/13/2019-00732/operation-of-small-unmanned-aircraft-systems-over-people for operations over people and at night without waivers and remote identification https://www.federalregister.gov/documents/2019/12/31/2019-28100/remote-identification-of-unmanned-aircraft-systems for remote identification NPRM]. Furthermore, given the possibilities for waivers, including enhancement of operational efficiencies under increasingly well-defined concepts of operations (CONOPS) — which ensures safety and transparent information flow across the community — more and more commercial uses will become likely, fueling even further growth. Notably, one such place for receiving all operational information, including registration, authorization, and logging accident reports, helps facilitate this growth further [https://faadronezone.faa.gov/#/].



As in the case of recreational UAS ownership, commercial sUAS are distributed across the country. A spatial distribution of equipment registration, using data for December 2019, demonstrates that commercial sUAS are distributed throughout the country with denser activities mapping closely against the economic or commercial activities of the country.

Last year, the FAA forecasted that the commercial UAS sector would have around 400,000 sUAS in 2019, a growth rate exceeding 44% over the year before (2018). Actual data came close to that projection with over 385,000 aircraft already registered by the end of 2019. Our forecast of commercial sUAS last year thus overshot by 4% for 2019 (or 385,450 actual aircraft vs 400,455 projected last year). Forecasting in a time of such monumental transition is indeed challenging, and the commercial UAS sector's fast growth is a demonstration of that fact. Nevertheless, our forecast errors for both recreation and commercial appear to be within the bounds of reasonableness.

	Total non-Model Fleet		
	(no. of '000 units)		
year	Low	Base	High
2019	385	385	385
2020	467	507	594
2021	535	633	830
2022	567	731	1031
2023	586	786	1136
2024	598	828	1197

Given the trend observed in the registrations, information from survey conducted in 2018, review of available industry forecasts/workshop and UAS Symposium, and internal research together with market/industry research, the FAA forecasts that the commercial UAS fleet by 2024 will likely (i.e., base scenario) be more than twice as large as the current number of commercial UAS[20]. As the present base (i.e., the cumulative total) increases, the FAA anticipates the growth rate of the sector will slow down over time. Nevertheless, the sector will be much larger than what was understood only a few years ago. Given the accelerated registration over the last year, the FAA now projects the commercial sUAS sector will have around 828,000 aircraft in 2024, the end of the 5-year period.

In order to understand the growth trajectory of the sector better, this report divides the commercial UAS sector into two types of sUAS aircraft: consumer grade and professional grade. The consumer grade commercial sUAS have a wide range of prices, below US $10,000 with an average unit price of approximately $2,500. The professional grade is typically priced above US $10,000 with an average unit price assumed to be around $25,000[21]. For both consumer grade and professional grade UAS, the average price is falling over time, particularly over the last few years. Currently, the consumer grade dominates the commercial UAS sector with a market share approaching 94%. However, as the sector matures and the industry begins to consolidate, the share of consumer grade commercial UAS is likely to decline, though it will still be dominant. By 2024, FAA projects this sub-sector will have approximately 85% of the overall commercial sUAS sector.

Starting from a low base of approximately 25,000 aircraft in 2019, the professional

[20] Last year, the ratio of end-year of forecast to base year forecast was 3-times; i.e., we forecasted end-year to be 3 times the base year's (2018) numbers in 5-year.

[21] Because of this wide range in prices between types of sUAS in commercial activities, start-up cost for a business may vary somewhere between $2,500 and $25,000.

grade commercial sUAS sub-sector stands to expand rapidly over time, especially as newer and more sophisticated uses are identified, designed, and operationally planned and flown. If, for example, professional grade sUAS meet feasibility criteria of operations, safety, regulations, and satisfy economics and business principles and enters into the logistics chain via small package delivery, the growth in this sector will likely be phenomenal. This growth trajectory could be even further enhanced by expanding operations, e.g., the Low Altitude Authorization and Notification Capability (LAANC) system[22], which began authorization in May, 2018. LAANC is designed to allow considerable flexibility in sUAS operations and to facilitate sUAS use of the NAS. While most of the near-term growth in commercial sUAS will continue to come from consumer grade units (over 90%), the FAA anticipates a significant part will come from professional grade sUAS as well.

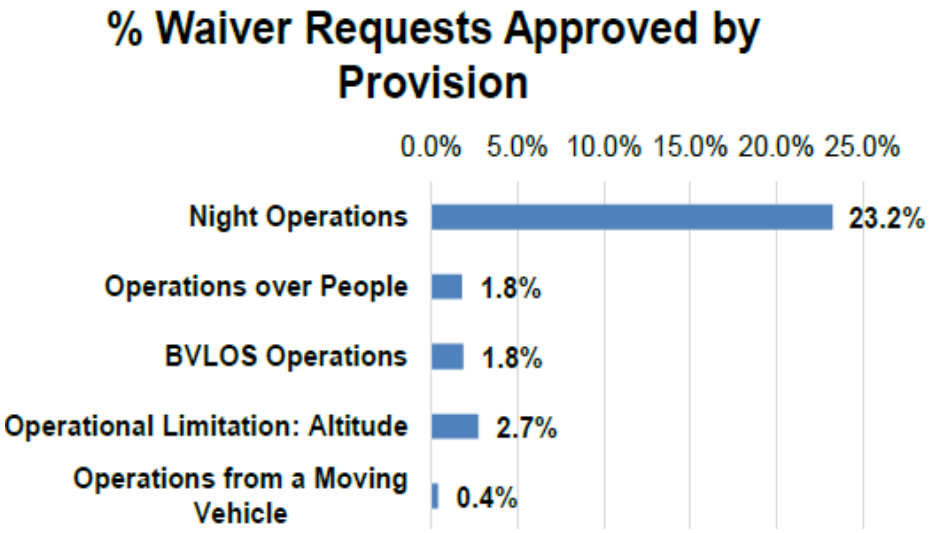
Unlike its recreational UAS counterpart, it is extremely difficult to put a floor on the growth of the commercial UAS sector due to its composition (i.e., consumer vs professional grades) and the varying business opportunities and growth paths. As commercial UAS become operationally more efficient and safe, battery life expands, and regulatory constraints are gradually relaxed, new business models will begin to develop, thus enhancing robust supply-side responses. These responses, in turn, will pull demand forces (e.g., consumer responses to receiving commercial packages; routine blood delivery to hospitals, search-and-rescue operations, just to name a few) that are somewhat latent and in the experimental stage at present. Unlike a developed sector such as passenger air transportation, it is impossible to put a marker on "intrinsic demand" (or core demand), primarily driven by economic and demographic factors underlying this sector. Nevertheless, in this year's forecast the FAA makes a provisional attempt to provide a low side for now, essentially capturing the intrinsic demand. In addition, we provide the likely or base scenario together with the enormous potential embodied in the high scenarios, representing cumulative annual growth rates of 17% and 35%, respectively. Average annual growth rate corresponding to the low scenario, on the other hand, is around 9%.

Commercial sUAS are presently used for numerous purposes. As the sector grows, the FAA anticipates there will be many more uses for and much more use of commercial sUAS as is increasingly evident, for example, from the participants' activities under the Integration Pilot Program (IPP). FAA awarded 10 communities, among a pool of 149 applicants, [https://www.faa.gov/uas/pro-

[22] Low Altitude Authorization and Notification Capability [https://www.faa.gov/uas/programs_partnerships/uas_data_exchange/] or LAANC automated the application/approval process for airspace authorizations. Requests submitted via FAA approved UAS Service Suppliers (USS) are checked against airspace data in the FAA UAS Data Exchange such as temporary flight restrictions, Notice to Airmen (NOTAMS), and the UAS Facility Maps (UASFM). Approved requests thus provide the FAA/ATO visibility into where and when planned drone operations will take place.

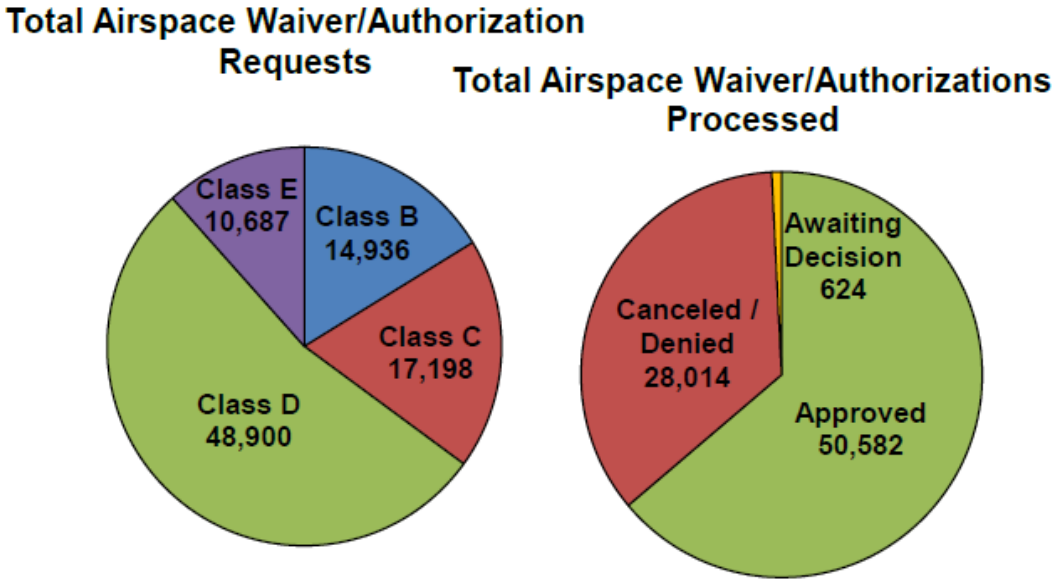
grams_partnerships/integration_pilot_program/lead_participants/] membership in the IPP in May, 2018. IPP applications and preliminary data indicate that awardees overwhelmingly pursuing numerous private business and public interest activities.

One way of identifying early trends in commercial sUAS use is to analyze the waiver applications granted to sUAS operators. Both the magnitude and relative composition of waiver types may indicate the direction of the commercial sUAS sector as a whole. A breakdown of the waiver requests granted in December, 2019 is shown in the chart below

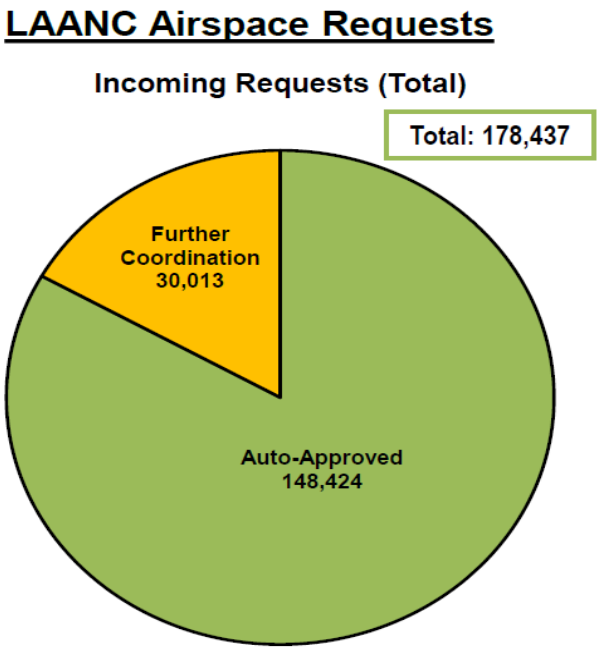


Beyond the daytime operation that is presently allowed under existing part 107 rules, expanding applications further requires waivers, to a large extent, for night operations as distinct from daylight operations (over 1 in 5 waivers); there are also limitations on altitude, for which waiver requests are made at a rate of 2.7%. Many of these waivers are combined, and thus total waivers (i.e., full + partial) granted (over 3,500 in December 2019) exceed 100%. The Agency issues these waivers to facilitate business activities by sUAS while preparing for the next round of regulations that will routinely allow the present waiver requirements. [See https://www.federalregister.gov/documents/2019/02/13/2019-00732/operation-of-small-unmanned-aircraft-systems-over-people for current NPRM on operations of small unmanned aircraft over people in certain conditions, and operations of small UAS at night without obtaining a waiver]. Analysis of these waiver applications allows us to understand the industry trends, one of many metrics essential for understanding and projecting the trajectory, course corrections, and growth trends of the sector.

Almost 50% of airspace authorizations and waivers were approved for the controlled airspaces at the end of December, 2019. While over half were for class D airspace (i.e., smaller airports with control towers), other classes were also requested and regularly flown.



Finally, LAANC has been routinely providing auto-approval since its inception in May, 2018, and covers all airports presently. It has provided, so far, over 148,000 auto-approvals for airspace access requests [see below]; over 100,000 more since this time last year, while sending over 30,000 for further coordination (an increase of over 23,000 from last year). LAANC authorizations are facilitated by the use of UAS facility maps (UASFM) [https://faa.maps.arcgis.com/apps/webappviewer/index.html?id=9c2e4406710048e19806ebf6a06754ad] that provide maximum allowed altitudes around airports where the FAA may authorize part 107 UAS operations without additional safety analysis. The UAS facility maps are used to inform requests for part 107 airspace authorizations and waivers in controlled airspace.



Remote Pilot Forecast

An important final metric in commercial sUAS is the trend in remote pilot (RP) certifications. RPs are used primarily to facilitate commercial sUAS flights. As of December 2019, 162,185 RP certifications have been issued[23].

Part 107 RP certifications require completing a multi-step process beginning with obtaining an FAA tracking number via the creation of an Integrated Airman Certification and Rating Application (IACRA) profile prior to registering for a knowledge test. Following this initial step, scheduling and passing the initial aeronautical knowledge test at a Knowledge Testing Center is required. Provided that one has passed this test, the applicant is required to fill out FAA Form 8710-13 in IACRA. A confirmation email is sent when an applicant has completed the necessary TSA security background check. This email contains instructions for printing a copy of the temporary remote pilot certificate from IACRA. A permanent remote pilot certificate is sent via mail once all other FAA-internal processing is complete. An RP certificate is valid for two years and certificate holders must pass a recurrent knowledge test every two years at a Knowledge Testing Center. It is required that RPs carry their certificate whenever flying a sUAS.

Certifications for part 61 operators, on the other hand, require that an applicant must hold a pilot certificate issued under 14 CFR part 61, and must have completed a flight review within the previous 24 months. Since

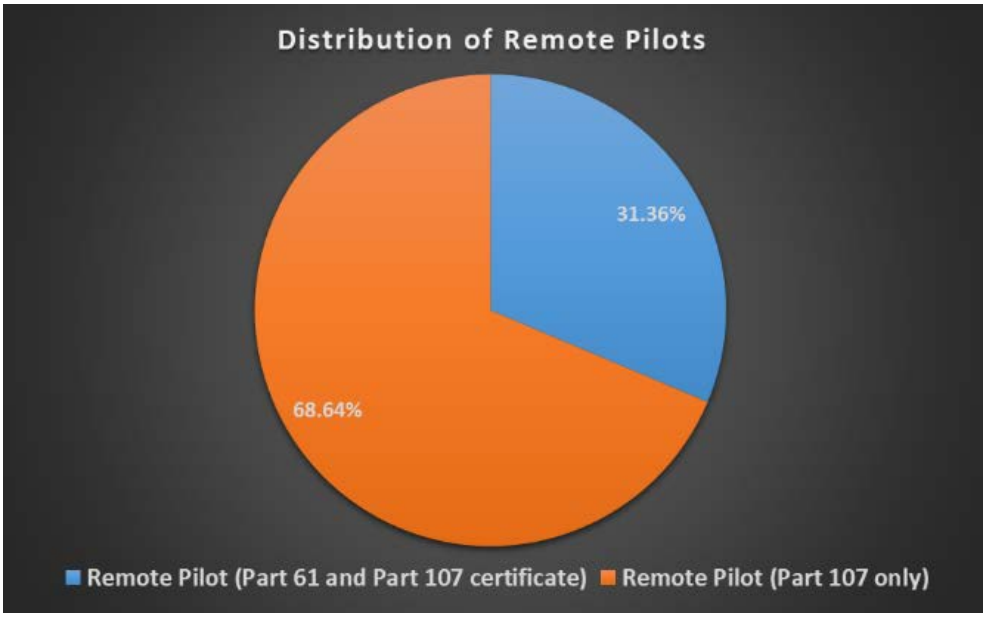
[23] In our accounting of RPs, we take pilots who passed the initial knowledge test (or part 107) plus current manned pilots who took online training in lieu of the knowledge test (or part 61).

Part 61 airmen already have IACRA profiles established, they are required to complete, like part 107 operators, FAA Form 8710-13 in IACRA. Upon completion of this form, proof of current flight review, and proof of online course completion, part 61 operators are required to meet with FAA representatives at the FAA Flight Standards District Office (FSDO), or with an FAA-designated pilot examiner (DPE), or an airman certification representative (ACR) or an FAA-certificated flight instructor (CFI) who issues the RP certificate to the part 61 operator. Like their part 107 counterparts, certificates for part 61 operators are valid for 2 years and require renewal. [See https://www.faa.gov/uas/commercial_operators/become_a_drone_pilot/ for more details].

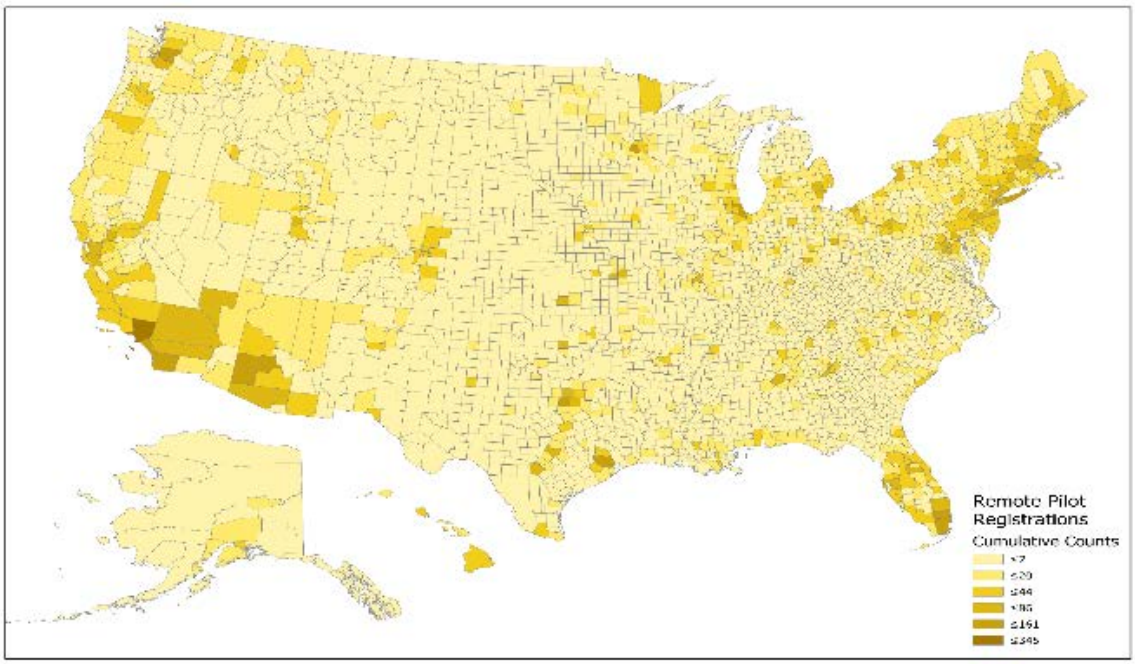
Following the process above, the FAA classifies RPs into two categories:

- those who do not hold any pilot certificate other than the part 107, or Remote Pilot only; and
- those who hold a part 61 certificate and a part 107 certificate, or part 61 and Remote Pilot.

The chart below provides a distribution of these two types of RPs who presently have certificates.



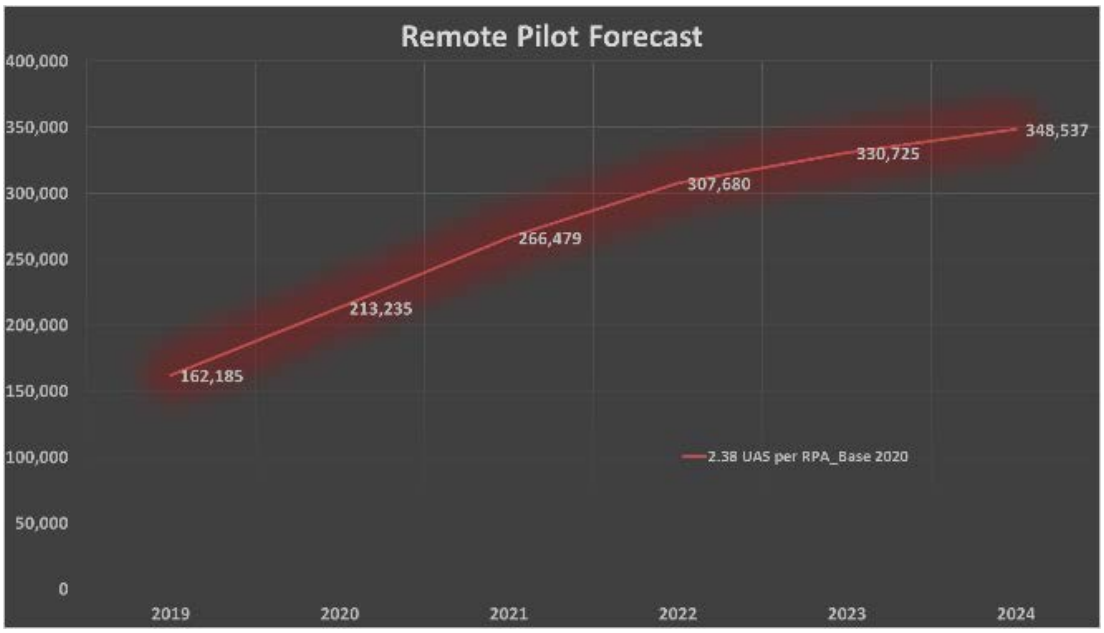
Over 2/3 of the RPs are part 107 RPs only. Over 90% of those who took the exam passed and obtained RP certification. A cumulative density distribution of remote pilots at a county level is provided in the map below.[24]



The RP forecast presented below are based on three primary data sources: (a) trends in total RPs; (b) renewal trends; and (c) trends in commercial sUAS registration and forecast of fleet. Given the trends in registration and our forecast of the commercial UAS fleet, the FAA assumes that one RP is likely to handle 2.38 units of commercial sUAS.

Using these assumptions and combined with the base scenario of commercial sUAS forecast, the FAA project RPs in the graph below. Last year, the FAA projected RPs to be around 167,500 by the end of 2019; which fell short by 5,000.

[24] Remote pilot data contains location by zip code. Remote pilots are mapped to counties by their reported zip code.



Given the actual numbers at the end of 2019, the FAA made the adjustments to RPs per commercial sUAS (2.38), thus lowering it slightly from last year's, 2.4. Despite this adjustment, RPs are set to experience tremendous growth following the growth trends of the commercial sUAS sector. Starting from the base of 162,185 RPs in 2019, commercial activities may require almost 350,000 RPs in 5 years, more than two-fold increase, providing tremendous opportunities for growth in employment associated with commercial activities of UAS. Potential for RPs may enhance even more if larger UAS are used in commercial activities and urban air mobility become a reality in the near future.

Larger UAS

According to FAA rules, UAS weighing 55 pounds or greater must be registered using the existing aircraft registration process (see https://faadronezone.faa.gov/#/). At present, many of these aircraft fly within the NAS by federal agencies including the Departments of Defense (DoD), Homeland Security (DHS), Interior (DOI), Energy (DOE), and Agriculture, as well as NASA, state governments, local governments, and academia. In order to calculate larger UAS (lUAS) in the NAS, we employ multitudes of data from various sources: the Certificate of Authorization (COA) Online system and its successor CAPS or COA Application Processing System; MITRE's Threaded Track infusing data from different sources (see https://www.mitre.org/publications/technical-papers/threaded-track-geospatial-data-fusion-for-aircraft-flight-trajectories); FAA's Performance Data Analysis and Reporting Systems or PDARS (see https://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/systemops/perf_analysis/perf_tools/ for more details); and Notices to Airmen (NOTAM) (See https://notams.aim.faa.gov/#Applications).

Combining these data sources, MITRE estimates 206 lUAS operation in the NAS in 2019. This is a 20% increase from the 172 lUAS operating in 2018. Most of the lUAS introduced in 2019 are operated by government agencies, with the DoD claiming the

bulk of the aircraft. Military lUAS have begun to increase after several years of declining operates in the NAS, suggesting the military fleet is expanding. The other source of lUAS growth is from the increased use of lUAS in commercial applications. Most of the commercial lUAS are operated in public-private partnerships, but these pilot programs are paving the way to widespread commercial use of lUAS in the future.

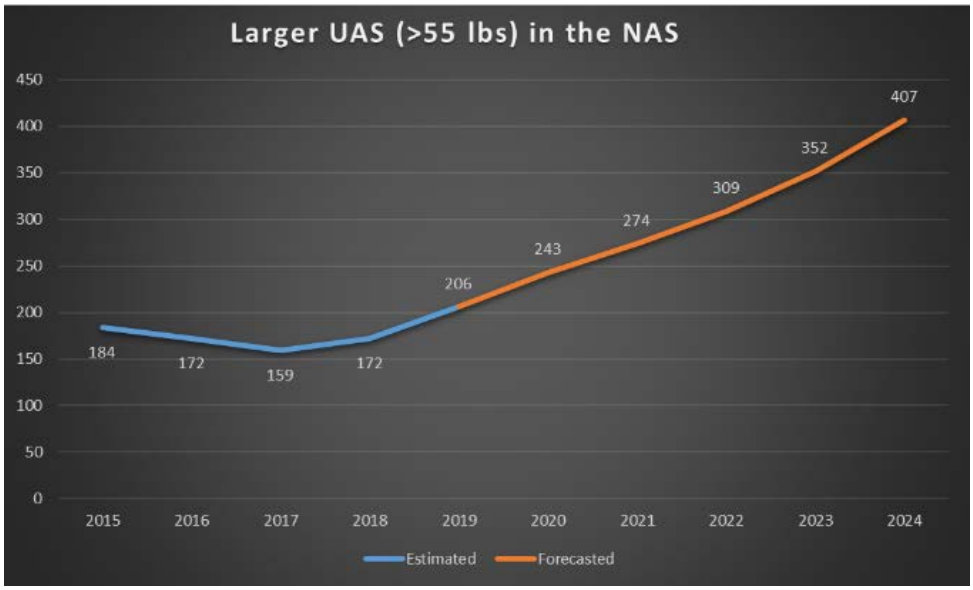
Since lUAS cannot operate under part 107, commercial operators must obtain an exemption under section 44807 [see https://www.faa.gov/uas/advanced_operations/section_333/how_to_file_a_petition/ for more details]. With the exemption, commercial operators are allowed to register their lUAS as aircraft under part 47 and operate them under part 91. As such, the number of exemptions granted for UAS larger than 55 lbs is the lower bound for the number of commercial lUAS in operation. In 2017, five new exemptions for lUAS were granted while six new lUAS were registered under part 47, and 22 new exemptions were issued with 22 lUAS added to the register in the following year. As such, the increase in the number of exemptions heralds an increase in the number of lUAS operating in the NAS.

Exempts are expected to increase over the next couple of years. In 2019, 19 companies were issued new FAA exemptions for commercial lUAS, the majority for agricultural purposes. For 2020, seven companies with federal-agency sponsorship are expected to seek exemptions for lUAS as well as several other non-sponsored companies. This suggests an upward trend in the number of exemption and hints at increasing demand for commercial lUAS.

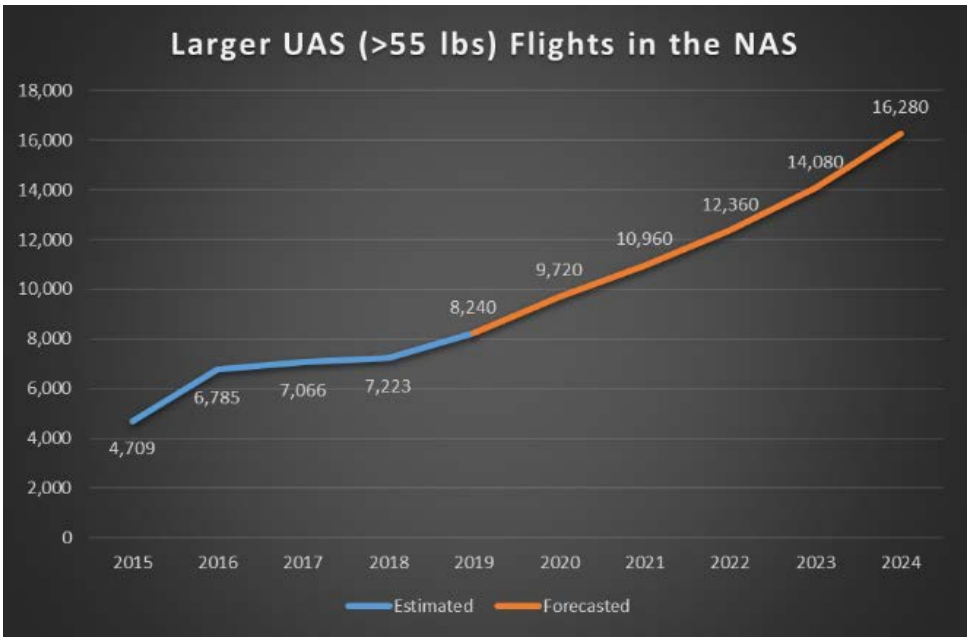
Larger UAS (>55 lbs) forecast in the NAS			
Year	Exemptions	Larger UAS	No. of Flights
2015	0	184	4,709
2016	0	172	6,785
2017	5	159	7,066
2018	22	172	7,223
2019	19	206	8,240
2020	21	243	9,720
2021	25	274	10,960
2022	34	309	12,360
2023	48	352	14,080
2024	67	407	16,280

Combining the baseline growth from the military and civilian agencies and projections of commercial exemptions under 44807, lUAS are expected to increase by 37 aircraft in 2020 due to more commercial applications and an expansion of military and civilian aircraft. As commercial use accelerates and military investment stabilizes over the next half decade, lUAS are projected to increase to 407 aircraft by 2024. However, the sunset of Section 44807 in September, 2023 could

drastically flatten and reduce number of lUAS after 2024 if an alternative is unavailable.



Correspondingly, the number of lUAS flights is expected to increase from the estimated 7,360 in 2019 to 16,280 by 2024, but a considerable number of the additional flights are likely for agricultural applications, operating well below controlled airspace.



Urban Air Mobility

In Sept 2017, NASA launched a study to assess the segment of autonomous vehicles broadly called Urban Air Mobility (or UAM). UAM is defined as “a safe and efficient system for air passenger and cargo transportation within an urban area, inclusive of small

package delivery and other urban Unmanned Aircraft Systems (UAS) services, which supports a mix of onboard/ground-piloted and increasingly autonomous operations." (See https://www.nasa.gov/aero/nasa-embraces-urban-air-mobility) UAM technology presents considerable opportunity for economic growth over the coming decades. Markets for UAM services, such as delivering packages by drone or large cargo or unmanned passenger shuttles, have a huge potential both in the United States and globally. However, UAM services are likely to face stiff competition from technological advances in industries with close substitutes, such as ground transportation. In addition, the high costs of urban infrastructure to facilitate these activities could slow down UAM adoption.

Package or larger cargo delivery, on the other hand, is the UAM service that is most likely to see economic growth in the next decade. By 2030 "last mile package delivery" could be profitable at a price point of $4.20 per delivery and may result in around 500 million deliveries annually with a fleet of 40,000.[25]

Airport shuttles and other fixed-route passenger services are the UAM passenger services most likely to gain economic traction in the coming decade. Under some assumptions, a highly-automated "air metro" could be profitable by 2028 and by 2030, it may result in 750 million annual passenger trips in 15 metro areas or 137 thousand passenger trips/day/area. Under more conservative assumptions, UAM market may yield $2.5 billion in passenger transport market revenue with around 8.2 thousand passenger trips/day/area. While air ambulance model may not be profitable, it may have high impact on public good [see https://www.nasa.gov/uam-studies-reports/].

Some others estimate the UAM passenger industry to have 23,000 aircraft with 740 million enplanements per year at a price of around $30 per trip by 2030.[26] However, other studies have reported more conservative estimates, arguing the market penetration is likely limited to a handful of major metropolitan areas where geography and economic conditions are conducive to UAM market development. As such, estimates by KMPG only predict 60.4 million enplanements by 2030 and a much smaller industry size.[27] Similarly, Roland Berger estimates a fleet of only 12,000 passenger UAS by 2030.[28] However, given the current safety, technology, and urban environment challenges, even these projections may likely to be somewhat optimistic within the timeframe.

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[25] Urban Air Mobility (UAM) Market Study, Nov. 2018, NASA. (See https://www.nasa.gov/uamgc).

[26] Urban Air Mobility (UAM) Market Study, Nov. 2018, NASA. (See https://www.nasa.gov/uamgc).

[27] Getting Mobility Off the Ground, 2019, KPMG. (See https://institutes.kpmg.us/manufacturing-institute/articles/2019/getting-mobility-off-the-ground.html).

[28] Urban Air Mobility: The rise of a new mode of transportation, Nov. 2018, Roland Berger. (See https://www.rolandberger.com/en/Publications/Passenger-drones-ready-for-take-off.html).

Passenger services promise larger markets for UAM services, but safety realities and technology may limit UAM's wide penetration into the passenger-services market. On the other hand, the UAM passenger industry is likely to be conspicuous due to an inflow of venture capital and experimental services exploring market potentials.

As the sector grows and new initiatives are undertaken, the Agency is keeping a keen eye on understanding the exploratory trajectory and growth trends in UAM. As more information becomes available, the FAA will likely provide emerging trends and forecast in the near future.

Forecast Uncertainties

The forecasts in this document are forecasts of aviation demand, driven by models built on forecasts of economic activity. There are many assumptions in both the economic forecasts and in the FAA models that could affect the degree to which these forecasts are realized. This year's forecast is driven, at least in the short-term, by a number of factors including the strength of the U.S. and global economies. Shifting international dynamics and impacts resulting from the U.S. administration's economic policies could drive further changes. Also, as numerous incidents in the past few years remind us, terrorism remains among the greatest worldwide risks to aviation growth. Any terrorist incident aimed at aviation could have an immediate and significant impact on the demand for aviation services that could be greater than its impact on overall economic activity.

The rapid spread of the novel coronavirus (COVID-19) that began in early 2020 now presents a new risk without clear historical precedent. Although the FAA forecast is a long-term trend forecast and does not focus on short-term perturbations, the great uncertainty surrounding the impact of the virus leaves open the possibility that it could affect values for 2020 and 2021. This uncertainty arises from not being able to assess the spread or intensity of the human consequences, whether within the U.S. or abroad, as well as the breadth and depth of possible economic fallout. If the increase in infections is brought under control relatively quickly, producer supply chains suffer little damage, and worker output and productivity are only slightly depressed, then a one-quarter decline followed by a one-quarter rebound in aviation activity might be a reasonable outcome. In that case, it could be that the consequence to annual numbers is quite subdued. On the other hand, of course, a less optimistic outcome could occur, resulting in longer term impacts to the industry.

Although oil prices moved lower in 2019 from the previous year, recent volatility reminds us there is still considerable uncertainty as to the future direction of oil prices. The FAA's baseline forecast (derived from economic assumptions in IHS Global Insight's November 2019 U.S. macro forecast and 30-Year Focus released during August 2019) calls for oil prices to decrease to $46 per barrel in 2021 and rise gradually thereafter. By 2030, oil prices are projected to exceed $80 per barrel and reach $104 per barrel by the end of the forecast period in 2040. Some forecasters are calling for a more gradual rebound in the price of oil. In October 2019, the World Bank released its latest commodity price forecast. The forecast calls for oil prices to hold steady at about $59 per barrel until 2021. After 2021 prices rise gradually and reach $70 per barrel by 2030. However, there are other oil price forecasts that are considerably more aggressive than the FAA base forecast. The latest Energy Information Administration (EIA) Annual Energy Outlook released in January 2020, sees oil prices rising approximately 4.0% per year between 2019 and 2040. By 2040, the spot price of oil ranges from $138 per barrel (West Texas Intermediate) to $146 per barrel (Brent), considerably above the FAA base forecast of $104. Over the long run, lower oil prices give consumers an impetus for additional spending, including air travel, and should enhance industry profitability. In the case where oil prices turn out to be higher than the FAA forecast, we would

expect lower spending on air travel by consumers, higher costs for fuel to airlines and reduced industry profitability.

The baseline forecast incorporates additional infrastructure spending in 2020 and beyond. However, there is considerable uncertainty as to the magnitude, timing, and nature of these programs that ultimately determines the impact on the future growth of the U.S. economy. In addition, how the U.S. will engage with the rest of the global economy over the next several years continues to evolve. Under the right conditions, a period of sustained high and more inclusive growth along with increased financial stability could occur but there is also the possibility of an outcome that leads to greater global economic fragmentation, slower growth, and increased financial instability.

The baseline forecast assumes that the global economic slowdown that began in 2019 will continue until 2021 as weakness in Europe and a slowdown in China constrains global growth. Thereafter, the baseline forecast assumes that China and India will be growth engines for emerging economies as China successfully transitions the economy from heavy reliance on manufacturing and resource industries to one more oriented towards the services and technology sectors and India continues to implement reforms to make its economy more competitive. In the United States, economic growth has slowed from 2018's level as the effects of the 2017 tax cuts on demand are beginning to wane, and at the same time demand has slowed in Japan and in the European Union as these areas continue to be constrained by structural economic problems (high debt, slow population growth, weak public finances, for example) and political instability. Furthermore, the actions taken to stabilize the global economy during the Great Recession continue to hamper economic policy makers. In some of the major advanced economies, governments need to shore up their finances and recent actions have many analysts concerned that policy makers will not take the steps needed. There exists a non-trivial possibility that authorities will either act prematurely or be excessively timid and late in taking necessary steps to maintain a healthy global economy. The current forecasts assume strong passenger growth for travel between the United States and other world regions. Further slowing of worldwide economic activity could seriously inhibit the growth in global passenger demand.

The outlook for further consolidation via mergers and acquisitions (M&A) appears to be rather limited. Based on FY 2019 data, the top 6 (American, Delta, United, Southwest plus Alaska/Virgin and JetBlue) accounted for almost 85% of the U.S. airline industry capacity and traffic. For many low cost carriers, the sheer size of merger transactions or the amount of risk associated with a merger makes further merger activity unlikely. For the network carriers, it is unclear how regulatory authorities will respond to any future proposed mergers.

The forecast assumes the addition of sizable numbers of large regional jets (70 to 90 seats) into the fleet of regional carriers. However, network carrier consolidation and new rules on pilot training have left regional carriers saddled with either excess capacity or a lack of pilots. Although air travel demand has been strong, the bankruptcy filings of Republic Airways in 2016, Great Lakes Airlines in 2018 and Trans States Airlines in 2020 (planned) are reminders that financial pressures on regional operators have not abated. Network carriers continue to adjust the size and breadth of their networks and, in many

cases, are significantly reducing the numbers of small regional jets. While these actions may provide some opportunities for well positioned regional carriers, the overall impact so far has been to reduce opportunities for regional flying substantially.

After suffering through a significant downturn in 2009, partial recovery of business and corporate aviation continues. The future pace of the recovery in business and corporate aviation is based largely upon the prospects for economic growth and corporate profits. Uncertainty in these leading indicators poses a risk to the forecast, but the risk is not limited to these factors. Other influences, such as potential environmental regulations and taxes do not seem to be as much of a concern in the short term, but over the long term, uncertainties about the direction of these influences may place downward pressure on the forecast.

Not only is the volume of aircraft operating at most large hubs expected to increase over the next 20 years, but the mix of aircraft is changing for this same period. The expected increases in the numbers of larger regional jets and business jets as well as the anticipated widespread deployment of UAS into the national airspace system will make the FAA's job more challenging. This change in the mix of aircraft will most likely add to workload above and beyond the increasing demand for aviation services resulting from the growth in operations over the forecast period.

While overall activity at FAA and contract towers increased 2.9 percent in 2019, activity at large and medium hub airports (61 in total) increased 1.8 percent and 1.9 percent in 2019 and delays remained at historically high levels at many U.S. airports. FAA forecasts operations at these airports to grow substantially faster than the overall national trend. As demand continues to grow and workload increases, congestion and delays could become critical limits to growth over the forecast period. FAA's forecasts of both demand and operations are unconstrained in that they assume that there will be sufficient infrastructure to handle the projected levels of activity. Should the infrastructure be inadequate and result in even more congestion and delays, it is likely that the forecasts of both demand and operations would not be achieved.

Increasing concerns about aviation's environmental impacts could potentially limit or delay the ability of the aviation sector to grow to meet national economic and mobility needs. Airspace modernization and airport expansion or new construction are often contentious because of concerns over noise, air quality, water quality, and climate change. Community concerns about aviation noise have led to increasing levels of public debate, political interest, and even litigation. Without effective measures to mitigate and abate aviation noise, the infrastructure projects and airspace redesign efforts needed to achieve aviation growth may be delayed.

The environmental noise and emissions issues associated with overflight operations also present global challenges. In addition to providing economic benefits, technologies to improve aircraft fuel efficiency and reduce fuel consumption provide benefits in terms of reduced emissions; many technologies that improve fuel efficiency also result in reduced noise. The implementation of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), a global market-based measure for international carbon dioxide emissions, will help ensure an approach

that is economically preferable to a patchwork of State or Regional-level regulations around the world is used. Continued advancements in technologies that result in improved fuel efficiency, reduced fuel consumption, noise reduction and reduced emissions are also required to ensure that access restrictions or operating limitations are not imposed on the in-service fleet, which in turn may depress growth. The continued deployment of sustainable aviation fuels, (i.e., drop-in fuels that are compatible with today's aviation infrastructure but are derived from biomass or waste resources), will also help to reduce emissions that affect air quality near airports and address concerns about climate change.

Appendix A: Alternative Forecast Scenarios

Uncertainty exists in all industries, but especially in the commercial air travel industry. As volatility in the global environment has increased, the importance of scenarios for planning purposes has increased. In order to help stakeholders better prepare for the future, the FAA provides alternative scenarios to our baseline forecasts of airline traffic and capacity.

To create the baseline domestic forecast, economic assumptions from IHS Markit's 10-year and 30-year U.S. Macro Baselines were used. To develop the alternative scenarios, assumptions from IHS Markit's 30-year optimistic and pessimistic forecasts from their August 2019 *US Economy: The 30-Year Focus* were utilized. Inputs from these alternative scenarios were used to create a "high" and "low" traffic, capacity, and yield forecast.

International passengers and traffic are primarily driven by country specific Gross Domestic Product (GDP) forecasts provided by IHS Markit. Thus, the alternative scenarios use inputs based on ratios derived from IHS Markit's Major Trading Partner and Other Important Trading Partners optimistic and pessimistic forecasts in order to create high and low cases.

Scenario Assumptions

The FAA's domestic baseline forecast assumes that economic growth remains slightly above trend in the near term, supported primarily by consumer spending. Recent tax cuts and favorable financial conditions contribute to that spending but after 2020, slower federal government spending and trade act as headwinds to GDP growth. Oil prices remain moderate by historic standards and there are no external shocks.

The FAA's high case forecast uses IHS Markit's optimistic forecast. The optimistic forecast sees stronger overall growth driven mainly by an increase in productivity in a low inflation environment. This results in stronger real wage growth and an improved employment outlook, leading to increased consumer spending and housing and business investment. Confidence is high and the stock market sees strong gains while the unemployment rate remains slightly lower than in the baseline scenario. Technological improvements lower the production costs of oil and, despite increased demand, the price of oil is largely below that of the baseline.

In this scenario, real personal consumption expenditure (PCE) per capita growth averages 0.3 percentage points faster per year than the baseline forecast and unemployment averages 0.2 points lower on a fiscal year basis than the baseline.[29]

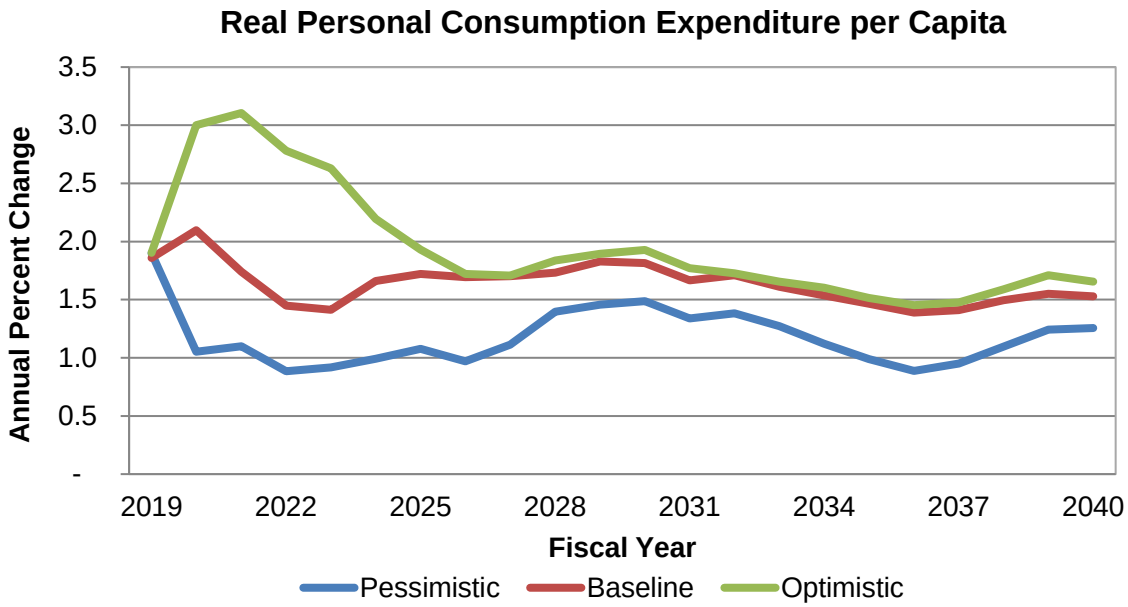
Conversely, FAA's low case forecast uses IHS Markit's pessimistic scenario. In this forecast, a broad loss in confidence and

[29] Real PCE per capita and unemployment are used as input variables to the FAA's base, high and low forecast of enplanements.

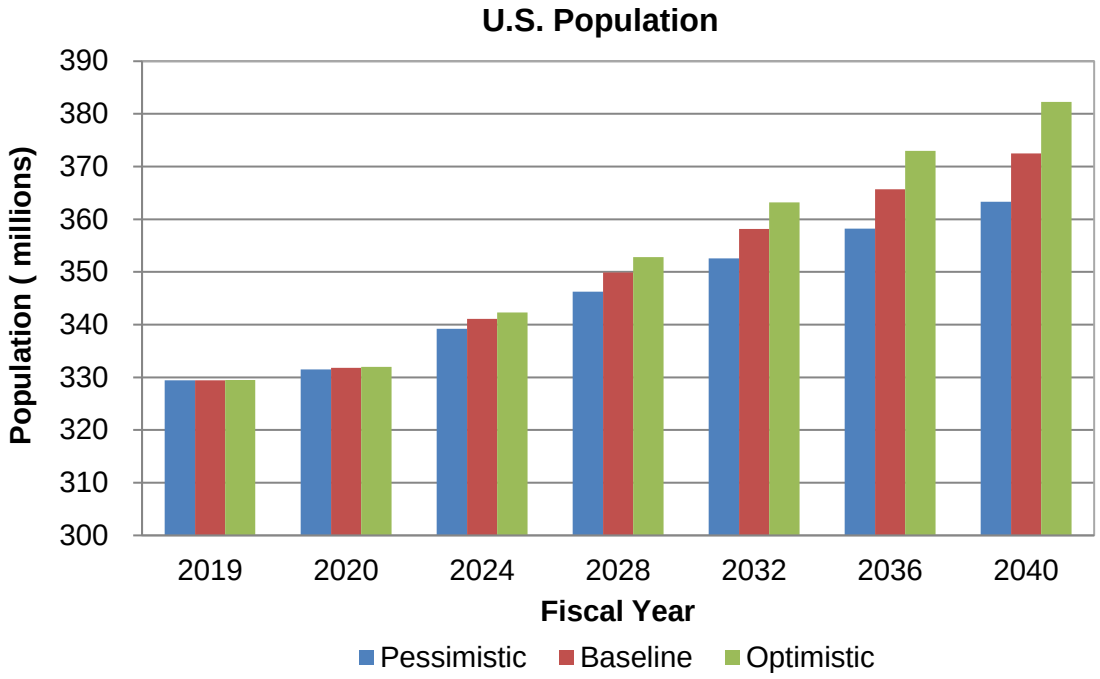
growing aversion to risk leads to declines in a wide range of investment and consumer spending categories. The economy slows with GDP growth below one percent, but still positive, for four years. GDP growth averages 0.6 percentage points lower than in the baseline over the forecast horizon.

In addition to slower GDP growth in this scenario, productivity, the labor force and capital investments also grow more slowly than in the baseline. Personal income growth is pressured leading to depressed consumer confidence and spending, with durable goods consumption, particularly of housing and motor vehicles, impacted the most. Financial conditions are tight and the higher interest rates reflect concerns about the inflationary outlook, given the Fed's accommodative monetary policy and accelerating inflation. Inflation is fanned by higher commodity prices and rising energy prices, wages, and import prices combine to push consumer price inflation above the baseline.

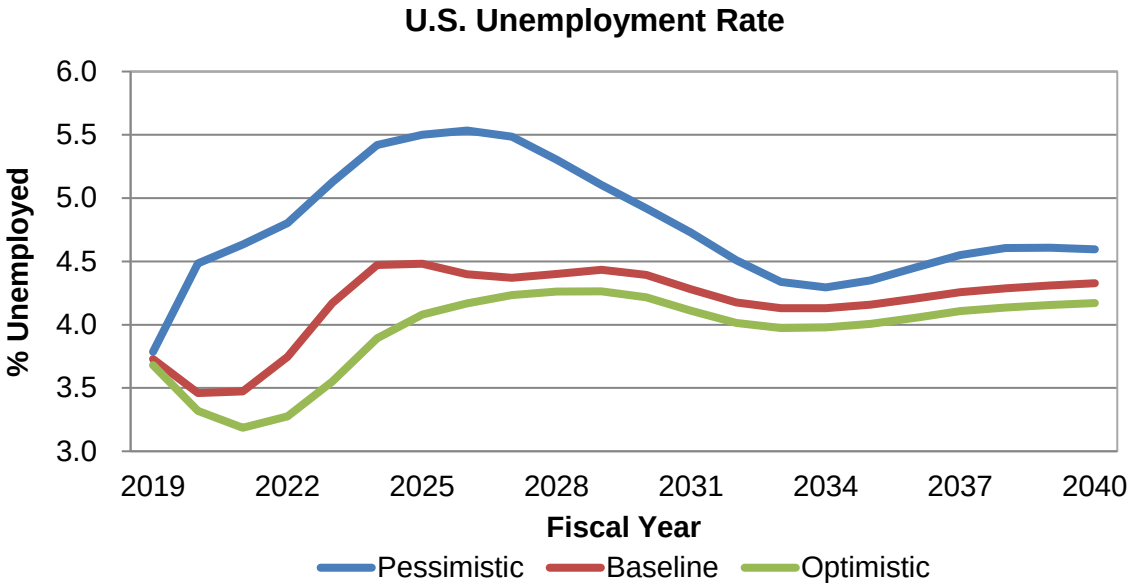
Oil prices rise faster than the baseline throughout the forecast and are $60 per barrel higher by 2040. Real PCE per capita in this scenario grows 0.5 percentage points slower per year than in the baseline; and unemployment, on average, is 0.6 points higher on an annual basis than in the baseline.



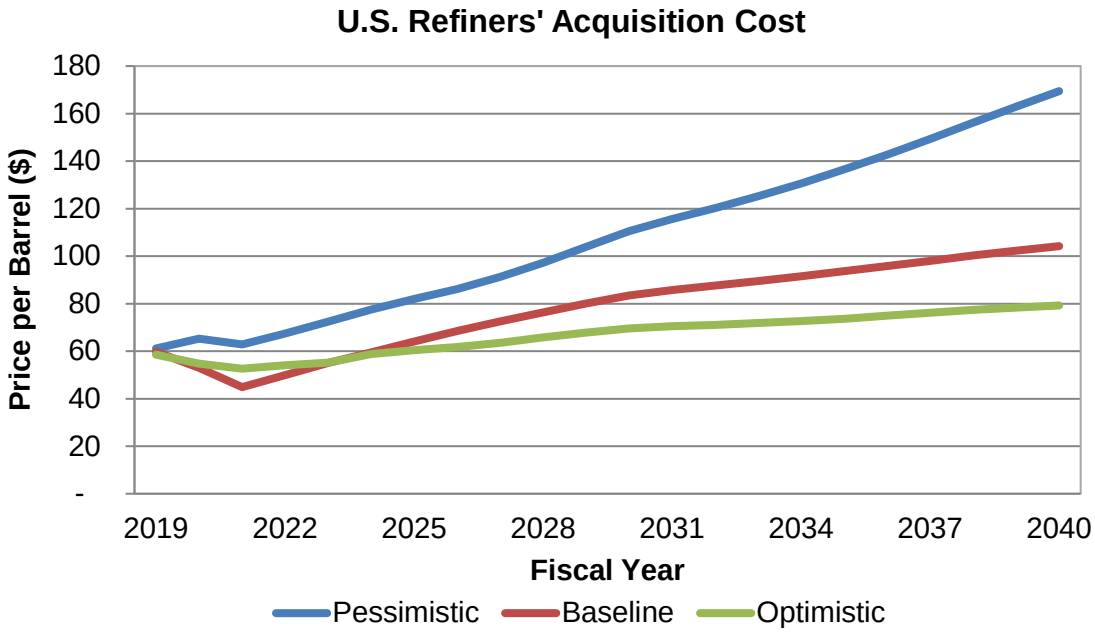
Source: IHS Markit



Source: IHS Markit

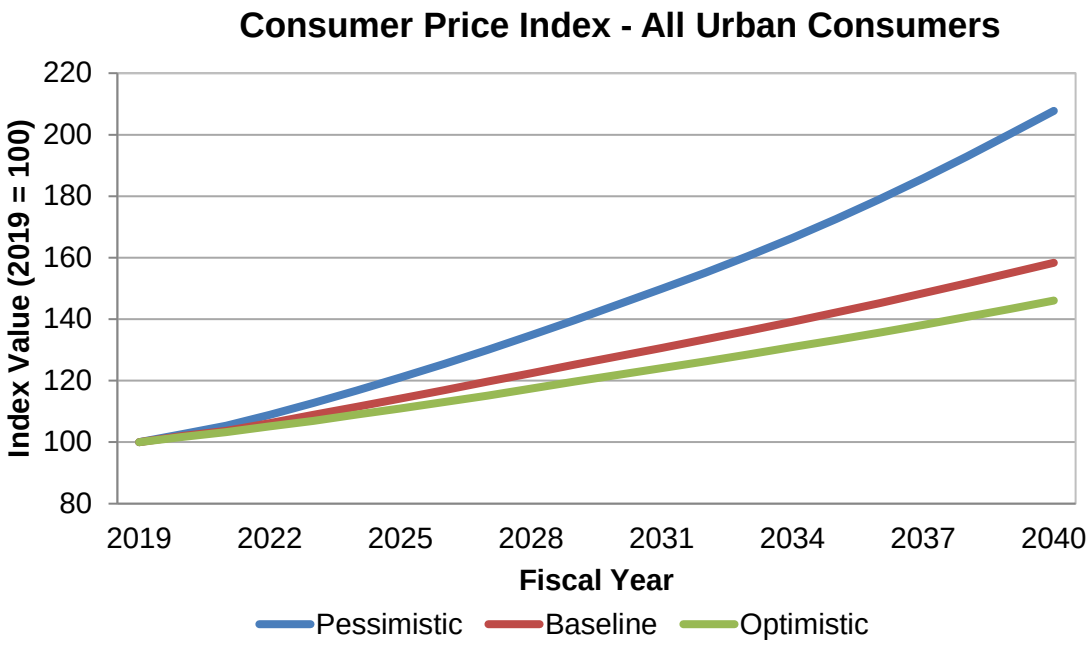


Source: IHS Markit



Source: IHS Markit

The price of energy is one of the drivers in the growth of consumer prices over the forecast period. In the optimistic case, slow growth of energy prices and import prices counteracts faster growth of other consumer goods prices causing the optimistic CPI to rise somewhat slower than the baseline. In the pessimistic case, energy prices, wages and import prices all rise more rapidly compared to the baseline.



Source: IHS Markit

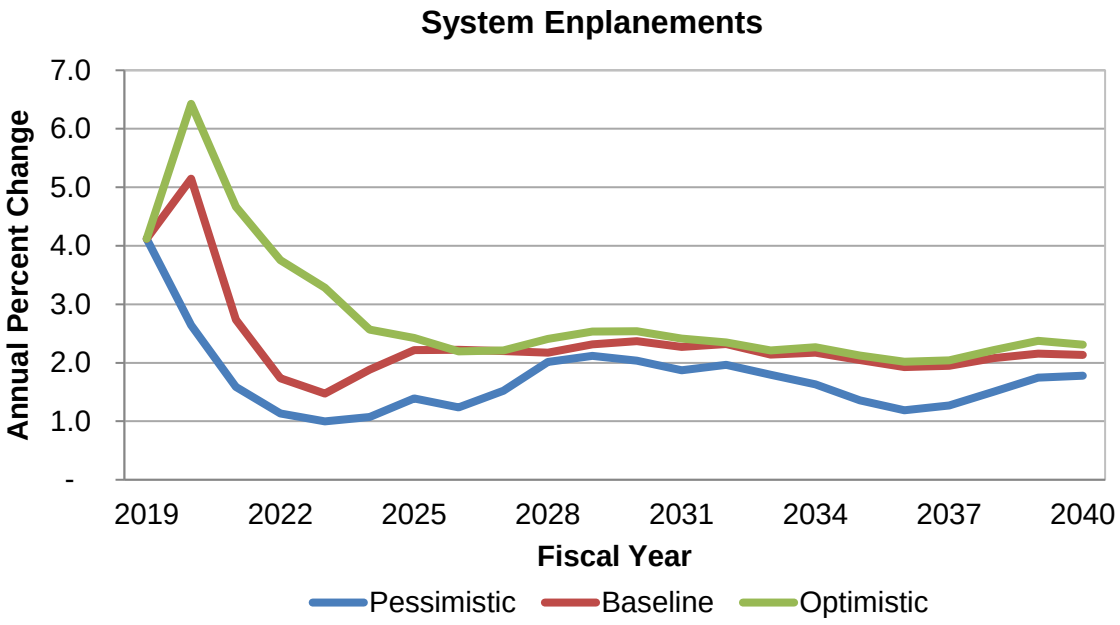
Alternative Forecasts

Enplanements

In the baseline forecast, system enplanements are forecast to grow at an average annual rate of 2.1 percent a year over the forecast horizon of 2020-2040 (with domestic and international passengers increasing at rates of 2.0 and 3.1 percent, respectively).

In the optimistic case, enplanements grow at a quicker pace, averaging 2.5 percent per year (up 2.4 percent domestically and 3.6 percent internationally). This scenario is marked by a more favorable business environment and lower fuel prices which make the price of flying more affordable to business and leisure travelers. By the end of the forecast period in 2040, system passengers in the optimistic case are 9.8 percent above the baseline, totaling 1.6 billion, 144 million greater than in the baseline.

The pessimistic case is characterized by a period of weakened personal income growth and consumer confidence combined with a contraction in financial asset markets, leading to higher interest rates, and curtailed investment and consumer spending. In this scenario, enplanements grow an average of 1.6 percent per year (domestic up 1.4 percent and international up 2.8 percent). In the pessimistic case, system passengers in 2040 are 12.6 percent below the baseline case, totaling 1.3 billion, or 186 million fewer than in the baseline.

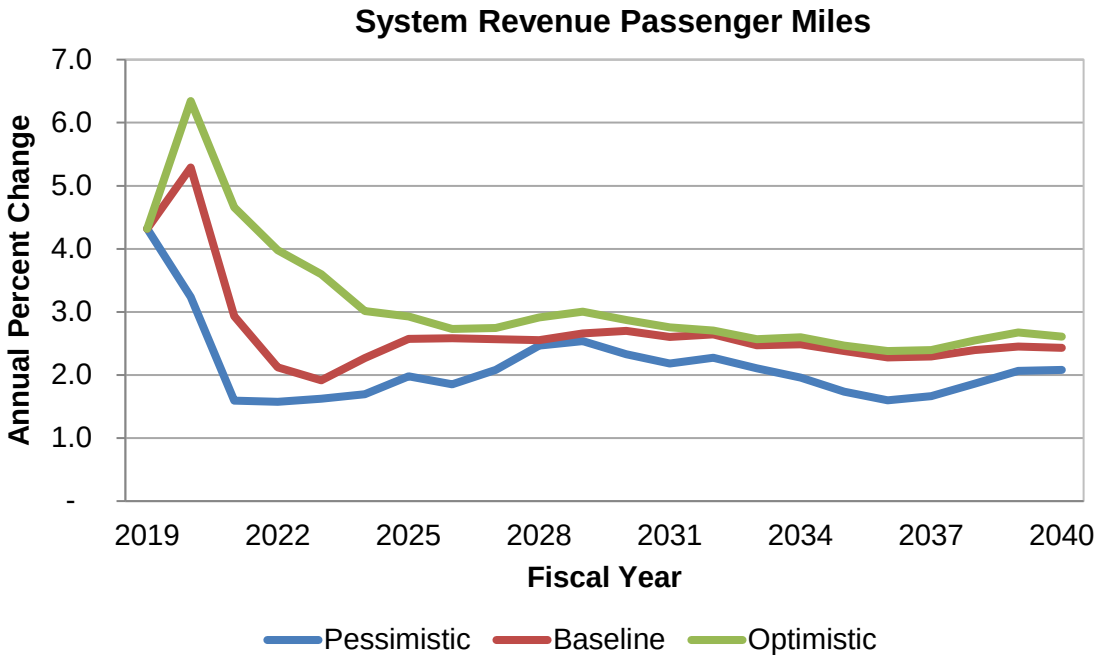


Revenue Passenger Miles

In the baseline forecast, system RPMs grow at an average annual rate of 2.5 percent a year over the forecast horizon (2020-2040), with domestic RPMs increasing 2.3 percent annually and international RPMs growing 3.0 percent annually.

In the optimistic case, the faster growing economy coupled with lower energy prices drives RPMs higher than the baseline, with growth averaging 2.9 percent per year (domestic and international RPMs up 2.7 and 3.5 percent, respectively).

In the pessimistic case, the combination of a slower growing economy and higher energy prices result in RPM growth averaging 2.0 percent annually with domestic markets growing 1.6 percent a year while international traffic grows 2.7 percent annually.



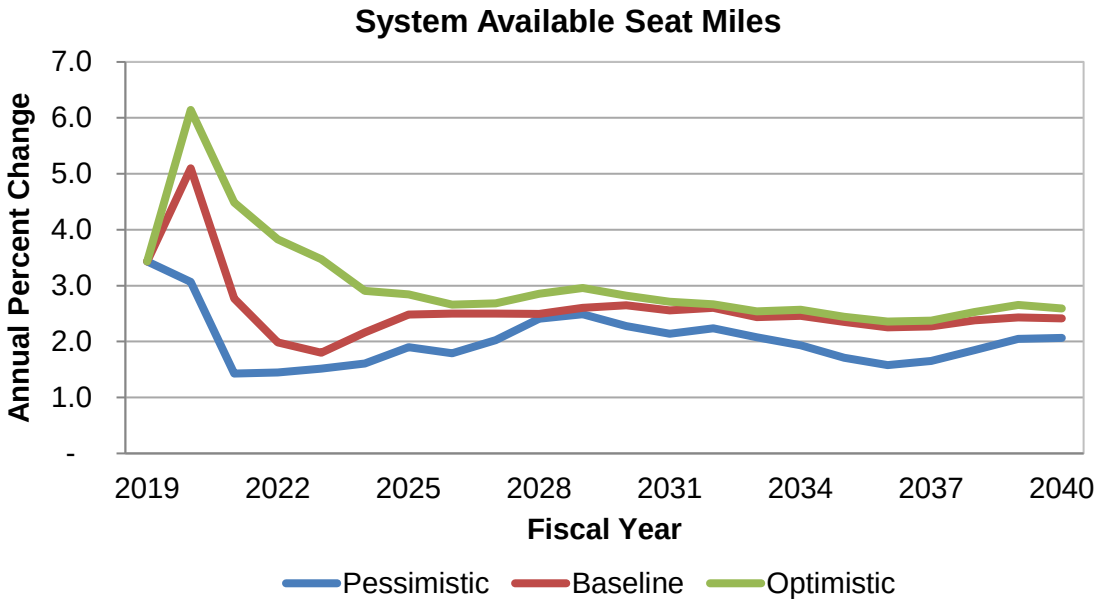
Available Seat Miles

In the base case, system capacity is forecast to increase an average of 2.4 percent annually over the forecast horizon with growth averaging 2.2 percent annually in domestic markets and 3.0 percent a year in international markets.

In the optimistic case, capacity grows at a faster clip than in the baseline forecast, averaging 2.8 percent annually system-wide (2.6 and 3.5 percent for domestic and international markets, respectively). Carriers increase capacity compared to the baseline forecast to accommodate increased travel

demand brought about by a more favorable economic environment.

In the pessimistic case, demand for air travel is lower than in the baseline, thus system capacity grows at a slower pace of 1.9 percent annually (domestic growth of 1.6 percent annually and international up 2.7 percent annually).



Load Factor

System load factors over the 20-year forecast period are similar for all three forecast scenarios. System load factor rises from 84.6 percent in 2020 to 85.6 (optimistic), 85.5 (pessimistic), and 85.6 (baseline) percent in 2040.

In all three scenarios it is assumed that carriers will keep load factors on the high side by actively managing capacity (seats) to more precisely meet demand (passengers).

The domestic load factor increases over the forecast horizon from 85.3 percent to 86.8 percent in the baseline and pessimistic scenarios, and from 85.3 percent to 86.9 percent in the optimistic one.

The international load factor is forecast to hold steady near 82.9 throughout the period in the optimistic scenario and rise slightly to 83.0 percent in the baseline and pessimistic scenarios. This reflects in part the relative growth in demand and capacity in the three (Atlantic, Latin, and Pacific) international regions under each scenario.

Yield

In the baseline forecast, nominal system yield increases 1.7 percent annually, rising from 13.81 cents in 2020 to 19.33 cents in 2040. In domestic markets, yield in the baseline forecast rises from 13.89 cents in 2020 to 19.60 cents in 2040. International yield rises from 13.61 cents in 2020 to 18.71 cents in 2040.

System yield rises in the optimistic case at a slower rate than in the baseline, up 1.3 percent annually to 17.85 cents by 2040. Domestic yield increases to 17.80 cents while international yield increases to 17.96 cents. The modest growth in yield in both cases is due to advancements in technology, gains in productivity, and relatively favorable fuel prices.

In the pessimistic case, nominal yields rise more rapidly than in the baseline, growing an average of 2.9 percent annually, reaching 24.70 cents by 2040 (26.16 cents domestically and 21.67 cents internationally). This scenario reflects higher general domestic inflation and higher energy prices than in the baseline, forcing carriers to increase fares in order to cover the higher costs of fuel, labor, and capital.

TABLE A-1

FAA FORECAST ECONOMIC ASSUMPTIONS

FISCAL YEARS 2019-2040

		Historical	FORECAST					PERCENT AVERAGE ANNUAL GROWTH				
Variable	Scenario	2019E	2020	2025	2030	2035	2040	2019-20	2020-25	2020-30	2020-35	2020-40
Economic Assumptions												
Real Personal Consumption	Pessimistic	40,037	40,390	42,437	45,234	48,064	50,731	0.9%	1.0%	1.1%	1.2%	1.1%
Expenditure per Capita	Baseline	40,037	40,877	44,247	48,266	52,246	56,213	2.1%	1.6%	1.7%	1.6%	1.6%
(2012 $)	Optimistic	40,037	41,257	46,741	51,145	55,518	60,037	3.0%	2.5%	2.2%	2.0%	1.9%
Refiners Acquisition Cost -	Pessimistic	59.7	65.3	82.0	110.5	136.5	169.4	9.3%	4.7%	5.4%	5.0%	4.9%
Average - $ Per Barrel	Baseline	59.7	53.0	64.0	83.5	93.6	104.2	-11.2%	3.8%	4.6%	3.9%	3.4%
	Optimistic	59.7	54.7	60.4	69.6	73.7	79.2	-8.4%	2.0%	2.4%	2.0%	1.9%
Consumer Price Index	Pessimistic	2.54	2.61	3.08	3.68	4.39	5.28	2.6%	3.4%	3.5%	3.5%	3.6%
All Urban, 1982-84 = 1.0	Baseline	2.54	2.60	2.91	3.25	3.62	4.03	2.1%	2.3%	2.3%	2.2%	2.2%
	Optimistic	2.54	2.59	2.82	3.10	3.39	3.72	1.7%	1.8%	1.8%	1.8%	1.8%
Civilian Unemployment Rate	Pessimistic	3.7	4.5	5.5	4.9	4.4	4.6	20.3%	4.2%	0.9%	-0.2%	0.1%
(%)	Baseline	3.7	3.5	4.5	4.4	4.2	4.3	-7.2%	5.3%	2.4%	1.2%	1.1%
	Optimistic	3.7	3.3	4.1	4.2	4.0	4.2	-11.0%	4.2%	2.4%	1.3%	1.1%

Source: IHS Markit

TABLE A-2

FAA FORECAST OF AVIATION ACTIVITY*

FISCAL YEARS 2019-2040

		Historical	FORECAST					PERCENT AVERAGE ANNUAL GROWTH				
Variable	Scenario	2019E	2020	2025	2030	2035	2040	2019-20	2020-25	2020-30	2020-35	2020-40
System Aviation Activity												
Available Seat Miles	Pessimistic	1,235.7	1,273.6	1,377.3	1,535.5	1,696.8	1,858.6	3.1%	1.6%	1.9%	1.9%	1.9%
(BIL)	Baseline	1,235.7	1,298.7	1,450.8	1,645.4	1,859.9	2,089.0	5.1%	2.2%	2.4%	2.4%	2.4%
	Optimistic	1,235.7	1,311.6	1,558.1	1,788.5	2,031.9	2,299.2	6.1%	3.5%	3.1%	3.0%	2.8%
Revenue Passenger Miles	Pessimistic	1,044.0	1,077.9	1,172.2	1,310.3	1,450.3	1,589.8	3.2%	1.7%	2.0%	2.0%	2.0%
(BIL)	Baseline	1,044.0	1,099.3	1,235.3	1,405.2	1,591.1	1,788.7	5.3%	2.4%	2.5%	2.5%	2.5%
	Optimistic	1,044.0	1,110.3	1,327.1	1,527.5	1,738.2	1,968.6	6.3%	3.6%	3.2%	3.0%	2.9%
Enplanements	Pessimistic	916.7	940.9	1,000.5	1,093.1	1,190.6	1,282.4	2.6%	1.2%	1.5%	1.6%	1.6%
(MIL)	Baseline	916.7	963.9	1,064.6	1,190.2	1,326.4	1,468.0	5.1%	2.0%	2.1%	2.2%	2.1%
	Optimistic	916.7	975.6	1,149.6	1,292.8	1,446.5	1,612.2	6.4%	3.3%	2.9%	2.7%	2.5%
Psgr Carrier Miles Flown	Pessimistic	7,845.3	8,034.9	8,480.8	9,247.4	10,040.4	10,797.5	2.4%	1.1%	1.4%	1.5%	1.5%
(MIL)	Baseline	7,845.3	8,212.5	8,977.8	9,985.6	11,092.0	12,243.3	4.7%	1.8%	2.0%	2.0%	2.0%
	Optimistic	7,845.3	8,303.5	9,668.5	10,852.3	12,109.6	13,463.2	5.8%	3.1%	2.7%	2.5%	2.4%
Psgr Carrier Departures	Pessimistic	9,369.9	9,536.4	9,758.2	10,323.7	10,915.9	11,416.1	1.8%	0.5%	0.8%	0.9%	0.9%
(000s)	Baseline	9,369.9	9,740.6	10,372.5	11,252.5	12,165.5	13,069.0	4.0%	1.3%	1.5%	1.5%	1.5%
	Optimistic	9,369.9	9,877.7	11,220.1	12,197.5	13,225.1	14,301.9	5.4%	2.6%	2.1%	2.0%	1.9%
Nominal Passenger Yield	Pessimistic	13.74	14.02	15.85	18.23	21.13	24.70	2.1%	2.5%	2.7%	2.8%	2.9%
(cents)	Baseline	13.74	13.81	15.08	16.57	17.90	19.33	0.5%	1.8%	1.8%	1.7%	1.7%
	Optimistic	13.74	13.84	14.75	15.85	16.80	17.85	0.7%	1.3%	1.4%	1.3%	1.3%

* Includes domestic and international activity.

TABLE A-3

FAA FORECAST OF DOMESTIC AVIATION ACTIVITY

FISCAL YEARS 2019-2040

Variable	Scenario	Historical 2019E	FORECAST 2020	2025	2030	2035	2040	PERCENT AVERAGE ANNUAL GROWTH 2019-20	2020-25	2020-30	2020-35	2020-40
Domestic Aviation Activity												
Available Seat Miles (BIL)	Pessimistic	883.6	907.4	963.4	1,049.9	1,146.2	1,236.0	2.7%	1.2%	1.5%	1.6%	1.6%
	Baseline	883.6	932.2	1,032.5	1,156.0	1,290.8	1,432.0	5.5%	2.1%	2.2%	2.2%	2.2%
	Optimistic	883.6	944.8	1,120.7	1,257.2	1,409.0	1,574.4	6.9%	3.5%	2.9%	2.7%	2.6%
Revenue Passenger Miles (BIL)	Pessimistic	752.2	774.3	828.9	907.6	993.6	1,073.3	2.9%	1.4%	1.6%	1.7%	1.6%
	Baseline	752.2	795.4	888.5	999.4	1,119.0	1,243.6	5.8%	2.2%	2.3%	2.3%	2.3%
	Optimistic	752.2	806.3	964.4	1,086.9	1,221.6	1,367.4	7.2%	3.6%	3.0%	2.8%	2.7%
Enplanements (MIL)	Pessimistic	813.3	834.9	881.9	952.6	1,029.2	1,097.0	2.7%	1.1%	1.3%	1.4%	1.4%
	Baseline	813.3	857.7	945.2	1,049.0	1,159.1	1,271.1	5.5%	2.0%	2.0%	2.0%	2.0%
	Optimistic	813.3	869.4	1,026.0	1,140.9	1265.3	1,397.6	6.9%	3.4%	2.8%	2.5%	2.4%
Psgr Carrier Miles Flown (MIL)	Pessimistic	6,256.8	6,391.8	6,642.8	7,104.6	7,624.2	8,081.2	2.2%	0.8%	1.1%	1.2%	1.2%
	Baseline	6,256.8	6,567.7	7,122.1	7,825.7	8,590.7	9,368.5	5.0%	1.6%	1.8%	1.8%	1.8%
	Optimistic	6,256.8	6,657.3	7,733.3	8,514.3	9,381.0	10,304.8	6.4%	3.0%	2.5%	2.3%	2.2%
Psgr Carrier Departures (000s)	Pessimistic	8,672.2	8,824.4	8,973.7	9,405.4	9,870.5	10,227.6	1.8%	0.3%	0.6%	0.7%	0.7%
	Baseline	8,672.2	9,026.8	9,581.8	10,326.2	11,077.9	11,800.7	4.1%	1.2%	1.4%	1.4%	1.3%
	Optimistic	8,672.2	9,162.9	10,402.5	11,203.5	12,050.8	12,924.5	5.7%	2.6%	2.0%	1.8%	1.7%
Nominal Passenger Yield (cents)	Pessimistic	13.86	14.19	16.35	19.20	22.31	26.16	2.4%	2.9%	3.1%	3.1%	3.1%
	Baseline	13.86	13.89	15.21	16.77	18.13	19.60	0.2%	1.8%	1.9%	1.8%	1.7%
	Optimistic	13.86	13.92	14.76	15.82	16.75	17.80	0.4%	1.2%	1.3%	1.2%	1.2%

TABLE A-4

FAA FORECAST OF INTERNATIONAL AVIATION ACTIVITY*

FISCAL YEARS 2019-2040

		Historical	FORECAST					PERCENT AVERAGE ANNUAL GROWTH				
Variable	Scenario	2019E	2020	2025	2030	2035	2040	2019-20	2020-25	2020-30	2020-35	2020-40
International Aviation Activity												
Available Seat Miles (BIL)	Pessimistic	352.0	366.2	414.0	485.6	550.6	622.6	4.0%	2.5%	2.9%	2.8%	2.7%
	Baseline	352.0	366.5	418.3	489.4	569.1	657.0	4.1%	2.7%	2.9%	3.0%	3.0%
	Optimistic	352.0	366.7	437.5	531.3	623.0	724.8	4.2%	3.6%	3.8%	3.6%	3.5%
Revenue Passenger Miles (BIL)	Pessimistic	291.8	303.6	343.2	402.7	456.7	516.5	4.0%	2.5%	2.9%	2.8%	2.7%
	Baseline	291.8	303.8	346.8	405.8	472.0	545.1	4.1%	2.7%	2.9%	3.0%	3.0%
	Optimistic	291.8	304.0	362.7	440.5	516.7	601.2	4.2%	3.6%	3.8%	3.6%	3.5%
Enplanements (MIL)	Pessimistic	103.4	106.1	118.7	140.5	161.5	185.4	2.5%	2.3%	2.9%	2.8%	2.8%
	Baseline	103.4	106.2	119.4	141.3	167.3	196.9	2.7%	2.4%	2.9%	3.1%	3.1%
	Optimistic	103.4	106.3	123.6	152.0	181.2	214.6	2.7%	3.1%	3.6%	3.6%	3.6%
Psgr Carrier Miles Flown (MIL)	Pessimistic	1,588.5	1,643.0	1,838.0	2,142.8	2,416.3	2,716.4	3.4%	2.3%	2.7%	2.6%	2.5%
	Baseline	1,588.5	1,644.9	1,855.7	2,159.8	2,501.4	2,874.7	3.5%	2.4%	2.8%	2.8%	2.8%
	Optimistic	1,588.5	1,646.2	1,935.2	2,338.1	2,728.7	3,158.4	3.6%	3.3%	3.6%	3.4%	3.3%
Psgr Carrier Departures (000s)	Pessimistic	697.7	712.0	784.5	918.4	1,045.4	1,188.4	2.0%	2.0%	2.6%	2.6%	2.6%
	Baseline	697.7	713.8	790.7	926.3	1,087.6	1,268.4	2.3%	2.1%	2.6%	2.8%	2.9%
	Optimistic	697.7	714.8	817.5	994.0	1,174.3	1,377.4	2.5%	2.7%	3.4%	3.4%	3.3%
Nominal Passenger Yield (cents)	Pessimistic	13.42	13.60	14.63	16.04	18.56	21.67	1.3%	1.5%	1.7%	2.1%	2.4%
	Baseline	13.42	13.61	14.77	16.08	17.36	18.71	1.4%	1.6%	1.7%	1.6%	1.6%
	Optimistic	13.42	13.63	14.71	15.91	16.90	17.96	1.5%	1.5%	1.6%	1.4%	1.4%

*Includes mainline and regional carriers.

Appendix B: FAA Forecast Accuracy

Forecasts, by their nature, have a degree of uncertainty incorporated in them. They involve not only statistical analyses and various scientific methods, but also judgment and reliance on industry knowledge and the forecaster's experience to incorporate industry trends not yet reflected in recent results. The FAA's annual Aerospace Forecast is no exception. Given the volatile nature of the U.S. airline industry, it is not surprising that each year's forecast would contain a certain degree of forecast variance. Therefore, FAA forecasters have tried to build forecast models that give a consistent and predictable pattern of results. Analysts relying on the forecasts produced by the models would then be able to adjust for the predictable variance from actual results.

The table below presents an analysis of the variance from historical results for a primary forecast assumption along with five key forecast metrics during the FY 2010-2019 forecast period. Although many of the forecasts prepared for the period examined were developed while the U.S. airline industry was going through upheaval, the FAA's forecast methodology remained consistent during this time. For this reason, inclusion of prior periods in an analysis of forecast variance might lead to inconclusive or inaccurate implications about the accuracy of FAA's current forecast methodology.

The table below contains the mean absolute percent errors for the projected values versus the actual results for U.S. carriers' system operations along with the projected values versus actual results for U.S. GDP. Each metric has five values showing the relative forecast variance by the number of years in advance the preparation of the forecast took place. For example, the "3 Years" column for ASMs shows that the mean absolute percent error was 4.7 percent for ASM forecasts prepared 3 years in advance. For the period under examination, preparation of the forecasts for FY 2010 through FY 2019 occurred in FY 2009 through FY 2018. [30]

[30] It should be noted that the first forecasted year for each respective fiscal year is that very same year. Therefore, FY 2010's first forecasted year is FY 2010, and the third forecasted year is FY 2012.

U.S. AIR CARRIERS
SYSTEM SCHEDULED PASSENGER ACTIVITY
FORECAST EVALUATION

Forecast Variable	Mean Absolute Percent Error (Combined FY 2010 - FY 2019) (Forecast Variance from Actual) Forecast Performed Years Prior to Actual				
	1 Year	2 Years	3 Years	4 Years	5 Years
U.S. Real GDP	1.0%	2.3%	4.6%	6.5%	8.1%
ASMs	0.8%	1.9%	4.7%	8.2%	11.7%
RPMs	0.8%	1.6%	4.0%	7.1%	9.9%
Passenger Enplanements	0.6%	1.5%	4.2%	7.3%	9.9%
Mainline Domestic Yield	2.3%	4.7%	7.1%	8.9%	10.1%
Commercial Operations at FAA/Contract Towers	0.8%	2.7%	6.2%	10.0%	14.7%

*Total - scheduled and nonscheduled commercial plus noncommercial

Presenting forecast variances from actual data in such a manner simplifies a review of longer-term trends. Typically, one would expect the variances to increase as the forecast year is moves away from the year the forecast is prepared. Presenting forecast variances in this way allows an examination of changes in the relative variances by time horizon, signaling when dramatic shifts in accuracy occur.

Examination of the forecast variances reveals several items. First, the forecast variances for GDP, a key exogenous variable, are similar to the variances of the key traffic measures, Passenger Enplanements and RPMs. This suggests that a substantial amount of the forecast variance for the traffic variables is attributable to the forecast error in the exogenous variables. Second, all the metrics examined have increasing variances as the forecast time horizon lengthens. Third, the variance in the Commercial Operations at FAA/Contract Towers relative to ASM variance is stable for the 2 to 5 year out horizon. This suggests that beyond a 2 year forecast horizon carriers are able to accommodate changes in capacity by means other than adjusting operations. Many carriers have been systematically reducing the number of smaller regional jets in their fleets, replacing them with larger 70-90 seat aircraft. This has allowed carriers to increase capacity without increasing flights.

Appendix C: Forecast Tables

TABLE 1

U.S. SHORT-TERM ECONOMIC FORECASTS

	FISCAL YEAR 2019				FISCAL YEAR 2020				FISCAL YEAR 2021			
ECONOMIC VARIABLE	1ST. QTR.	2ND. QTR.	3RD QTR.	4TH. QTR.	1ST. QTR.	2ND. QTR.	3RD QTR.	4TH. QTR.	1ST. QTR.	2ND. QTR.	3RD QTR.	4TH. QTR.
Real Personal Consumption Expenditure per Capita												
(2012 $)	39,766	39,807	40,181	40,393	40,590	40,786	40,975	41,155	41,335	41,511	41,676	41,830
Year over year change	0.7%	0.4%	3.8%	2.1%	2.0%	2.0%	1.9%	1.8%	1.8%	1.7%	1.6%	1.5%
Refiners' Acquisition Cost - Average												
(Dollars per barrel)	59.61	57.03	63.60	58.60	54.42	52.67	54.38	50.60	44.94	43.65	44.29	46.61
Year over year change	-44.6%	-16.2%	54.6%	-27.9%	-25.6%	-12.2%	13.6%	-25.1%	-37.8%	-11.0%	6.0%	22.7%
Consumer Price Index												
(1982-84 equals 100)	252.8	253.3	255.1	256.3	257.8	258.9	260.4	261.3	261.8	262.9	264.3	266.0
Seasonally Adjusted Annual Rate	1.5%	0.9%	2.9%	1.8%	2.4%	1.6%	2.4%	1.4%	0.7%	1.7%	2.2%	2.6%
Source: IHS Markit												

TABLE 2

U.S. LONG-TERM ECONOMIC FORECASTS

FISCAL YEAR	REAL GROSS DOMESTIC PRODUCT (Billions 2012 $)	REAL PERSONAL CONSUMPTION EXPENDITURE PER CAPITA (2012 $)	CONSUMER PRICE INDEX (1982-84=1.00)	REFINERS' ACQUISITION COST AVERAGE (Dollars per barrel)
Historical				
2010	15,500	34,165	2.17	74.61
2015	17,322	36,907	2.37	56.69
2016	17,600	37,654	2.39	39.12
2017	17,984	38,369	2.44	48.16
2018	18,523	39,306	2.50	63.72
2019E	18,961	40,316	2.54	59.71
Forecast				
2020	19,349	40,877	2.60	53.02
2025	21,199	44,247	2.91	64.02
2030	23,581	48,266	3.25	83.51
2035	25,946	52,246	3.62	93.65
2040	28,374	56,213	4.03	104.20
Avg Annual Growth				
2010-19	2.3%	1.9%	1.8%	-2.4%
2019-20	2.0%	1.4%	2.1%	-11.2%
2020-30	2.0%	1.7%	2.3%	4.6%
2020-40	1.9%	1.6%	2.2%	3.4%

Source: IHS Markit

TABLE 3

INTERNATIONAL GDP FORECASTS BY TRAVEL REGION

	GROSS DOMESTIC PRODUCT (In Billions of 2015 U.S. Dollars)				
CALENDAR YEAR	CANADA	EUROPE / AFRICA / MIDDLE EAST	LATIN AMERICA / CARIBBEAN / MEXICO	JAPAN / PACIFIC BASIN / CHINA / OTHER ASIA / AUSTRALIA / NEW ZEALAND	WORLD
Historical					
2010	1,400	21,273	4,613	18,934	64,293
2015	1,557	23,157	5,174	24,341	74,354
2016	1,572	23,678	5,164	25,528	76,380
2017	1,622	24,319	5,259	26,852	78,969
2018	1,655	24,825	5,329	28,163	81,501
2019E	1,682	25,148	5,365	29,401	83,598
Forecast					
2020	1,707	25,467	5,427	30,649	85,719
2025	1,844	27,824	6,026	38,027	98,396
2030	2,012	30,621	6,995	46,429	113,523
2035	2,197	33,599	8,155	55,186	129,347
2040	2,402	36,756	9,487	64,810	146,485
Avg Annual Growth					
2010-19	2.1%	1.9%	1.7%	5.0%	3.0%
2019-20	1.5%	1.3%	1.2%	4.2%	2.5%
2020-30	1.7%	1.9%	2.6%	4.2%	2.8%
2020-40	1.7%	1.9%	2.8%	3.8%	2.7%

Source: IHS Markit website, GDP Components Tables (Interim Forecast, Monthly)

TABLE 4

INTERNATIONAL GDP FORECASTS – SELECTED AREAS/COUNTRIES

	GROSS DOMESTIC PRODUCT (In Billions of 2015 U.S. Dollars)				
CALENDAR YEAR	NORTH AMERICA (NAFTA)	EUROZONE	UNITED KINGDOM	JAPAN	CHINA
Historical					
2010	18,745	11,187	2,651	4,179	7,473
2015	20,951	11,667	2,930	4,390	10,916
2016	21,296	11,887	2,986	4,412	11,650
2017	21,814	12,207	3,043	4,509	12,436
2018	22,427	12,437	3,085	4,524	13,255
2019E	22,905	12,583	3,123	4,573	14,071
Forecast					
2020	23,353	12,697	3,142	4,586	14,887
2025	25,553	13,512	3,341	4,773	19,420
2030	28,465	14,397	3,596	5,001	24,531
2035	31,361	15,298	3,861	5,227	29,558
2040	34,441	16,201	4,134	5,460	34,879
Avg Annual Growth					
2010-19	2.3%	1.3%	1.8%	1.0%	7.3%
2019-20	2.0%	0.9%	0.6%	0.3%	5.8%
2020-30	2.0%	1.3%	1.4%	0.9%	5.1%
2020-40	2.0%	1.2%	1.4%	0.9%	4.3%

Source: IHS Markit website, GDP Components Tables (Interim Forecast, Monthly)

TABLE 5

U.S. COMMERCIAL AIR CARRIERS[1]

TOTAL SCHEDULED U.S. PASSENGER TRAFFIC

	REVENUE PASSENGER ENPLANEMENTS (Millions)			REVENUE PASSENGER MILES (Billions)		
FISCAL YEAR	DOMESTIC	INTERNATIONAL	TOTAL	DOMESTIC	INTERNATIONAL	TOTAL
Historical						
2010	635	77	712	555	231	786
2015	696	90	787	629	261	890
2016	726	93	820	663	265	928
2017	744	97	841	684	271	955
2018	781	100	880	720	281	1,001
2019E	813	103	917	752	292	1,044
Forecast						
2020	858	106	964	795	304	1,099
2025	945	119	1,065	889	347	1,235
2030	1,049	141	1,190	999	406	1,405
2035	1,159	167	1,326	1,119	472	1,591
2040	1,271	197	1,468	1,244	545	1,789
Avg Annual Growth						
2010-19	2.8%	3.3%	2.8%	3.4%	2.6%	3.2%
2019-20	5.5%	2.7%	5.1%	5.8%	4.1%	5.3%
2020-30	2.0%	2.9%	2.1%	2.3%	2.9%	2.5%
2020-40	2.0%	3.1%	2.1%	2.3%	3.0%	2.5%

Source: Forms 41 and 298-C, U.S. Department of Transportation.

[1]Sum of U.S. Mainline and Regional Air Carriers.

TABLE 6

U.S. COMMERCIAL AIR CARRIERS[1]

SCHEDULED PASSENGER CAPACITY, TRAFFIC, AND LOAD FACTORS

FISCAL YEAR	DOMESTIC			INTERNATIONAL			SYSTEM		
	ASMs (BIL)	RPMs (BIL)	% LOAD FACTOR	ASMs (BIL)	RPMs (BIL)	% LOAD FACTOR	ASMs (BIL)	RPMs (BIL)	% LOAD FACTOR
Historical									
2010	679	555	81.7	281	231	82.1	961	786	81.8
2015	744	629	84.5	323	261	80.7	1,067	890	83.4
2016	783	663	84.7	329	265	80.6	1,112	928	83.5
2017	809	684	84.5	335	271	81.0	1,144	955	83.5
2018	850	720	84.7	345	281	81.5	1,195	1,001	83.8
2019E	884	752	85.1	352	292	82.9	1,236	1,044	84.5
Forecast									
2020	932	795	85.3	366	304	82.9	1,299	1,099	84.6
2025	1,033	889	86.1	418	347	82.9	1,451	1,235	85.1
2030	1,156	999	86.5	489	406	82.9	1,645	1,405	85.4
2035	1,291	1,119	86.7	569	472	82.9	1,860	1,591	85.5
2040	1,432	1,244	86.8	657	545	83.0	2,089	1,789	85.6
Avg Annual Growth									
2010-19	3.0%	3.4%		2.5%	2.6%		2.8%	3.2%	
2019-20	5.5%	5.8%		4.1%	4.1%		5.1%	5.3%	
2020-30	2.2%	2.3%		2.9%	2.9%		2.4%	2.5%	
2020-40	2.2%	2.3%		3.0%	3.0%		2.4%	2.5%	

Source: Forms 41 and 298-C, U.S. Department of Transportation.

[1]Sum of U.S. Mainline and Regional Air Carriers.

TABLE 7

U.S. COMMERCIAL AIR CARRIERS[1]

TOTAL SCHEDULED U.S. INTERNATIONAL PASSENGER TRAFFIC

	REVENUE PASSENGER ENPLANEMENTS				REVENUE PASSENGER MILES			
FISCAL YEAR	ATLANTIC (Mil)	LATIN AMERICA (Mil)	PACIFIC (Mil)	TOTAL INTERNATIONAL (Mil)	ATLANTIC (Bil)	LATIN AMERICA (Bil)	PACIFIC (Bil)	TOTAL INTERNATIONAL (Bil)
Historical								
2010	25	40	13	77	109	63	59	231
2015	25	52	14	90	107	83	71	261
2016	24	55	14	93	105	87	73	265
2017	25	58	14	97	106	90	75	271
2018	26	60	13	100	112	94	75	281
2019E	28	62	13	103	121	96	75	292
Forecast								
2020	30	63	14	106	130	97	77	304
2025	33	71	15	119	148	112	87	347
2030	37	87	17	141	169	139	98	406
2035	42	107	19	167	189	172	110	472
2040	46	130	21	197	211	211	123	545
Avg Annual Growth								
2010-19	1.4%	5.1%	0.3%	3.3%	1.2%	4.7%	2.7%	2.6%
2019-20	6.9%	0.7%	2.2%	2.6%	7.4%	1.2%	2.4%	4.1%
2020-30	2.3%	3.3%	2.3%	2.9%	2.7%	3.7%	2.5%	2.9%
2020-40	2.2%	3.7%	2.2%	3.1%	2.5%	4.0%	2.3%	3.0%

Source: Forms 41 and 298-C, U.S. Department of Transportation.

[1]Sum of U.S. Mainline and Regional Air Carriers.

TABLE 8

U.S. AND FOREIGN FLAG CARRIERS

TOTAL PASSENGER TRAFFIC TO/FROM THE UNITED STATES

	TOTAL PASSENGERS BY WORLD TRAVEL AREA (Millions)				
CALENDAR YEAR	ATLANTIC	LATIN AMERICA	PACIFIC	U.S./CANADA TRANSBORDER	TOTAL
Historical					
2010	56	53	27	22	158
2015	70	75	36	27	207
2016	75	79	39	28	220
2017	79	82	41	29	232
2018	85	86	42	31	244
2019E	88	88	44	32	252
Forecast					
2020	91	91	45	32	259
2025	104	102	55	37	298
2030	123	124	66	44	357
2035	143	150	78	51	422
2040	164	182	90	60	496
Avg Annual Growth					
2010-19	5.2%	5.8%	5.5%	4.2%	5.3%
2019-20	3.1%	2.9%	3.1%	2.5%	2.9%
2020-30	3.1%	3.2%	3.9%	3.1%	3.3%
2020-40	3.0%	3.5%	3.5%	3.2%	3.3%

Source: US Customs & Border Protection data processed and released by Department of Commerce; data also received from Transport Canada.

TABLE 9

U.S. COMMERCIAL AIR CARRIERS' FORECAST ASSUMPTIONS[1]

SEATS PER AIRCRAFT MILE AND PASSENGER TRIP LENGTH

	AVERAGE SEATS PER AIRCRAFT MILE			AVERAGE PASSENGER TRIP LENGTH		
FISCAL YEAR	DOMESTIC (Seats/Mile)	INTERNATIONAL (Seats/Mile)	SYSTEM (Seats/Mile)	DOMESTIC (Miles)	INTERNATIONAL (Miles)	SYSTEM (Miles)
Historical						
2010	121.8	216.4	139.7	874.8	2,988.0	1,104.2
2015	131.5	214.8	149.0	902.7	2,892.6	1,131.0
2016	134.8	214.8	151.5	913.2	2,833.8	1,132.2
2017	137.8	217.2	154.3	918.9	2,798.6	1,135.6
2018	139.9	219.1	156.2	921.9	2,820.1	1,136.7
2019E	141.2	221.6	157.5	924.9	2,821.4	1,138.9
Forecast						
2020	141.9	222.8	158.1	927.4	2,861.2	1,140.4
2025	145.0	225.4	161.6	940.0	2,904.6	1,160.3
2030	147.7	226.6	164.8	952.7	2,873.2	1,180.6
2035	150.3	227.5	167.7	965.4	2,821.2	1,199.5
2040	152.8	228.6	170.6	978.4	2,768.0	1,218.4

Source: Forms 41 and 298-C, U.S. Department of Transportation.

[1]Sum of U.S. Mainline and Regional Air Carriers.

TABLE 10

U. S. MAINLINE AIR CARRIERS

SCHEDULED PASSENGER TRAFFIC

	REVENUE PASSENGER ENPLANEMENTS (Millions)			REVENUE PASSENGER MILES (Billions)		
FISCAL YEAR	DOMESTIC	INTERNATIONAL	SYSTEM	DOMESTIC	INTERNATIONAL	SYSTEM
Historical						
2010	473	75	548	480	230	710
2015	543	87	630	556	259	815
2016	575	90	665	590	262	852
2017	595	93	689	612	269	881
2018	627	96	723	645	279	924
2019E	654	100	754	674	290	963
Forecast						
2020	690	103	792	712	301	1,014
2025	760	116	876	795	344	1,139
2030	844	137	981	894	403	1,297
2035	932	163	1,095	1,000	469	1,469
2040	1,023	192	1,214	1,111	541	1,652
Avg Annual Growth						
2010-19	3.7%	3.3%	3.6%	3.8%	2.6%	3.4%
2019-20	5.5%	2.6%	5.1%	5.7%	4.1%	5.2%
2020-30	2.0%	2.9%	2.2%	2.3%	2.9%	2.5%
2020-40	2.0%	3.2%	2.2%	2.2%	3.0%	2.5%

Source: Form 41, U.S. Department of Transportation.

TABLE 11

U.S. MAINLINE AIR CARRIERS

SCHEDULED PASSENGER CAPACITY, TRAFFIC, AND LOAD FACTORS

	DOMESTIC			INTERNATIONAL			SYSTEM		
FISCAL YEAR	ASMs (BIL)	RPMs (BIL)	% LOAD FACTOR	ASMs (BIL)	RPMs (BIL)	% LOAD FACTOR	ASMs (BIL)	RPMs (BIL)	% LOAD FACTOR
Historical									
2010	581	480	82.7	279	230	82.2	860	710	82.5
2015	653	556	85.1	321	259	80.8	973	815	83.7
2016	692	590	85.3	325	262	80.7	1,017	852	83.8
2017	718	612	85.2	331	269	81.1	1,049	881	83.9
2018	756	645	85.3	342	279	81.6	1,098	924	84.1
2019E	785	674	85.8	349	290	83.0	1,134	963	84.9
Forecast									
2020	828	712	86.0	363	301	83.0	1,192	1,014	85.1
2025	917	795	86.7	415	344	83.0	1,332	1,139	85.6
2030	1,026	894	87.2	486	403	83.0	1,511	1,297	85.8
2035	1,144	1,000	87.4	565	469	83.0	1,709	1,469	85.9
2040	1,268	1,111	87.6	652	541	83.0	1,920	1,652	86.0
Avg Annual Growth									
2010-19	3.4%	3.8%		2.5%	2.6%	0.1%	3.1%	3.4%	
2019-20	5.5%	5.7%		4.1%	4.1%	0.0%	5.1%	5.2%	
2020-30	2.2%	2.3%		2.9%	2.9%	0.0%	2.4%	2.5%	
2020-40	2.2%	2.2%		3.0%	3.0%	0.0%	2.4%	2.5%	

Source: Form 41, U.S. Department of Transportation.

TABLE 12

U.S. MAINLINE AIR CARRIERS

SCHEDULED INTERNATIONAL PASSENGER ENPLANEMENTS

	REVENUE PASSENGER ENPLANEMENTS (MIL)			
FISCAL YEAR	ATLANTIC	LATIN AMERICA	PACIFIC	TOTAL
Historical				
2010	24.5	37.2	12.9	74.6
2015	24.6	48.6	14.0	87.2
2016	24.4	51.5	14.0	89.9
2017	24.8	54.7	13.9	93.5
2018	26.0	56.9	13.3	96.2
2019E	27.9	59.1	13.2	100.2
Forecast				
2020	29.8	59.5	13.5	102.8
2025	33.4	67.2	15.0	115.7
2030	37.4	82.7	16.9	137.1
2035	41.7	102.1	18.9	162.7
2040	46.3	124.6	21.0	191.9
Avg Annual Growth				
2010-19	1.4%	5.3%	0.3%	3.3%
2019-20	6.9%	0.6%	2.2%	2.6%
2020-30	2.3%	3.4%	2.3%	2.9%
2020-40	2.2%	3.8%	2.2%	3.2%

Source: Form 41, U.S. Department of Transportation.

TABLE 13

U.S. MAINLINE AIR CARRIERS

SCHEDULED PASSENGER CAPACITY, TRAFFIC, AND LOAD FACTORS

BY INTERNATIONAL TRAVEL REGIONS

	ATLANTIC			LATIN AMERICA			PACIFIC			INTERNATIONAL		
FISCAL YEAR	ASMs (BIL)	RPMs (BIL)	% LOAD FACTOR	ASMs (BIL)	RPMs (BIL)	% LOAD FACTOR	ASMs (BIL)	RPMs (BIL)	% LOAD FACTOR	ASMs (BIL)	RPMs (BIL)	% LOAD FACTOR
Historical												
2010	131	109	82.9	78	62	79.2	70	59	84.1	279	230	82.2
2015	133	107	80.0	101	81	80.3	86	71	82.5	321	259	80.8
2016	134	105	78.0	104	85	81.4	87	73	83.9	325	262	80.7
2017	134	106	79.5	107	88	82.3	91	75	82.2	331	269	81.1
2018	138	112	81.0	111	92	82.2	92	75	81.7	342	279	81.6
2019E	146	121	82.9	112	94	83.4	91	75	82.6	349	290	83.0
Forecast												
2020	156	130	82.9	113	95	83.4	94	77	82.6	363	301	83.0
2025	179	148	82.9	131	109	83.4	105	87	82.6	415	344	83.0
2030	203	169	82.9	163	136	83.4	119	98	82.6	486	403	83.0
2035	228	189	82.9	203	169	83.4	133	110	82.6	565	469	83.0
2040	255	211	82.9	249	207	83.4	149	123	82.6	652	541	83.0
Avg Annual Growth												
2010-19	1.2%	1.2%		4.1%	4.7%		2.9%	2.7%		2.5%	2.6%	
2019-20	7.4%	7.4%		1.1%	1.1%		2.4%	2.4%		4.1%	4.1%	
2020-30	2.7%	2.7%		3.7%	3.7%		2.5%	2.5%		2.9%	2.9%	
2020-40	2.5%	2.5%		4.0%	4.0%		2.3%	2.3%		3.0%	3.0%	

Source: Form 41, U.S. Department of Transportation.

TABLE 14

U.S. MAINLINE AIR CARRIER FORECAST ASSUMPTIONS

SEATS PER AIRCRAFT MILE

		INTERNATIONAL				
FISCAL YEAR	DOMESTIC (Seats/Mile)	ATLANTIC (Seats/Mile)	LATIN AMERICA (Seats/Mile)	PACIFIC (Seats/Mile)	TOTAL (Seats/Mile)	SYSTEM (Seats/Mile)
Historical						
2010	152.0	231.7	171.7	287.2	220.9	169.2
2015	157.7	237.0	173.9	272.1	219.5	173.8
2016	159.9	241.7	174.1	266.6	219.8	175.1
2017	162.3	243.4	176.4	267.5	221.8	177.3
2018	164.2	247.5	178.1	265.2	223.2	178.9
2019E	166.1	251.6	178.1	269.9	225.7	180.8
Forecast						
2020	166.7	252.1	178.6	270.6	226.9	181.4
2025	169.6	254.6	181.1	274.4	229.4	184.6
2030	172.0	257.1	183.6	278.1	230.4	187.2
2035	174.1	259.6	186.1	281.9	231.1	189.6
2040	176.2	262.1	188.6	285.6	232.0	191.9

Source: Form 41, U.S. Department of Transportation.

TABLE 15

U.S. MAINLINE AIR CARRIER FORECAST ASSUMPTIONS

AVERAGE PASSENGER TRIP LENGTH

		INTERNATIONAL				
FISCAL YEAR	DOMESTIC (Miles)	ATLANTIC (Miles)	LATIN AMERICA (Miles)	PACIFIC (Miles)	TOTAL (Miles)	SYSTEM (Miles)
Historical						
2010	1,015	4,433	1,660	4,587	3,077	1,296
2015	1,023	4,336	1,669	5,080	2,969	1,292
2016	1,027	4,291	1,650	5,176	2,917	1,283
2017	1,028	4,278	1,602	5,373	2,875	1,279
2018	1,029	4,299	1,610	5,638	2,895	1,277
2019E	1,030	4,330	1,582	5,709	2,890	1,278
Forecast						
2020	1,033	4,352	1,590	5,721	2,933	1,280
2025	1,046	4,440	1,622	5,776	2,976	1,301
2030	1,059	4,502	1,642	5,816	2,938	1,322
2035	1,072	4,538	1,656	5,842	2,880	1,341
2040	1,086	4,561	1,664	5,854	2,821	1,360

Source: Form 41, U.S. Department of Transportation.

TABLE 16

U.S. MAINLINE AIR CARRIER FORECAST ASSUMPTIONS

PASSENGER YIELDS

	REVENUE PER PASSENGER MILE					
	DOMESTIC		INTERNATIONAL		SYSTEM	
FISCAL YEAR	CURRENT $ (Cents)	FY 2019 $ (Cents)	CURRENT $ (Cents)	FY 2019 $ (Cents)	CURRENT $ (Cents)	FY 2019 $ (Cents)
Historical						
2010	12.62	14.76	12.84	15.02	12.69	14.85
2015	14.79	15.89	14.16	15.21	14.59	15.67
2016	13.96	14.86	12.88	13.71	13.62	14.50
2017	13.91	14.51	12.90	13.46	13.60	14.19
2018	13.92	14.17	13.58	13.84	13.82	14.07
2019E	14.12	14.12	13.47	13.47	13.92	13.92
Forecast						
2020	14.15	13.87	13.66	13.38	14.00	13.72
2025	15.49	13.56	14.82	12.97	15.29	13.39
2030	17.09	13.36	16.14	12.61	16.79	13.13
2035	18.47	12.99	17.42	12.25	18.14	12.75
2040	19.98	12.62	18.78	11.86	19.58	12.37
Avg Annual Growth						
2010-19	1.3%	-0.5%	0.5%	-1.2%	1.0%	-0.7%
2019-20	0.2%	-1.8%	1.4%	-0.6%	0.6%	-1.5%
2020-30	1.9%	-0.4%	1.7%	-0.6%	1.8%	-0.4%
2020-40	1.7%	-0.5%	1.6%	-0.6%	1.7%	-0.5%

Source: Form 41, U.S. Department of Transportation.

TABLE 17

U.S. MAINLINE AIR CARRIER FORECAST ASSUMPTIONS

INTERNATIONAL PASSENGER YIELDS BY REGION

	REVENUE PER PASSENGER MILE							
	ATLANTIC		LATIN AMERICA		PACIFIC		TOTAL INTERNATIONAL	
FISCAL YEAR	CURRENT $ (Cents)	FY 2019 $ (Cents)	CURRENT $ (Cents)	FY 2019 $ (Cents)	CURRENT $ (Cents)	FY 2019 $ (Cents)	CURRENT $ (Cents)	FY 2019 $ (Cents)
Historical								
2010	12.73	14.90	13.33	15.60	12.50	14.63	12.84	15.02
2015	14.64	15.72	14.38	15.45	13.20	14.18	14.16	15.21
2016	13.83	14.72	12.72	13.54	11.69	12.45	12.88	13.71
2017	13.58	14.16	13.40	13.98	11.36	11.85	12.90	13.46
2018	14.38	14.65	14.13	14.39	11.73	11.94	13.58	13.84
2019E	14.04	14.04	14.20	14.20	11.63	11.63	13.47	13.47
Forecast								
2020	14.25	13.97	14.36	14.08	11.80	11.57	13.66	13.39
2025	15.54	13.63	15.42	13.52	12.84	11.26	14.82	12.99
2030	16.97	13.29	16.62	13.01	14.04	10.99	16.14	12.63
2035	18.40	12.96	17.74	12.49	15.25	10.74	17.42	12.27
2040	19.95	12.64	18.89	11.97	16.56	10.50	18.78	11.90
Avg Annual Growth								
2010-19	1.1%	-0.7%	0.7%	-1.0%	-0.8%	-2.5%	0.5%	-1.2%
2019-20	1.5%	-0.5%	1.2%	-0.8%	1.4%	-0.5%	1.4%	-0.5%
2020-30	1.8%	-0.5%	1.5%	-0.8%	1.8%	-0.5%	1.7%	-0.6%
2020-40	1.7%	-0.5%	1.4%	-0.8%	1.7%	-0.5%	1.6%	-0.6%

Source: Form 41, U.S. Department of Transportation.

TABLE 18

U.S. MAINLINE AIR CARRIER FORECAST ASSUMPTIONS

JET FUEL PRICES

	DOMESTIC		INTERNATIONAL		SYSTEM	
FISCAL YEAR	CURRENT $ (Cents)	FY 2019 $ (Cents)	CURRENT $ (Cents)	FY 2019 $ (Cents)	CURRENT $ (Cents)	FY 2019 $ (Cents)
Historical						
2010	219.19	256.45	220.12	257.55	219.49	256.81
2015	207.29	222.72	211.77	227.53	208.96	224.51
2016	146.17	155.61	147.01	156.51	146.47	155.93
2017	162.31	169.31	160.79	167.72	161.76	168.73
2018	206.63	210.47	208.42	212.29	207.29	211.14
2019E	205.66	205.66	207.81	207.81	206.62	206.62
Forecast						
2020	189.22	185.41	191.20	187.34	190.10	186.27
2025	212.93	186.42	215.16	188.36	213.93	187.29
2030	280.36	219.16	283.29	221.45	281.67	220.18
2035	316.82	222.80	320.13	225.12	318.30	223.83
2040	352.46	222.60	356.13	224.92	354.10	223.63
Avg Annual Growth						
2010-19	-0.7%	-2.4%	-0.6%	-2.4%	-0.7%	-2.4%
2019-20	-8.0%	-9.8%	-8.0%	-9.8%	-8.0%	-9.8%
2020-30	4.0%	1.7%	4.0%	1.7%	4.0%	1.7%
2020-40	3.2%	0.9%	3.2%	0.9%	3.2%	0.9%

Source: Form 41, U.S. Department of Transportation

TABLE 19

U.S. COMMERCIAL AIR CARRIERS

AIR CARGO REVENUE TON MILES[1, 2, 3]

	ALL-CARGO CARRIER RTMS (Millions)			PASSENGER CARRIER RTMS (Millions)			TOTAL RTMS (Millions)		
FISCAL YEAR	DOMESTIC	INT'L.	TOTAL	DOMESTIC	INT'L.	TOTAL	DOMESTIC	INT'L.	TOTAL
Historical									
2010	11,306	15,971	27,276	1,495	6,246	7,742	12,801	22,217	35,018
2015	11,636	16,359	27,995	1,455	6,277	7,733	13,091	22,636	35,727
2016	11,998	16,236	28,234	1,373	6,136	7,509	13,372	22,372	35,744
2017	13,062	17,587	30,649	1,579	6,958	8,537	14,641	24,545	39,186
2018	14,182	19,465	33,647	1,580	7,532	9,112	15,761	26,997	42,759
2019E	14,737	19,668	34,405	1,468	6,986	8,453	16,205	26,654	42,858
Forecast									
2020	15,020	20,953	35,973	1,485	7,346	8,831	16,505	28,300	44,804
2025	16,133	26,908	43,041	1,537	8,831	10,368	17,670	35,739	53,409
2030	18,301	35,050	53,350	1,677	10,743	12,420	19,978	45,792	65,771
2035	20,113	42,881	62,994	1,772	12,243	14,015	21,885	55,123	77,008
2040	22,018	51,143	73,161	1,862	13,562	15,424	23,880	64,705	88,585
Avg Annual Growth									
2010-19	3.0%	2.3%	2.6%	-0.2%	1.3%	1.0%	2.7%	2.0%	2.3%
2019-20	1.9%	6.5%	4.6%	1.2%	5.2%	4.5%	1.9%	6.2%	4.5%
2020-30	2.0%	5.3%	4.0%	1.2%	3.9%	3.5%	1.9%	4.9%	3.9%
2020-40	1.9%	4.6%	3.6%	1.1%	3.1%	2.8%	1.9%	4.2%	3.5%

Source: Form 41, U.S. Department of Transportation

[1]Includes freight/express and mail revenue ton miles on mainline air carriers and regionals/commuters.

[2]Domestic figures from 2000 through 2002 exclude Airborne Express, Inc.; international figures for 2003 and beyond include new reporting of contract service by U.S. carriers for foreign flag carriers.

[3]Domestic figures from 2003 and beyond include Airborne Express. Inc.

TABLE 20

U.S. COMMERCIAL AIR CARRIERS

INTERNATIONAL AIR CARGO REVENUE TON MILES BY REGION[1, 2]

FISCAL YEAR	ATLANTIC (MILLIONS)	LATIN AMERICA (MILLIONS)	PACIFIC (MILLIONS)	OTHER INTERNATIONAL (MILLIONS)	TOTAL (MILLIONS)
Historical					
2010	6,786	1,990	7,897	5,545	22,217
2015	6,627	1,639	9,018	5,352	22,636
2016	6,639	1,565	8,851	5,316	22,372
2017	7,061	1,689	9,939	5,857	24,545
2018	7,554	1,846	10,422	7,176	26,997
2019E	7,426	1,663	10,429	7,135	26,654
Forecast					
2020	7,894	1,640	11,124	7,642	28,300
2025	9,318	1,644	14,403	10,374	35,739
2030	11,052	1,867	18,754	14,119	45,792
2035	12,833	2,031	22,947	17,312	55,123
2040	14,591	2,143	27,619	20,352	64,705
Avg Annual Growth					
2010-19	1.0%	-2.0%	3.1%	2.8%	2.0%
2019-20	6.3%	-1.4%	6.7%	7.1%	6.2%
2020-30	3.4%	1.3%	5.4%	6.3%	4.9%
2020-40	3.1%	1.3%	4.7%	5.0%	4.2%

Source: Form 41, U.S. Department of Transportation

[1]Includes freight/express and mail revenue ton miles on mainline air carriers and regionals/commuters.

[2]Figures for 2003 and beyond include new reporting of contract service by U.S. carriers for foreign flag carriers.

TABLE 21

U.S. MAINLINE AIR CARRIERS

PASSENGER JET AIRCRAFT

	LARGE NARROWBODY				LARGE WIDEBODY						
CALENDAR YEAR	2 ENGINE	3 ENGINE	4 ENGINE	TOTAL	2 ENGINE	3 ENGINE	4 ENGINE	TOTAL	LARGE JETS	REGIONAL JETS	TOTAL JETS
Historical											
2010	3,120	8	1	3,129	470	9	43	522	3,651	71	3,722
2015	3,319	2	0	3,321	492	0	31	523	3,844	99	3,943
2016	3,457	2	0	3,459	490	0	27	517	3,976	97	4,073
2017	3,539	1	0	3,540	517	0	0	517	4,057	98	4,155
2018	3,678	0	0	3,678	541	0	0	541	4,219	98	4,317
2019E	3,775	0	0	3,775	553	0	0	553	4,328	60	4,388
Forecast											
2020	3,706	0	0	3,706	516	0	0	516	4,222	60	4,282
2025	3,723	0	0	3,723	527	0	0	527	4,250	60	4,310
2030	3,799	0	0	3,799	607	0	0	607	4,406	52	4,458
2035	4,126	0	0	4,126	702	0	0	702	4,828	16	4,844
2040	4,505	0	0	4,505	805	0	0	805	5,310	0	5,310
Avg Annual Growth											
2010-19	2.1%	-100.0%	N/A	2.1%	1.8%	N/A	-100.0%	0.6%	1.9%	-1.9%	1.8%
2019-20	-1.8%	N/A	N/A	-1.8%	-6.7%	N/A	N/A	-6.7%	-2.4%	0.0%	-2.4%
2020-30	0.2%	N/A	N/A	0.2%	1.6%	N/A	N/A	1.6%	0.4%	-1.4%	0.4%
2020-40	1.0%	N/A	N/A	1.0%	2.2%	N/A	N/A	2.2%	1.2%	-99.9%	1.1%

TABLE 22

U.S. MAINLINE AIR CARRIERS

CARGO JET AIRCRAFT

	LARGE NARROWBODY				LARGE WIDEBODY				
CALENDAR YEAR	2 ENGINE	3 ENGINE	4 ENGINE	TOTAL	2 ENGINE	3 ENGINE	4 ENGINE	TOTAL	TOTAL
Historical									
2010	153	104	31	288	265	200	97	562	850
2015	228	22	2	252	309	156	72	537	789
2016	235	19	2	256	328	149	77	554	810
2017	243	16	2	261	360	149	85	594	855
2018	213	11	2	226	392	120	100	612	838
2019E	216	10	2	228	419	120	112	651	879
Forecast									
2020	224	11	2	237	440	118	111	669	906
2025	258	6	2	266	547	113	123	783	1,049
2030	346	0	0	346	729	112	122	963	1,309
2035	398	0	0	398	920	103	114	1,137	1,535
2040	457	0	0	457	1,223	17	94	1,334	1,791
Avg Annual Growth									
2010-19	3.9%	-22.9%	N/A	-2.6%	5.2%	-5.5%	1.6%	1.6%	0.4%
2019-20	3.7%	10.0%	N/A	3.9%	5.0%	-1.7%	-0.9%	2.8%	3.1%
2020-30	4.4%	N/A	N/A	3.9%	5.2%	-0.5%	0.9%	3.7%	3.7%
2020-40	3.6%	N/A	N/A	3.3%	5.2%	-9.2%	-0.8%	3.5%	3.5%

TABLE 23

TOTAL JET FUEL AND AVIATION GASOLINE FUEL CONSUMPTION

U.S. CIVIL AVIATION AIRCRAFT

(Millions of Gallons)

	JET FUEL					AVIATION GASOLINE			
	U.S. AIR CARRIERS[1, 2]								
FISCAL YEAR	DOMESTIC	INT'L.	TOTAL	GENERAL AVIATION	TOTAL	AIR CARRIER	GENERAL AVIATION	TOTAL	TOTAL FUEL CONSUMED
Historical									
2010	12,036	6,315	18,351	1,435	19,786	2	221	223	20,009
2015	12,834	6,541	19,374	1,383	20,757	2	196	198	20,955
2016	13,441	6,467	19,699	1,437	21,136	2	206	208	21,345
2017	13,868	6,668	20,535	1,541	22,076	2	206	208	22,285
2018	14,553	7,121	21,674	1,820	23,494	2	232	234	23,728
2019E	14,598	7,043	21,641	1,879	23,521	2	231	233	23,754
Forecast									
2020	15,247	7,260	22,507	1,934	24,441	2	230	232	24,673
2025	16,069	7,884	23,953	2,152	26,105	2	218	220	26,325
2030	17,117	8,777	25,894	2,354	28,248	2	211	213	28,460
2035	18,186	9,711	27,896	2,519	30,416	2	206	208	30,623
2040	19,195	10,667	29,862	2,689	32,551	2	205	207	32,758
Avg Annual Growth									
2010-19	2.2%	1.2%	1.8%	3.0%	1.9%	0.0%	0.5%	0.5%	1.9%
2019-20	4.4%	3.1%	4.0%	2.9%	3.9%	0.0%	-0.8%	-0.8%	3.9%
2020-30	1.2%	1.9%	1.4%	2.0%	1.5%	0.0%	-0.9%	-0.9%	1.4%
2020-40	1.2%	1.9%	1.4%	1.7%	1.4%	0.0%	-0.6%	-0.6%	1.4%

Source: Air carrier jet fuel, Form 41, U.S. Department of Transportation; all others, FAA APO estimates.

[1]Includes both passenger (mainline and regional air carrier) and cargo carriers.

[2]Forecast assumes 1.0% annual improvement in available seat miles per gallon for U.S. Commercial Air Carrier

TABLE 24

U.S. REGIONAL CARRIER FORECAST ASSUMPTIONS

	AVERAGE SEATS PER AIRCRAFT MILE			AVERAGE PASSENGER TRIP LENGTH			REVENUE PER PASSENGER MILE**	
FISCAL YEAR	DOMESTIC (Seats/Mile)	INT'L (Seats/Mile)	TOTAL (Seats/Mile)	DOMESTIC (Miles)	INT'L. (Miles)	TOTAL (Miles)	CURRENT $ (Cents)	2018 $ (Cents)
Historical								
2010	56.1	53.2	56.0	464	503	465	15.74	18.41
2015	59.9	62.6	60.0	475	695	480	10.93	11.74
2016	61.5	68.9	61.8	481	723	487	11.31	12.04
2017	63.0	70.8	63.2	482	718	487	11.30	11.79
2018	63.8	70.8	64.0	487	680	491	11.32	11.53
2019E	64.3	70.8	64.4	492	685	496	11.50	11.50
Forecast								
2020	64.9	71.1	65.0	494	688	498	11.53	11.29
2025	67.5	72.6	67.6	504	703	508	12.61	11.04
2030	70.0	74.1	70.1	515	717	519	13.90	10.87
2035	72.6	75.6	72.7	525	731	529	15.02	10.57
2040	75.4	77.1	75.4	535	746	539	16.24	10.26
Avg Annual Growth								
2010-19	1.5%	3.2%	1.6%	0.7%	3.5%	0.7%	-3.4%	-5.1%
2019-20	1.0%	0.4%	0.9%	0.4%	0.4%	0.4%	0.2%	-1.8%
2020-30	0.8%	0.4%	0.8%	0.4%	0.4%	0.4%	1.9%	-0.4%
2020-40	0.8%	0.4%	0.7%	0.4%	0.4%	0.4%	1.7%	-0.5%

Source: Form 41 and 298C, U.S. Department of Transportation.

** Reporting carriers.

TABLE 25

U.S. REGIONAL CARRIERS

SCHEDULED PASSENGER TRAFFIC

(In Millions)

	REVENUE PASSENGERS			REVENUE PASSENGER MILES		
FISCAL YEAR	DOMESTIC	INTERNATIONAL	TOTAL	DOMESTIC	INTERNATIONAL	TOTAL
Historical						
2010	162	3	164	75,030	1,347	76,377
2015	153	3	156	72,754	2,116	74,870
2016	152	4	155	72,964	2,564	75,527
2017	149	3	152	71,715	2,468	74,183
2018	154	3	157	74,886	2,295	77,181
2019E	159	3	163	78,499	2,211	80,709
Forecast						
2020	168	3	172	83,110	2,341	85,450
2025	185	4	189	93,361	2,629	95,990
2030	205	4	209	105,564	2,973	108,537
2035	227	5	231	118,971	3,351	122,321
2040	249	5	254	133,046	3,747	136,793
Avg Annual Growth						
2010-19	-0.2%	2.1%	-0.1%	0.5%	5.7%	0.6%
2019-20	5.4%	5.4%	5.4%	5.9%	5.9%	5.9%
2020-30	2.0%	2.0%	2.0%	2.4%	2.4%	2.4%
2020-40	2.0%	2.0%	2.0%	2.4%	2.4%	2.4%

Source: Form 41 and 298C, U.S. Department of Transportation.

TABLE 26

U.S. REGIONAL CARRIERS

SCHEDULED PASSENGER CAPACITY, TRAFFIC, AND LOAD FACTORS

	DOMESTIC			INTERNATIONAL			TOTAL		
YEAR	ASMs (MIL)	RPMs (MIL)	% LOAD FACTOR	ASMs (MIL)	RPMs (MIL)	% LOAD FACTOR	ASMs (MIL)	RPMs (MIL)	% LOAD FACTOR
Historical									
2010	98,461	75,030	76.2	1,857	1,347	72.5	100,318	76,377	76.1
2015	90,681	72,754	80.2	2,819	2,116	75.0	93,500	74,870	80.1
2016	91,158	72,964	80.0	3,519	2,564	72.8	94,677	75,527	79.8
2017	90,938	71,715	78.9	3,380	2,468	73.0	94,317	74,183	78.7
2018	93,924	74,886	79.7	3,023	2,295	75.9	96,947	77,181	79.6
2019E	98,259	78,499	79.9	2,933	2,211	75.4	101,192	80,709	79.8
Forecast									
2020	103,793	83,110	80.1	3,098	2,341	75.5	106,891	85,450	79.9
2025	115,736	93,361	80.7	3,455	2,629	76.1	119,191	95,990	80.5
2030	130,373	105,564	81.0	3,892	2,973	76.4	134,265	108,537	80.8
2035	146,604	118,971	81.2	4,376	3,351	76.6	150,980	122,321	81.0
2040	163,703	133,046	81.3	4,887	3,747	76.7	168,590	136,793	81.1
Avg Annual Growth									
2010-19	0.0%	0.5%		5.2%	5.7%	0.4%	0.1%	0.6%	
2019-20	5.6%	5.9%		5.6%	5.9%	0.2%	5.6%	5.9%	
2020-30	2.3%	2.4%		2.3%	2.4%	0.1%	2.3%	2.4%	
2020-40	2.3%	2.4%		2.3%	2.4%	0.1%	2.3%	2.4%	

Source: Form 41 and 298C, U.S. Department of Transportation.

TABLE 27

U.S. REGIONAL CARRIERS

PASSENGER AIRCRAFT

	REGIONAL AIRCRAFT											
				31 TO 40 SEATS			OVER 40 SEATS			TOTAL FLEET		
AS OF JANUARY 1	LESS THAN 9 SEATS	10 TO 19 SEATS	20 TO 30 SEATS	PROP	JET	TOTAL	PROP	JET	TOTAL	NON JET	JET	TOTAL
Historical												
2010	440	92	82	144	28	172	99	1,728	1,827	857	1,756	2,613
2015	346	68	13	32	0	32	57	1,628	1,685	516	1,628	2,144
2016	390	55	13	59	0	59	40	1,637	1,677	557	1,637	2,194
2017	367	65	19	26	0	26	65	1,644	1,709	542	1,644	2,186
2018	360	77	20	11	3	14	54	1,795	1,849	522	1,798	2,320
2019E	374	72	19	11	0	11	39	1,846	1,885	515	1,846	2,361
Forecast												
2020	347	67	18	10	0	10	44	1,876	1,920	486	1,876	2,362
2025	269	52	14	8	0	8	59	1,915	1,974	402	1,915	2,317
2030	194	37	10	6	0	6	67	1,848	1,915	314	1,848	2,162
2035	116	22	6	3	0	3	74	2,001	2,075	221	2,001	2,222
2040	34	6	2	1	0	1	85	2,192	2,277	128	2,192	2,320
Avg Annual Growth												
2010-19	-1.8%	-2.7%	-15.0%	-24.9%	N/A	-26.3%	-9.8%	0.7%	0.3%	-5.5%	0.6%	-1.1%
2019-20	-7.3%	-6.9%	N/A	-9.1%	N/A	-9.1%	12.8%	1.6%	1.9%	-5.7%	1.6%	0.0%
2020-30	-5.7%	-5.8%	N/A	-5.0%	N/A	-5.0%	4.3%	-0.2%	0.0%	-4.3%	-0.2%	-0.9%
2020-40	-11.0%	-11.4%	N/A	-10.9%	N/A	-10.9%	3.3%	0.8%	0.9%	-6.5%	0.8%	-0.1%

TABLE 28

ACTIVE GENERAL AVIATION AND AIR TAXI AIRCRAFT

	FIXED WING						ROTORCRAFT						TOTAL		
		PISTON		TURBINE									GENERAL		
AS OF DEC. 31	SINGLE ENGINE	MULTI-ENGINE	TOTAL	TURBO PROP	TURBO JET	TOTAL	PISTON	TURBINE	TOTAL	EXPERI-MENTAL**	LIGHT SPORT AIRCRAFT**	OTHER	AVIATION FLEET	TOTAL PISTONS	TOTAL TURBINES
Historical*															
2010	139,519	15,900	155,419	9,369	11,484	20,853	3,588	6,514	10,102	24,784	6,528	5,684	223,370	159,007	27,367
2015	127,887	13,254	141,141	9,712	13,440	23,152	3,286	7,220	10,506	27,922	2,369	4,941	210,031	144,427	30,372
2016	129,652	12,986	142,638	9,779	13,751	23,530	3,344	7,233	10,577	27,585	2,478	4,986	211,794	145,982	30,763
2017	129,833	13,083	142,916	9,949	14,217	24,166	3,270	7,241	10,511	26,921	2,551	4,692	211,757	146,186	31,407
2018	130,179	12,861	143,040	9,925	14,596	24,521	3,082	6,907	9,989	27,531	2,554	4,114	211,749	146,122	31,428
2019E	129,535	12,800	142,335	9,965	15,035	25,000	3,130	7,035	10,165	27,725	2,700	4,410	212,335	145,465	32,035
Forecast															
2020	128,495	12,750	141,245	9,995	15,495	25,490	3,175	7,165	10,340	27,970	2,845	4,490	212,380	144,420	32,655
2025	122,245	12,485	134,730	10,230	17,760	27,990	3,405	7,820	11,225	29,365	3,545	4,545	211,400	138,135	35,810
2030	115,710	12,195	127,905	10,795	19,970	30,765	3,665	8,540	12,205	30,805	4,185	4,575	210,440	131,570	39,305
2035	109,600	11,900	121,500	11,530	22,035	33,565	3,940	9,305	13,245	32,245	4,810	4,595	209,960	125,440	42,870
2040	104,335	11,635	115,970	12,595	24,000	36,595	4,215	10,080	14,295	33,475	5,430	4,615	210,380	120,185	46,675
Avg Annual Growth															
2010-19	-0.8%	-2.4%	-1.0%	0.7%	3.0%	2.0%	-1.5%	0.9%	0.1%	1.3%	-9.3%	-2.8%	-0.6%	-1.0%	1.8%
2019-20	-0.8%	-0.4%	-0.8%	0.3%	3.1%	2.0%	1.4%	1.8%	1.7%	0.9%	5.4%	1.8%	0.0%	-0.7%	1.9%
2020-30	-1.0%	-0.4%	-1.0%	0.8%	2.6%	1.9%	1.4%	1.8%	1.7%	1.0%	3.9%	0.2%	-0.1%	-0.9%	1.9%
2020-40	-1.0%	-0.5%	-1.0%	1.2%	2.2%	1.8%	1.4%	1.7%	1.6%	0.9%	3.3%	0.1%	0.0%	-0.9%	1.8%

* Source: 2001-2010, 2012-2018, FAA General Aviation and Air Taxi Activity (and Avionics) Surveys.

**Experimental Light-sport category that was previously shown under Sport Aircraft is moved under Experimental Aircraft category, starting in 2012.

Note: An active aircraft is one that has a current registration and was flown at least one hour during the calendar year.

TABLE 29

ACTIVE GENERAL AVIATION AND AIR TAXI HOURS FLOWN

(In Thousands)

	FIXED WING												TOTAL		
	PISTON			TURBINE			ROTORCRAFT						GENERAL		
AS OF DEC. 31	SINGLE ENGINE	MULTI-ENGINE	TOTAL	TURBO PROP	TURBO JET	TOTAL	PISTON	TURBINE	TOTAL	EXPERI-MENTAL**	LIGHT SPORT AIRCRAFT**	OTHER	AVIATION FLEET	TOTAL PISTONS	TOTAL TURBINES
Historical*															
2010	12,161	1,818	13,979	2,325	3,375	5,700	794	2,611	3,405	1,226	311	181	24,802	14,773	8,311
2015	11,217	1,608	12,825	2,538	3,837	6,375	798	2,496	3,294	1,295	191	162	24,142	13,623	8,871
2016	11,865	1,683	13,548	2,708	3,847	6,554	780	2,348	3,128	1,224	187	193	24,834	14,328	8,902
2017	12,047	1,536	13,583	2,625	4,065	6,690	782	2,538	3,320	1,241	209	168	25,212	14,366	9,228
2018	12,092	1,694	13,785	2,736	4,592	7,328	601	2,322	2,922	1,153	187	131	25,506	14,386	9,650
2019E	12,030	1,670	13,700	2,774	4,810	7,584	621	2,394	3,015	1,195	209	150	25,853	14,321	9,978
Forecast															
2020	11,846	1,651	13,497	2,807	5,019	7,827	641	2,457	3,098	1,242	223	153	26,039	14,138	10,284
2025	10,881	1,598	12,479	2,956	5,945	8,901	738	2,756	3,494	1,363	292	156	26,684	13,218	11,657
2030	10,209	1,567	11,776	3,129	6,824	9,953	831	3,058	3,889	1,480	357	157	27,612	12,608	13,011
2035	9,770	1,550	11,321	3,344	7,592	10,936	923	3,362	4,285	1,598	424	159	28,723	12,244	14,298
2040	9,626	1,551	11,177	3,652	8,331	11,983	1,012	3,670	4,682	1,707	496	160	30,205	12,189	15,652
Avg Annual Growth															
2010-19	-0.1%	-0.9%	-0.2%	2.0%	4.0%	3.2%	-2.7%	-1.0%	-1.3%	-0.3%	-4.3%	-2.1%	0.5%	-0.3%	2.1%
2019-20	-1.5%	-1.1%	-1.5%	1.2%	4.4%	3.2%	3.2%	2.6%	2.7%	3.9%	6.5%	2.1%	0.7%	-1.3%	3.1%
2020-30	-1.5%	-0.5%	-1.4%	1.1%	3.1%	2.4%	2.6%	2.2%	2.3%	1.8%	4.8%	0.3%	0.6%	-1.1%	2.4%
2020-40	-1.0%	-0.3%	-0.9%	1.3%	2.6%	2.2%	2.3%	2.0%	2.1%	1.6%	4.1%	0.2%	0.7%	-0.7%	2.1%

* Source: 2001-2010, 2012-2018, FAA General Aviation and Air Taxi Activity (and Avionics) Surveys.

**Experimental Light-sport category that was previously shown under Sport Aircraft is moved under Experimental Aircraft category, starting in 2012.

Note: An active aircraft is one that has a current registration and was flown at least one hour during the calendar year.

TABLE 30

ACTIVE PILOTS BY TYPE OF CERTIFICATE, EXCLUDING STUDENT PILOTS*

AS OF DEC. 31	RECREA-TIONAL	SPORT PILOT	PRIVATE	COMMERCIAL	AIRLINE TRANSPORT	ROTOR-CRAFT ONLY	GLIDER ONLY	TOTAL LESS STUDENT PILOTS	INSTRUMENT RATED PILOTS[1]
Historical**									
2010	212	3,682	202,020	123,705	142,198	15,377	21,275	508,469	318,001
2015	190	5,482	170,718	101,164	154,730	15,566	19,460	467,310	304,329
2016	175	5,889	162,313	96,081	157,894	15,518	17,991	455,861	302,572
2017	153	6,097	162,455	98,161	159,825	15,355	18,139	460,185	306,652
2018	144	6,246	163,695	99,880	162,145	15,033	18,370	465,513	311,017
2019	127	6,467	161,105	100,863	164,947	14,248	19,143	466,900	314,168
Forecast									
2020	125	6,740	161,700	100,950	166,900	14,100	19,350	469,865	316,300
2025	110	8,110	157,900	100,800	171,100	14,500	20,050	472,570	322,700
2030	90	9,405	150,700	100,100	176,900	15,700	20,300	473,195	329,200
2035	70	10,615	144,500	99,300	183,400	17,000	20,450	475,335	335,300
2040	50	11,680	140,600	98,600	190,100	18,300	20,600	479,930	341,200
Avg Annual Growth									
2010-19	-5.5%	6.5%	-2.5%	-2.2%	1.7%	-0.8%	-1.2%	-0.9%	-0.1%
2019-20	-1.6%	4.2%	0.4%	0.1%	1.2%	-1.0%	1.1%	0.6%	0.7%
2020-30	-3.2%	3.4%	-0.7%	-0.1%	0.6%	1.1%	0.5%	0.1%	0.4%
2020-40	-4.5%	2.8%	-0.7%	-0.1%	0.7%	1.3%	0.3%	0.1%	0.4%

** Source: FAA U.S. Civil Airmen Statistics.

*Starting with April 2016, there is no expiration date on the new student pilot certificates. This generates a cumulative increase in the student pilot numbers and breaks the link between student pilot and private pilot or higher level certificates. Since there is no sufficient data yet to forecast the student certificates unter the new rule, student pilot forecast is suspended and excluded from this table.

[1]Instrument rated pilots should not be added to other categories in deriving total.

Note: An active pilot is a person with a pilot certificate and a valid medical certificate.

TABLE 31

GENERAL AVIATION AIRCRAFT FUEL CONSUMPTION

(In Millions of Gallons)

	FIXED WING								TOTAL FUEL CONSUMED		
	PISTON		TURBINE		ROTORCRAFT						
CALENDAR YEAR	SINGLE ENGINE	MULTI-ENGINE	TURBO PROP	TURBO JET	PISTON	TURBINE	EXPERI-MENTAL** / OTHER	LIGHT SPORT**	AVGAS	JET FUEL	TOTAL
Historical*											
2010	133	54	187	1,123	11	125	22	1	221	1,435	1,656
2015	128	40	191	1,063	10	128	15	1	196	1,383	1,578
2016	137	42	207	1,117	10	113	17	1	206	1,437	1,643
2017	138	41	198	1,204	10	139	16	1	206	1,541	1,747
2018	152	50	234	1,455	9	132	20	1	232	1,820	2,052
2019E	152	49	236	1,509	9	135	21	1	231	1,879	2,111
Forecast											
2020	149	48	239	1,558	9	137	22	1	230	1,934	2,164
2025	137	46	248	1,755	11	149	24	2	218	2,152	2,370
2030	127	44	259	1,936	12	160	26	2	211	2,354	2,565
2035	119	44	270	2,079	13	171	27	2	206	2,519	2,725
2040	115	44	287	2,225	14	177	29	3	205	2,689	2,894
Avg Annual Growth											
2010-19	1.5%	-1.1%	2.6%	3.3%	-2.1%	0.9%	-0.3%	-2.6%	0.5%	3.0%	2.7%
2019-20	-1.5%	-1.5%	1.2%	3.3%	3.2%	1.6%	4.2%	6.7%	-0.8%	2.9%	2.5%
2020-30	-1.6%	-0.8%	0.8%	2.2%	2.5%	1.5%	1.5%	4.4%	-0.9%	2.0%	1.7%
2020-40	-1.3%	-0.5%	0.9%	1.8%	2.3%	1.3%	1.4%	3.7%	-0.6%	1.7%	1.5%

*Source: FAA APO Estimates.

**Experimental Light-sport category that was previously shown under Sport Aircraft is moved under Experimental Aircraft category, starting in 2012.

Note: Detail may not add to total because of independent rounding.

TABLE 32

TOTAL COMBINED AIRCRAFT OPERATIONS AT AIRPORTS WITH FAA AND CONTRACT TRAFFIC CONTROL SERVICE

(In Thousands)

			GENERAL AVIATION			MILITARY				NUMBER OF TOWERS	
FISCAL YEAR	AIR CARRIER	AIR TAXI/ COMMUTER	ITINERANT	LOCAL	TOTAL	ITINERANT	LOCAL	TOTAL	TOTAL	FAA	CONTRACT
Historical											
2010	12,658	9,410	14,864	11,716	26,580	1,309	1,298	2,607	51,255	264	244
2015	13,755	7,895	13,887	11,691	25,579	1,292	1,203	2,495	49,724	264	252
2016	14,417	7,580	13,905	11,633	25,538	1,317	1,145	2,462	49,997	264	252
2017	15,047	7,180	13,839	11,732	25,571	1,326	1,200	2,526	50,325	264	253
2018	15,686	7,126	14,130	12,354	26,485	1,319	1,155	2,474	51,770	264	254
2019E	16,192	7,234	14,245	13,109	27,354	1,349	1,134	2,483	53,264	264	256
Forecast											
2020	16,869	7,423	14,412	13,600	28,013	1,350	1,136	2,486	54,790	264	256
2025	19,398	5,557	14,594	13,824	28,418	1,350	1,136	2,486	55,858	264	256
2030	21,389	5,840	14,780	14,055	28,835	1,350	1,136	2,486	58,550	264	256
2035	23,638	6,143	14,970	14,293	29,264	1,350	1,136	2,486	61,531	264	256
2040	25,995	6,462	15,166	14,539	29,705	1,350	1,136	2,486	64,648	264	256
Avg Annual Growth											
2010-19	2.8%	-2.9%	-0.5%	1.3%	0.3%	0.3%	-1.5%	-0.5%	0.4%		
2019-20	4.2%	2.6%	1.2%	3.7%	2.4%	0.0%	0.1%	0.1%	2.9%		
2020-30	2.4%	-2.4%	0.3%	0.3%	0.3%	0.0%	0.0%	0.0%	0.7%		
2020-40	2.2%	-0.7%	0.3%	0.3%	0.3%	0.0%	0.0%	0.0%	0.8%		

Source: FAA Air Traffic Activity.

TABLE 33

TOTAL TRACON OPERATIONS

(In Thousands)

FISCAL YEAR	AIR CARRIER	AIR TAXI/ COMMUTER	GENERAL AVIATION	MILITARY	OVERFLIGHT	TOTAL
Historical						
2010	12,576	8,667	10,839	2,054	4,851	38,987
2015	13,611	7,095	10,399	1,966	4,100	37,171
2016	14,292	6,893	10,289	1,979	4,260	37,713
2017	14,909	6,513	10,490	1,928	4,244	38,085
2018	15,519	6,495	10,805	1,954	4,115	38,888
2019E	16,014	6,600	10,960	1,946	3,706	39,227
Forecast						
2020	16,680	6,828	11,055	1,947	3,821	40,331
2025	19,183	4,658	11,179	1,947	3,869	40,835
2030	21,159	4,908	11,306	1,947	4,114	43,434
2035	23,391	5,177	11,436	1,947	4,389	46,339
2040	25,728	5,460	11,568	1,946	4,676	49,379
Avg Annual Growth						
2010-19	2.7%	-3.0%	0.1%	-0.6%	-2.9%	0.1%
2019-20	4.2%	3.4%	0.9%	0.0%	3.1%	2.8%
2020-30	2.4%	-3.2%	0.2%	0.0%	0.7%	0.7%
2020-40	2.2%	-1.1%	0.2%	0.0%	1.0%	1.0%

Source: FAA Air Traffic Activity.

TABLE 34

IFR AIRCRAFT HANDLED
AT FAA EN ROUTE TRAFFIC CONTROL CENTERS
(In Thousands)

	IFR AIRCRAFT HANDLED			
FISCAL YEAR	COMMERCIAL	GENERAL AVIATION	MILITARY	TOTAL
Historical				
2010	30,965	6,550	2,982	40,498
2015	33,116	7,007	1,795	41,918
2016	34,104	7,301	1,826	43,231
2017	34,665	7,428	1,765	43,858
2018	35,729	7,406	1,735	44,870
2019E	35,781	6,309	1,645	43,734
Forecast				
2020	37,059	6,298	1,525	44,882
2025	38,489	6,450	1,525	46,464
2030	42,340	6,610	1,525	50,475
2035	46,687	6,778	1,525	54,990
2040	51,236	6,955	1,525	59,716
Avg Annual Growth				
2010-19	1.6%	-0.4%	-6.4%	0.9%
2019-20	3.6%	-0.2%	-7.3%	2.6%
2020-30	1.3%	0.5%	0.0%	1.2%
2020-40	1.6%	0.5%	0.0%	1.4%

Source: FAA Air Traffic Activity