Failure to Act: Investment in Airports Takes Off, But Bumpy Skies Ahead

January 2021

Prepared by:
EBP US

Table of Contents

Preface

The American Society of Civil Engineers (ASCE) 2020-2021 Failure to Act study continues a series of prior studies which began in 2011. As in the previous studies, the purposes of the report are to provide an objective analysis of the economic implications of continuing "business-as-usual' investment spending on the nation's infrastructure by:

- Estimating the gap between what we are spending now and what we should be spending to bring our systems back to a state of good repair.
- Providing an analysis of the direct economic costs of current investment trends for transportation system users and transportation agency providers; and
- Presenting a macroeconomic analysis of those costs on the nation's households and businesses.

These findings will support ASCE in developing the 2021 *Report Card for America's Infrastructure* and to gauge the adequacy of current levels of investment in that infrastructure. ASCE publishes the *Report Card for America's Infrastructure* every four years and grades the current state of 17 national infrastructure categories on a school grading scale of "A" through "F." This report answers the question "So what?" In terms of economic performance, what does a "D" mean? What does a "B" mean?

The 2020-2021 Failure to Act update is a series of five reports that assess implications for the productivity of industries, national competitiveness, and effects on households given the present trends of infrastructure investment. Together these reports review 11 of the 17 categories addressed by the ASCE Report Card.

This report covers airports. Other Failure to Act reports address: water and wastewater delivery and treatment; energy generation, transmission and distribution, surface transportation, marine ports, and inland waterways. When reading this individual report, it is important to bear in mind that the impacts stated in any of these reports do not include compounding impacts from continuing current investment trends on the other infrastructure sectors. This is an especially important caveat concerning surface transportation access to and egress from airport, marine ports, and inland waterway ports. However, the final Failure to Act report will summarize and integrate the effects for all the preceding reports.

Objectives and Limitations of this Study

The purpose of this study is limited to presenting the economic consequences of continuing investment levels in the nation's airports on a trends-extended basis and is not intended to propose or imply prescriptive policy changes. This analysis explains the relationship between investment in the national airport system, and subsequent effects on the U.S. economy. Moreover, because our purpose in this study is to address the consequences of current investment trends, this study does not include the potential economic impacts of construction spending that would be required to, at least in part, address identified infrastructure investment gaps.

Economics in Pandemics: A Note on COVID-19

Arguably, there has been no sector in the U.S. economy more impacted by the COVID-19 pandemic than aviation. In April 2020, commercial passenger travel was 5% of the level seen in

April 2019. By October 2020, passenger volume rebounded to just 32% of October 2019. Federal support has so far kept a portion of employees on airline payroll, but passenger volumes aren't expected to rebound in the coming months. Conversely, cargo volumes have increased during the pandemic with the expansion of "e-commerce".

We do not yet know the intermediate or long-term future of air travel and the effects of COVID-19 on airports. In the past, disruptions such as 9/11 and the recession of 2008-2010 led to reductions in air travel, but volumes have bounced back to pre-disruption levels and then continued to increase. In the short-term, infrastructure needs for airports may change, including space needed for COVID-19 screenings before boarding and the expansion of cargo facilities as greater volumes of tonnage is overwhelming some airports.[1]

The analysis in this report relies on baseline data that predates the COVID-19 pandemic. Data sets and economic models generally lag one to three years behind the present, to allow for data collection, validation, and publication. As a result, economic modeling does not yet account for COVID-19 impacts. Thus, the key assumption for this study is that the aviation industry and demand for air travel will bounce back over the course of this 20-year analysis.

Many transportation planning concepts – from capacity investments to the introduction of new technologies – rely on future traffic growth forecasts. The COVID-19 pandemic is revealing that travel behaviors and transportation practices can dramatically change. For example, pandemic-related adjustments are demonstrating that virtual meetings can effectively reduce the need for frequent business travel. Meanwhile, the future of retailing will likely shift even more dramatically to e-commerce and air shipments.

The impacts of these pandemic-related changes on future air-travel patterns may be significant and sustained. An acceleration in telecommuting and e-commerce adoption may alter the dynamics of airport congestion from passenger travel to cargo, although we cannot be certain if these trends will continue to grow once the virus is behind us.

Finally, the COVID-19 pandemic is creating massive impacts on revenue streams, including the airport and airways trust fund, which supports the federal Airport Improvement Program for infrastructure projects as well as the FAA. The pandemic is also contributing to decreases in the collection of passenger facility charges (PFCs) that are also used in financing capital expenditures.

The pandemic has precipitated massive shifts in transportation demand, supply, and performance, particularly related to the speed and magnitude of trends that were already occurring or expected (such as exacerbating the growth of ecommerce and telecommuting). While it is impossible to say which changes will endure, approaches to planning transportation systems and investments may need rethinking, and/or the trends projected from this 2019 data may be delayed.

[1] As examples, see *The Loadstar: Making Sense of the Supply Chain,* May 2020 and *Air Cargo Parcel and Post Technology*, May 2020.

1. Introduction

This report presents the importance of capital investments for airports in the context of the U.S. economy. The national network of airports functions as gateways to long-distance markets that enable U.S. industries to purchase and sell goods across the nation and around the globe. Air transportation is an effective means of long-distance transport, particularly for high-value, low-weight goods or commodities that require just-in-time delivery. Manufacturing parts, perishable food, and electronics are frequently air shipped. Moreover, airports traditionally support travel for business meetings and personal travel. Overall, airports expand the reach of U.S. businesses, enhance the quality of life for our citizens, and support tourism across the nation. On that last note, U.S. airports have experienced an upsurge in low-cost carriers since our initial analysis in 2011, which has made air travel accessible to more people and has seriously tested congestion limits at airports.

The annual airport investment levels have varied significantly over the last 10 years. In 2011, investment – including federal sources, passenger facility charges, bonds, debt and other – totaled $11 billion, but funding levels dropped to less than $10 billion in 2013 and 2014. Over the past three years, total investments have risen to more than $15 billion annually. As will be discussed, the investment growth since 2014 has helped support U.S. economic performance.

The major sections of this report include:

1. An Overview of the U.S. Airport System
2. The Role of Airports in the U.S. Economy
3. A Review of Airport Capital Needs
4. Economic Impacts
5. Conclusions
6. Appendix

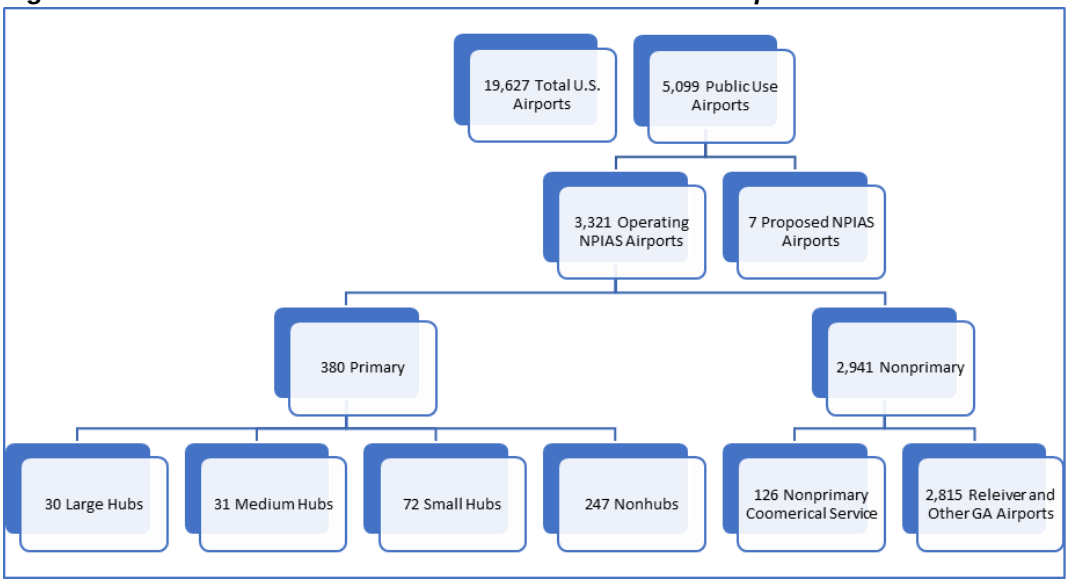
This report is based primarily on documentation of freight and air passenger movement from the Freight Analysis Framework (U.S. Federal Highway Administration), the Foreign Trade Division of the U.S. Census Bureau, the U.S. Bureau of Transportation Statistics, and the FAA. Data on the needs of airports were developed from data from the FAA, and Airports Council International-North America (ACI-NA). Economic analysis was conducted by EBP and the Interindustry Forecasting Project at the University of Maryland.

2. Overview of the U.S. Airport System

The U.S. aviation system includes almost 20,000 civilian airports, of which nearly 15,000 have restricted access and 5,087 are public use (open to the public).[2] About 81% of public use airports are publicly owned and 19% are privately owned.[3]

The FAA designates those public use airports that are important to the national system; these are included in the National Plan of Integrated Airport Systems (NPIAS) and are eligible to receive grant money under the FAA Airport Improvement Program (AIP). The NPIAS includes 3,328 airports (3,321 existing and 7 proposed), which account for 65% of the nation's public use airports. The remaining public use airports are not included in the NPIAS, either because they do not meet the minimum entry criteria, are located at inadequate sites, cannot be expanded or improved to provide a safe and efficient airport, or are located within 20 miles of another NPIAS airport. Figure 1 illustrates the composition of the U.S. system of airports.

Figure 1. Failure to Act: Current Investment Trends in Airports



Note: Seven airports are expected to be added to the NPIAS by 2023, including 2 primary airports, 2 nonprimary commercial service airports and 3 general aviation airports.
Source: FAA, National Plan of Integrated Airport Systems, 2019-2023, Report to Congress, October 2018.

Of the operating 3,321 NPIAS airports, 380 are classified as primary airports and 133 airports are designated as hub airports. An additional 126 airports are classified as non-primary commercial airports. These non-primary airports host commercial service of 2,500 to 9,999 passenger boarders per year, or 7 to 27 per day. Overall, primary airports account for 11%, and commercial service airports represent 15%, of operating NPIAS facilities.[4]

The 380 primary airports of the U.S. air system accommodate 99.8% of total enplaned passengers (73% attributed to large hub airports) and almost 36% of all aircraft operations (13%

2 U.S. DOT Bureau of Transportation Statistics (2018).

3 FAA NFDC Facility Database.

4 FAA, National Plan of Integrated Airport Systems (NPIAS), 2019-2023, Report to Congress, October 2018.

at large hub airports).[5] The proportion of travel through large hubs is expected to be relatively stable over the next 20 years. By 2039, the FAA projects that 75% of air carrier passengers will travel through the large hubs. Still, the (pre-COVID) expected growth rate of air carrier enplanements from 2020-2039 will be 51% at large hubs and 45% at all other airports.

It is important to note that the remaining 2,941 nonprimary airports in the NPIAS play an important role in the national airport system. A total of 580 national and regional airports are sited in urban areas and accommodate pilots in small aircraft separately from large commercial aircraft, offering Generation Aviation (GA) pilots with attractive alternatives to hub airports, providing access to nearby urban areas, and reducing congestion at commercial facilities.

The remaining GA airports largely serve populations outside of major metropolitan regions, including more than 1,000 airports in rural areas. These airports are often critical for air rescue, medical airlifts, support for agriculture, disaster relief operations, and other services that require fast response times. Given the multiple needs filled by GA airports, a federal policy objective is to ensure "as many people as possible" have access to air transportation, which generally means that most of the U.S. population be within 20 miles of a NPIAS airport. According to 2017 FAA estimates, 98.5% of the U.S. population lives within 20 miles of a NPIAS airport, with 72% living within 20 miles of a primary airport. Thus about 27% of the American public (almost 85 million people) rely on nonprimary airports for air connectivity.[6]

3. Role of Airports in the U.S. Economy

FAA and the U.S. Department of Transportation (USDOT), prior to the COVID-19 pandemic, predicted that air transportation would grow in volume for moving people and commodities both within the U.S. and between the U.S. and international markets. In 2019, the U.S. airport system accommodated over 922 million air carrier and commuter passenger enplanements, almost 100 million air operations (including those by air carrier, air taxi, commuter, military and general aviation) and moved 5.8 billion tons of cargo valued at $632 billion.[7] [8] By 2039, FAA predicts that the U.S. airport system will service 114 million takeoffs and landings, accommodate approximately 1.4 billon passengers, and move 21 billion tons of cargo.[9] [10]

3.1 Passenger Movement

The most recent FAA projections, published before the COVID-19 pandemic, estimated that the number of air travel passengers would increase by 48% from 2020 to 2039, and that GA operations would increase 7% from 2020 through 2039.[11]

COVID-19 has had a devastating effect on aviation. At this writing, it is not clear when passenger travel will return to 2019 levels and resume a growth trajectory. Therefore, in thinking

5 FAA NPIAS, 2019-2023.

6 NPIAS 2019-2023.

7 FAA, APO Terminal Area Forecast, issued January 2020, and pulled July 2020. Note historical data are through 2018 and data starting with 2019 are forecasted.

8 U.S. Department of Transportation, Freight Analysis Tabulation Tool, 2018, Freight Analysis Forecast (FAF), 2018 and extrapolated to 2019.

9 APO Terminal Area Forecast, January 2020.

10 U.S. Department of Transportation, Freight Analysis Tabulation Tool.

11 An itinerant operation is a flight that takes off from one airport and lands at another airport.

about a forecast, it might be reasonable to think in terms of 22-25 years to achieve this study's 20-year forecast based on trends through 2019. Table 1 shows growth that had been expected between 2019 and 2020 and projections to 2029 and 2039. Note, the robust growth in demand projected for commercial aviation indicates that investments will be required to maximize capacity on runways, in terminals, and for ground access. Improvements in all these aspects of airport operation imply combinations of investments in both facilities and in airport-related technologies. The GA system, on the other hand, appears to have a stable long-term future, which implies the need for facility modernization, upgrades, and maintenance/rehabilitation catch-up as opposed to general capacity expansion.

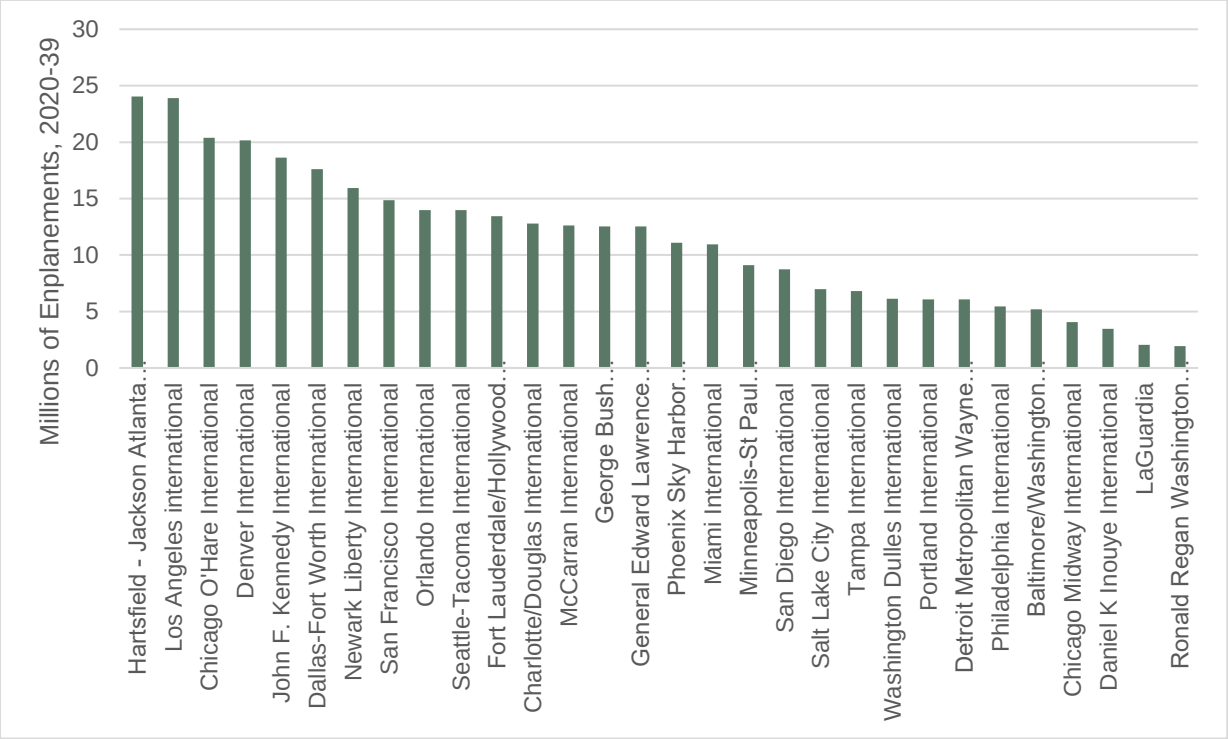
Table 1. Commercial Enplanements are Projected to Increase by 200,000 by 2029 and 500,000 by 2039

Type of Aviation	Growth Projected				Percent Change		
	2019	2020	2029	2039	2020 - 2029	2030 - 2039	2020 - 2039
Commercial Enplanements	922,624,258	967,184,383	1,165,065,046	1,429,915,818	20%	23%	48%
GA Operations	68,854,373	69,673,618	71,913,547	74,764,303	3%	4%	7%

Source: FAA, APO Terminal Area Forecast, issued January 2020, and pulled July 2020.

Passenger growth envisioned between 2020 and 2039 will be sustained by large hubs, which accounted for 71% of total national enplanements in 2019 and are expected to account for 74% of the total forecast increase. Overall, in the pre-COVID forecast, enplanements at the 32 large hubs were expended to increase by 50% over 20 years. Fort Lauderdale International Airport was expected to show the largest percentage increase at 71% and LaGuardia was expected to show the lowest increase at 12% (the other large hub airports in the New York market, JFK and Newark, were forecast to grow 60% and 67%, respectively). Percent gains are only one part of this story; the six largest hub airports were also predicted to see the largest gains in absolute growth in enplanements: Hartsfield-Jackson in Atlanta, Los Angeles International, O'Hare International in Chicago, JFK, Denver International, and Dallas-Fort Worth (see Figure 2).

Figure 2. Hartsfield-Jackson Airport and Los Angeles International Airports Forecast to See Largest Absolute Growth in Commercial Passenger Enplanements, 2020-2039



Source: FAA, APO Terminal Area Forecast, issued January 2020, and pulled July 2020.

3.2 2030 Selected Capacity Analysis

FAA's third Future Airport Capacity Task report (FACT3), published in 2015, is the most recent outlook of U.S. airport capacity.[12] The primary goal of FACT3 is to identify airports that are likely to need more capacity to service anticipated growth through 2030. The FACT3 research team analyzed conditions at 48 airports, including 30 large hub airports, other potentially constrained commercial service airports, and general aviation airports that can affect airspace and air traffic in multi-airport areas such as New York and Southern California.

As shown in Table 2, under the FACT 3 Improvement Scenario, nine airports were identified to need capacity in 2030 to meet previously projected demand. By 2030, the nine airports were anticipated to sustain roughly 1,600 hours of flight time congestion, split among arrivals and departures. Seventeen airports were flagged to be monitored for possible capacity constraints by 2030.[13]

[12] FAA, FACT3: Airport Capacity Needs in the National Airspace System, January 2015.

[13] Federal Aviation Administration, FACT 3: Airport Capacity Needs in the National Aerospace System, January 2015.

Table 2. Capacity Needs by 2030

Airports Needing Additional Capacity by 2030	Airports Experiencing Congestion to be Monitored
Hartsfield-Jackson Atlanta International	Boston Logan International
Charlotte Douglas International	Baltimore/Washington Thurgood Marshall International
Newark Liberty International	Washington Reagan National
George Bush Intercontinental/Houston	Denver International
John F. Kennedy International	Dallas Fort Worth International
McCarran International	Detroit International
LaGuardia	Washington Dulles International
Phoenix Sky Harbor International	Los Angeles International
San Francisco International	Orlando International
	Chicago Midway International
	Miami International
	Minneapolis-St. Paul International
	San Diego International
	Seattle-Tacoma International
	John Wayne Orange County
	Teterboro
	Tampa International

Source: FAA, FACT3: Airport Capacity Needs in the National Airspace System, January 2015.

Importantly, the report found that runway development continues to be critical to meet future growth in demand, even with the implementation of NextGen and associated performance improvements.

FACT3 findings are based on a 2030 Improvement Scenario that assumes implementation of all planned improvements with midterm implementation of NextGen. Importantly, FACT3 utilizes data that is now eight years old, meaning it fails to consider recent airline passenger growth and the impacts of that growth on future projections. Obviously, FACT3 also does not incorporate the effects of COVID-19. However, for an analysis based on 2019 conditions, the FACT3 findings provide an understatement of total investment needs.

3.3 Air Cargo

Goods moved by air include domestic production that is flown between U.S. markets, international imports, and international exports. Commodities that arrive at U.S. airports from domestic or international points of origination are either used in production processes, such as metal products used for manufacturing, or are consumer goods ready for final sale through retailers or wholesalers.

Air cargo represents the sale of products by U.S. businesses to long-distance domestic or international customers. Air cargo is the means that businesses can expand sales to long-distance markets when surface transportation is too time consuming or not practical, and purchase goods from extended supply chains in North America and around the world. The

recent explosion of web commerce through Amazon, Alibaba and similar companies has extended the convenience of air cargo to households around the U.S.

Table 3 shows the extent that commodities rely on air cargo in the U.S., accounting for tonnage shipped between domestic airports and international exports and imports. Electronics and machinery account for 18% and 12% of air cargo tonnage, respectively, followed by food and agricultural products and chemicals and pharmaceuticals, which account for 9% each.

Table 3. Electronics and Machinery Dominate Air Cargo Movement in the U.S.

Commodity Group	1000s of Tons	Percent of Total
Electronics	1011	18%
Machinery	673	12%
Food and agriculture products	530	9%
Chemicals and pharmaceuticals	501	9%
Metals	427	7%
Motorized vehicles	425	7%
Precision instruments	385	7%
Animal feed	329	6%
Textiles/leather	308	5%
Plastics/rubber	278	5%
Miscellaneous manufactured products	243	4%
Transport equipment	156	3%
Other (20 Commodities)	504	9%
Totals	**5,772**	**100%**

Note: As shown in this table, "Food and Agriculture Products" includes Other Agriculture Products, Meat and seafood, other foodstuffs, milled grain products, live animals and fish, cereal grains, and tobacco products. Chemicals and pharmaceuticals include chemical products, base chemicals, pharmaceuticals, and fertilizers. Source: U.S. Department of Transportation, Freight Analysis Tabulation Tool, 2018, Freight Analysis Forecast (FAF), 2018.

Air cargo shipments are concentrated in major metropolitan areas. Table 4 shows the 15 Customs Districts and 22 metropolitan areas though which at least 100,000 tons of international and domestic air cargo, respectively, were shipped in 2019. Note that air cargo activity is more concentrated for international shipments than domestic shipments, with 93% of international air cargo tonnage being imported or exported through the 15 major Customs Districts and 79% in the key metro markets. The leading air cargo centers include Alaska and Hawaii due to the long shipping distances required for international cargo, as well as the location of these two states as refueling stopovers.

Projections from the Freight Analysis Framework indicate the volume of air cargo will more than double from 2020 through 2039. The magnitude of these increases mirrors the rapid increase of e-commerce and rapid delivery services. For example, from 2011 through 2018, the U.S. Census documented increases of 133% in the value of e-commerce retail when adjusted to constant 2019 dollars, 33% in manufacturing, 39% in wholesale and 140% in electronic

shopping and mail order houses.[14] Although the most recent data are through 2018, it is clear that the trend continued through 2019 and has likely grown even more during the COVID-19 pandemic. Increases that approach the magnitude projected by FAF, and that echo current trends, will place more pressure on the air cargo centers identified in Table 4 domestic.

Table 4. International and Domestic Cargo Flows by Customs District and City Market

International Air Cargo			Domestic Air Cargo		
U.S. Customs District	**1000s of Metric Tons**	**Percent of Total**	**U.S. City Market**	**1000s of Metric Tons**	**Percent of Total**
Chicago, Il	1,176	15%	Memphis, TN	1,971	17%
New York City, NY	1,112	14%	Louisville, KY	1,302	11%
Los Angeles, CA	1,067	13%	Los Angeles, CA*	817	7%
Miami, Fl	926	12%	Anchorage, AK	786	7%
Cleveland, OH	695	9%	Cincinnati, OH	538	5%
New Orleans, LA	477	6%	Indianapolis, IN	429	4%
Savannah, GA	405	5%	New York City, NY*	405	4%
Dallas/Fort Worth, TX	309	4%	San Francisco, CA*	371	3%
San Francisco, CA	298	4%	Dallas/Fort Worth, TX	362	3%
Houston/Galveston, TX	207	3%	Chicago, IL	233	2%
Seattle, WA	159	2%	Philadelphia, PA	203	2%
Boston, MA	138	2%	Miami, FL*	201	2%
Philadelphia, PA	136	2%	Honolulu, HI	190	2%
Anchorage, AK	133	2%	Seattle, WA	178	2%
Washington, DC	112	1%	Phoenix, AZ	177	2%
Subtotal	7,352	93%	Rockford, IL	173	2%
Other (27 Districts)	584	7%	Atlanta, GA*	148	1%
TOTAL	**7,936**	**100%**	Washington, DC*	146	1%
			Boston, MA*	129	1%
			Portland, OR	116	1%
			Houston, TX	114	1%
			Denver, CO	109	1%
			Subtotal	9,094	79%
			Other (630 markets)	2,433	21%
			TOTAL	**11,527**	**100%**

[14] U.S. Department of Commerce, 2018 E-commerce Multi-sector Data Tables https://www.census.gov/data/tables/2018/econ/e-stats/2018-e-stats.html.

Note: International and domestic data cannot be added due to double counting if shipments between domestic points lead to, or result from, international cargo flights. Metro markets and customs districts may include multiple airports.
Sources: U.S. Census Bureau, Foreign Trade Division, aggregated by WISERTrade and the Bureau of Transportation Statistics, T-100 Domestic Cargo Database.

4 U.S. Airport Infrastructure Needs and Investment

FAA's most recent survey of NPIAS airports found capital needs for AIP-eligible projects of $35.1 billion between 2019 and 2023. However, these projections significantly underestimate total infrastructure needs because they exclude projects that are ineligible under the AIP grant program. These include improvements to terminal areas related to the movement of passengers and baggage that are leased by airlines, such as parking facilities, hangars, and cargo buildings. Infrastructure needs that are also excluded from the NPIAS survey include the revenue portions of passenger terminals such as concessions areas, some improvements to airport-serving highway and transit, airport-funded air traffic control facilities, and airport or TSA-funded security projects. The volume of passenger enplanements determines the need for terminal infrastructure, while volume of operations places demands on runway and supporting infrastructure.

Airports Council International-North America (ACI-NA), a private aviation industry organization, estimates airport capital needs averaging $25.6 billion annually (in current dollars) over the 2019-2023 period, for a total of $128.1 billion over the five years. ACI-NA derived these data from its periodic survey of airport operators on future airport infrastructure needs. In addition to including projects in the four categories noted above, the ACI-NA survey includes all projects whether or not they have an identified funding source and includes contingency costs (commonly included in project planning to provide for construction uncertainties).

Analysis reported by ACI-NA is that investment needs at large and medium-sized hubs, which have experienced accelerated growth in passengers and cargo in recent years, account for more than 77% of total needs. In terms of project type, terminal capacity and terminal access represent over half of airport infrastructure needs.

Another private industry group, the Airport Consultants Council, conducted its own airport capital needs survey using a slightly different methodology, and determined airport capital needs at $138 billion for the 2019-2023 period, which is within 8% of the ACI-NA estimate.

4.1 Capital Needs for Integrating Innovation

FAA and ACI-NA projections do not account for costs associated with the continued implementation of the air traffic control modernization program known as NextGen (Next Generation Air Transportation System); and costs associated with infrastructure needed to serve unmanned aerial vehicles (UAV), such as vertiports and unmanned traffic management (air traffic control for UAV). We estimate that NextGen will require an additional $11.1 billion during the 2019-2030 analysis period. However, the speculative nature of future UAV infrastructure needs makes it impossible to project a credible estimate of associated airport investment costs at this time.

NextGen Implementation

NextGen is the FAA-led modernization of the nation's air transportation system. It is a portfolio of safety and efficiency-oriented programs encompassing new air traffic management technologies and procedures, airport infrastructure improvements, and environmental, safety and security-related enhancements. In 2007, the FAA made an initial investment of $20.6 billion, which was complemented by $15.1 billion from the aviation industry, largely to update aircraft. Of the FAA's share, $16 billion was spent for facilities and equipment, $3.1 billion for operations, and $1.5 billion for research and development. As of 2020, ground systems are largely complete, particularly at larger airports. Remaining expenditures primarily consist of subsidies for aircraft modification, as well as completing ground systems at smaller airports.

A 2017 U.S. Government Accountability Office (GAO) review of NextGen implementation found that cost estimates were comparable with those originally projected in 2007, despite significant program changes such as the elimination of elements found to have low benefits relative to their costs, and the addition of elements such as Performance Based Navigation. The GAO reported that the FAA had received approximately $7.4 billion for NextGen during FY2004-2016 and that $5.8 billion had been spent through FY2014. Investments made so far represent approximately 28% of the total needed, with the remaining $14.8 billion occurring in FY2015-2030. This implies investment needs of approximately $925 million annually through 2030, for a total of $11.1 billion during our 2019-2039 analysis period (concluding approximately in 2030).

Infrastructure for Urban Air Mobility and Unmanned Aerial Vehicles

Technological advances in Unmanned Aerial Vehicles (UAV), along with growing road congestion in urban areas, have moved Urban Air Mobility (UAM) closer to reality for a wide range of commercial uses, including air taxi, air ambulance, and on-demand package delivery in urban areas, as well as improved rural connectivity such as same day prescription medication delivery to outlying areas. While the nature of the deployment of UAV is still conceptual, the market has been growing steadily in recent years. The FAA reports that more than 1.7 million UAVs are registered in the United States (as of November 2020), of which more than 500,000 are commercial drones and 1.2 million are registered for recreation.[15] A 2017 study indicated that the value of commercial drone activity (excluding military and intelligence applications) in the U.S. increased from $40 million in 2012 to about $1 billion in 2017. McKinsey & Company estimated that UAVs will have an annual impact on GDP of between $31 billion and $46 billion by 2026. This study estimates that the market for moving objects (packages) will mature over the next 5 to 10 years, while the market for moving people will mature 10 to 15 years in the future.[16]

While specific infrastructure needs are unknown at this point, and will largely depend on the technology of the vehicles themselves and how they are deployed, at very least widespread use of UAV will require an unmanned traffic management system (UTM), as well as physical infrastructure including:

- Vertiports and vertistops - specialized helipads to facilitate UAS landings and take-offs potentially with passenger boarding/disembarking areas

15 Federal Aviation Administration, By the Numbers, accessed November 28,2020. https://www.faa.gov/uas/resources/by_the_numbers/,

16 Pamela Cohn, Alastair Green, Meredith Langstaff, and Melanie Roller, "Commercial drones are here: The future of unmanned aerial systems." December 5, 2017 (https://www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/commercial-drones-are-here-the-future-of-unmanned-aerial-systems).

- Loading or storage facilities for package deliveries
- Charging stations - which could be in vertiports, vertistops, or low-cost docks

Currently, infrastructure needs are highly speculative and the role of the public sector relative to private sector investment has not been determined. The FAA and the National Aeronautics and Space Administration (NASA) are now collaborating to develop a plan to integrate UAV operations into the national aviation system.[17]

4.2 Estimating Airport Capital Needs Projections to 2039

Based on current assessments, annual infrastructure capital needs at airports will grow from $23.2 billion in 2020 to more than $32.7 billion by 2039 (in 2019 dollars), an increase of more than 40% during the 19-year period. The 5-year average for the 2019-2023 period was used as a baseline to which a future growth rate assumption was applied. The likely growth rate for the 2024-39 period was determined by studying historical growth rates in airport capital needs since 2011, as well as projected growth rates for passengers, enplanements, and cargo reported by FAA, and infrastructure construction cost projections.[18] [19] The FAA Reauthorization Act of 2018 allocated $21.1 billion for facilities and equipment for FY2018 through FY2023, for an average of $3.5 billion per year. This would result in an estimated gap of $19.7 billion to $29.2 billion annually between estimated airport capital needs and federal funding availability.

4.3 Airport Capital Investment

In the US, airport infrastructure is primarily funded through federal grants from the FAA Airport Improvement Program (AIP), Passenger Facility Charge (PFC, a user fee), and airport-generated revenue such as rents collected from concessions, parking, and other tenants. The PFC, created by the Congress in 1990, is a local user fee that an airport may use only to fund FAA-approved airport improvement projects. Originally set at $3 per flight segment, the federal government increased it to $4.50 per segment 20 years ago in 2000. The PFC is not indexed to inflation and has not been increased since then.

Commercial airports are required to report spending, including infrastructure investments, to FAA and this data is publicly available as far back as 2001. Actual expenditures, in inflation adjusted 2019 dollars, increased from $13.3 billion in 2001 to $15.5 billion in 2019. However, annual investments fluctuated widely during that period. Overall, funding for airports is not increasing. For example, investments in some years represented an increase of 11%, 14%, and even 22% over the previous year, while in other years they represented declines of 6%, 8% and as much as 17%. Above average investment in 2018 and 2019 occurred through supplemental appropriations.

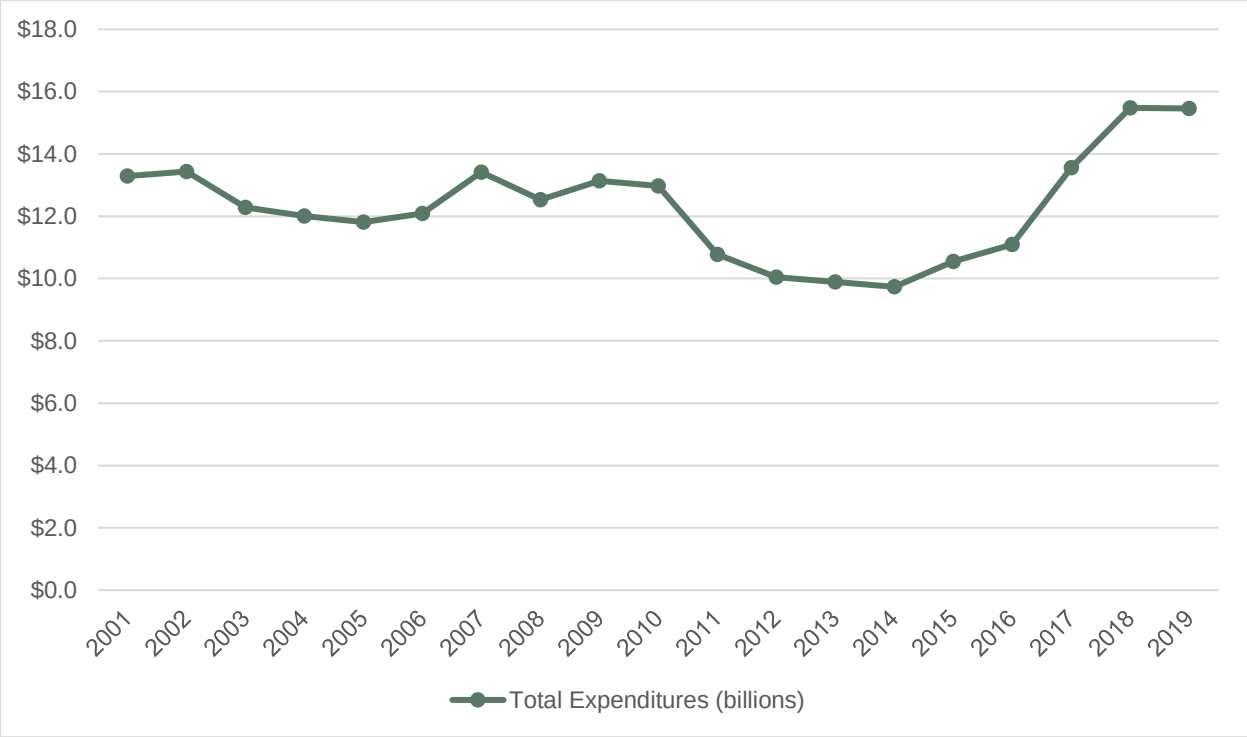
As illustrated in Figure 3, airport infrastructure investment has fluctuated over the past 18 years, particularly dipping in the years between 2009 and 2014, and then rising significantly through 2019. By 2016 and 2017, airport investments reached the levels seen before the investment decline in 2009. Overall, investments averaged about $12.3 billion annually over the last 18 years.

[17] Federal Aviation Administration, Research and Development, https://www.faa.gov/uas/research_development//

[18] Federal Aviation Administration, 2020-2040 Aerospace Forecast.

[19] ENR Construction Cost Index, reported by ACI-NA.

Figure 3. Annual Infrastructure Investments at Commercial Airports and % Change from Year to Year, 2001-2019



Source: FAA with EBP calculations.

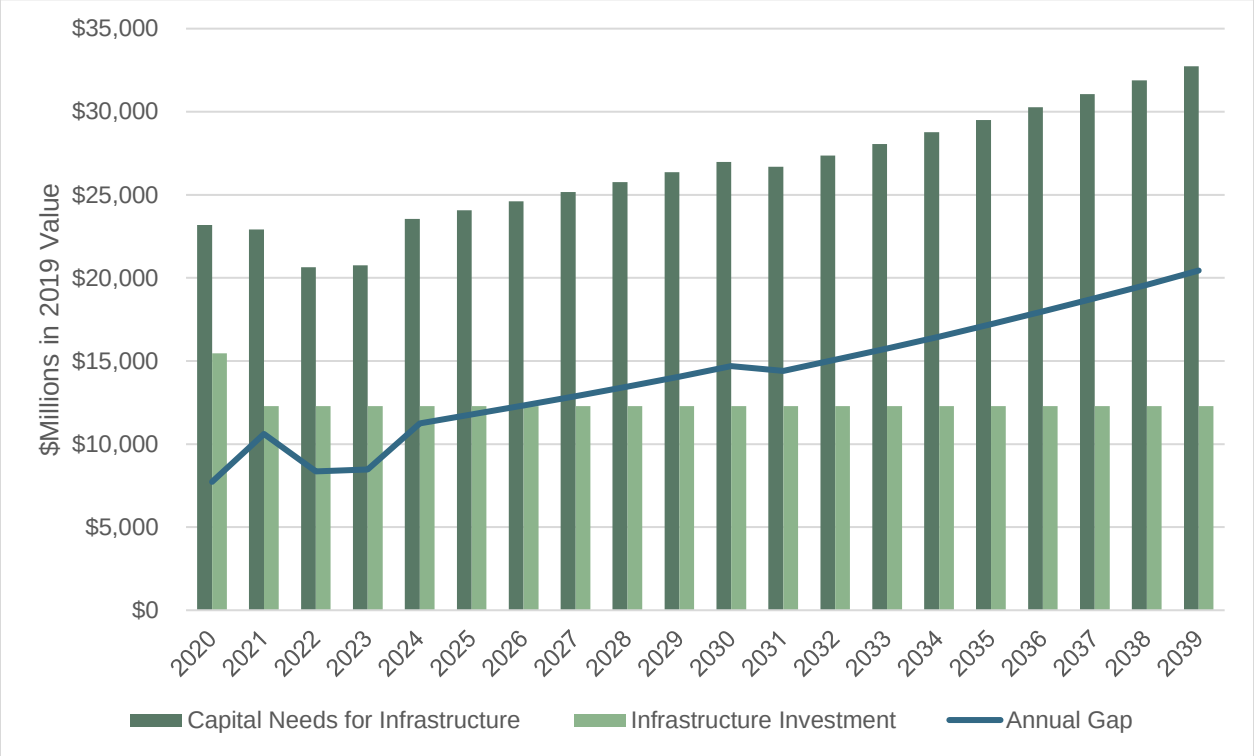
4.4 Capital Needs Gap

Steadily increasing infrastructure investment needs compared with relatively static levels of investment will result in an average annual funding gap of approximately $14 billion through 2039. The annual gap ranges from $7.7 billion in 2020 to more than $20.4 billion in 2039. Figure 4 shows year-by-year estimates. These estimates represent needs and investment projections only at commercial airports, which account for over 98% of all passenger enplanements. Due to data limitations, actual investments at non-commercial, GA airports were not available.

Assuming that U.S. needs for air transportation eventually continue to grow in a post-pandemic economy, and current investment trends continue, airport congestion will cost U.S. industries and households approximately $28 billion in 2029 and $41 billion in 2039 (2019 dollars).

The U.S. commercial aviation system is congested in key metropolitan areas and requires significant capacity expansion to meet the passenger and air cargo growth projected through 2039. In this respect, the options are to build new capacity in major markets; continue full implementation of NextGen; and/or pursue research, testing and implementation of other advanced technology solutions to meet projected demand for airport capacity. This analysis is based on a mixed approach of facility improvements and technology changes.

Figure 4. Gap between Airport Infrastructure Needs and Investment, 2020-2039 (2019 millions)



Source: ACI-NA and FAA Form 127. Calculations by EBP.

We know from airport operators that near-term airport capital needs are fairly well established, while needs beyond 1-2 years are increasingly speculative.

Actual capital expenditures in 2018 and 2019 were about $15.5 billion, and based on our observation of year-to-year changes in investment over the last 20 years (where investment generally stays in the same range for a few consecutive years before shifting), we assumed investments would continue at a consistent level for one additional year (2020). After 2020, we reverted to the 20-year average. Our expectation is that funding will fluctuate throughout the 2020-2039 timeframe but will remain stable (in real terms) over the period as a whole. However, estimated levels of 2020 spending were developed at the beginning months of the COVID-19 pandemic. In response to the virus, the FAA has halted most construction projects at FAA facilities other than those considered critical to air operations and safety. The FAA is also engaging airports to plan completion of capital project approved under the Airport Improvements Program (AIP), and is committed to awarding AIP grants approved for federal FY 2020.[20] As the pandemic continues, it is becoming apparent that the expected investment level for 2020 may be significantly overstated, as are the passenger forecasts from the 2020 Terminal Area Forecast.

5 Economic Impacts

The preceding analysis has summarized the gap between what investment is expected annually for airports and what will be needed to assure a reliable air transportation network for people

[20] Federal Aviation Administration, Coronavirus Guidance & Resources From FAA, https://www.faa.gov/coronavirus/guidance_resources/#fcp.

and air cargo. This section explains the economic consequences of airports that are not maintained and are not upgraded to keep pace with expected demand projected in the future.

Positive economic health indicators in the short term reflect significant recent investments shown above, and losses in the short term would be minimal due to the recent spate of financed improvements. Of course, short term demand has been affected by COVID-19. While the virus' impact is not certain on long-term travel demand and air cargo shipments, this study assumes that demand eventually resumes, and that by 2039 both passenger and cargo movements will be on course with 2019 projections.

In the years that immediately preceded the COVID epidemic, the upswing in investments in our air transportation system promised to provide a foundation for a modern network of airports to serve long-term passenger and cargo needs. From 2011-2016, annual capital investments in commercial airports averaged about $10.3 billion, but jumped to $14.8 billion annually from 2017-2019 and was expected to exceed $15 billion in 2020. However, preliminary data indicate that after final 2020 data are analyzed, we will find that capital investments for 2020 fall far short of recent averages.

Investment needs for U.S. airports will not be met if the robust spending levels witnessed in recent years revert to the long-term average. Lack of investment to meet demand will lead to the following productivity impacts:

- Costs to airlines, including fuel, crew costs, extended wear and tear on aircraft, and therefore higher maintenance costs;
- Costs to shippers and receivers of cargo due to delays. These costs are particularly important to firms that rely on just-in-time deliveries;
- Cost to passengers based on delayed and canceled flights and missed connections, and increased investment in buffer time to account for this decreasing reliability; and
- Costs to passengers who decline to take trips due to travel uncertainty from increased delays and decreased reliability. Business travel can lead to sales, while personal trips contribute to pleasure or to satisfy an obligation. Some of these benefits would be foregone if trips become too expensive or arduous.

This study assumes that investment from 2021 to 2039 will revert to the 2001-2019 annual average expenditure level of about $12.3 billion. As a result, the higher recent years of spending, including 2020 – the first year of this analysis – stimulate economic gains in the near term. As a result, there are minimal cumulative economic disruption over the first decade of this study. However, annual GDP will turn negative by 2025 and by 2028 cumulative GDP will reflect an overall loss. Similarly, annual employment will fall beneath projected base case levels by 2025. By the second decade of this study, as the investment gap mounts due to the presumed decrease in investment as spending levels return to past averages, we'll observe a mounting burden on U.S. industries and households. This burden will take the form of higher costs of doing business for industries that rely on air transportation for cargo shipments and business travel, as well as higher costs for personal travel. As a result, U.S. households will earn less income because of additional business expense and will pay more for transportation.

5.1 Direct Economic Impacts to Businesses and Households

Failing to increase investment in aviation infrastructure will directly cost industries and households a total of $922 billion (2019 value) over the next 20 years. As shown in Table 5,

direct costs break down to almost $560 billion to industries (including airlines) and $364 billion directly to households (not accounting for costs passed on from businesses to households). The direct impact to industries will lead to additional impacts to households in the form of lost wages and reduced purchasing power. Furthermore, trends through 2029 reflect the recent investments made at airports, but a downswing will occur if investment levels are rolled back to prior, longer term averages. Total costs to households and industries will amount to $360 billion over the 2020 -2029 period and $560 billion during the 2030-2039 decade.

Inefficiencies in air transportation lead to higher expenditures for businesses that are passed on to customers. These include more hours spent for business travel that add to costs of professional services as well as to sales overhead and executive travel attributed to producing sectors, and delayed deliveries that increase costs of goods shipped by and delivered to businesses and households. The latter includes increased production costs due to delays and spoilage for agricultural products.

Table 5. Direct costs to industries and households from inadequate airport infrastructure ($2019 billions)

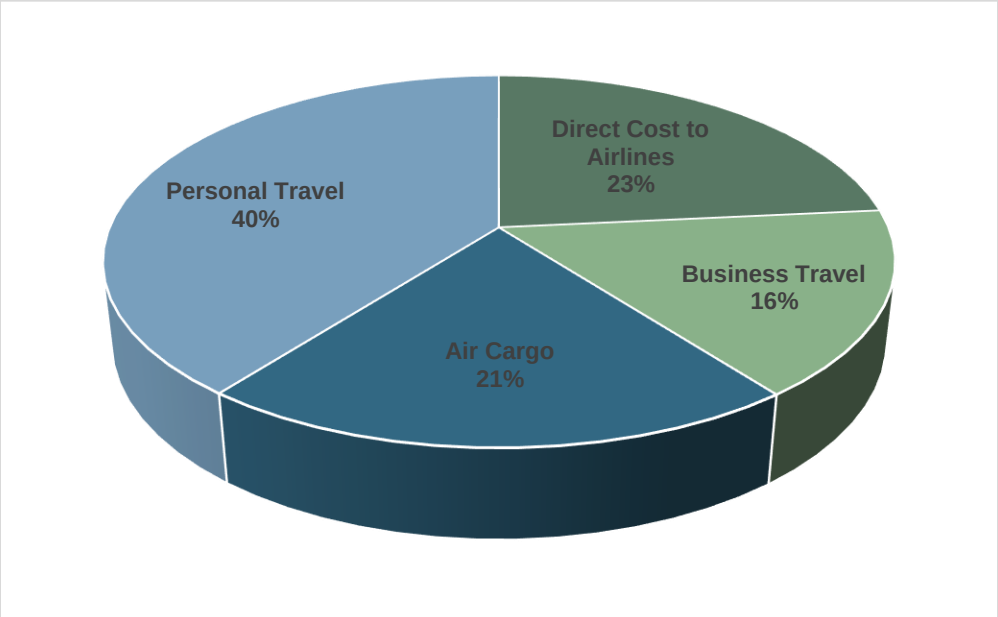
Costs incurred	2020-2029	2030-2039	2020-2039
Airlines	$85	$131	$216
Business Travel	$59	$90	$149
Air Cargo Shipment	$76	$117	$193
Personal Travel	$144	$220	$364
Totals	$364	$559	$922

Source: EBP analysis

It is important to point out that the $922 billion dollars in cumulative costs to businesses and households does not include a significant proportion of the time value of delay experienced by personal travelers. Travel delay for business travelers are absorbed by companies. However, delays to personal travelers, though often exasperating, are not of direct consequence to the "measured" U.S. economy.

By 2039, direct personal travel costs will total almost $2,600 over 20 years per household. However, if industry costs are passed through to consumers, cost per household over 20 years could be as high as $6,500. Costs accruing directly to industries in the U.S. will reach a cumulative total of $558 billion from 2020 through 2039. The spread of costs by sector is illustrated in Figure 5.

Figure 5. Breakout of Costs Due to Insufficient Capital Investments, 2020-2039



5.2 Impacts to the U.S. Economy

The capital investment gap projected for airports is expected to cost U.S. businesses and households $922 billion by 2039 in higher prices of goods and services. With changes in price levels, these costs will affect supply and demand of goods and services throughout the national economy, resulting in weakening business performance and less disposable income for households. Overall economic impacts of deficient airport infrastructure are summarized in Table 6. Observe that cumulative dollar losses for business sales, GDP, and disposable income predicted from 2020-2029 are less than expected losses expected in the year 2029. This is because the strong investment levels in airport infrastructure, which began in 2017 and were expected to carryover though 2020, support aviation-dependent economic growth. For example, net business revenues based on recent and expected infrastructure investment show positive impacts through 2023, then begin to turn negative in 2024. Industry benefits from the near-term improvements to terminals and runway capacity enhancements. The cumulative loss shown from 2020-2029 represents the sum of positive gains from 2020-2023 (+$116 billion) and increasingly negative impacts from 2024-2029 (-$137 billion).

Table 6. Losses to U.S. Economy due to Inefficient Airport Facilities Infrastructure ($2019 billions)

Year	Business Sales (Output)[21]	GDP	Disposable Income	Jobs
Losses in the Year 2029	$50	$26	$23	102,000

[21] Output represents gross production of U.S. industries. According the U.S. Bureau of Economic Analysis, gross output consists of both the value of what is produced and then used by other industries in production processes and the value of what is produced and sold to final users. Industry "value added" is defined as the value of the industry's sales to other industries and to final users minus the value of its purchases from other industries. Value added is a nonduplicative measure of production that when aggregated across all industries equals gross domestic product (GDP) for the economy.

Losses in the Year 2039	$175	$84	$227	311,000
Cumulative Losses 2020-2029	$21	$6	$8	N/A
Cumulative Losses 2030-2039	$1,120	$541	$383	N/A
Cumulative Losses 2020-2039	$1,141	$547	$391	N/A

Columns may not add due to rounding. Note: Losses and increases reflect impacts in a given year against national baseline projections. These measures do not indicate declines from 2019 levels. Sources: EBP and LIFT model, University of Maryland, INFORUM Group, 2020.

Because the bulk of losses are anticipated to be experienced from 2030 through 2039, there is time to appreciate the value of the recent bump in capital investment and adjust investment levels to sustain those increases to ensure a modern, reliable air transportation system. In total, almost all output and GDP losses are expected from 2030-2039 reflecting the reversion to average annual capital spending from the investment increase seen from 2017-2019. As shown previously in Table 6, direct losses imposed on businesses and households will accumulate over time. Moreover, as time goes on, disadvantages will compound. Minimal economic slowdowns will be observed over the 2020 to 2029 decade. However, impact will worsen from 2030 to 2039 if recent levels of investment are not maintained.

The success of our aviation systems is closely linked with the success of our surface transportation network – our roads, bridges, and rail systems. The national economy hinges on being able to economically, efficiently, and safely transport goods across the country from buyers to sellers and to and from airports, as well as in assuring efficient business and personal travel. Thus, while recent airport investments are stabilizing the condition of our aviation infrastructure, it will be for naught if ground transportation needs are not addressed.

5.3 Total Economic Output and GDP

Total output represents total economic activity in producing and providing goods and services in the U.S. economy. If average capital investment from 2021-2039 years reverts to the 2001-2020 annual average of $12.3 billion, business sectors across the nation are expected lose more than $1.1 trillion from what would be supported with efficiently operating airports. Moreover, our findings indicate that negative impacts will be minimal through 2029, in large part due to the recent increase of capital investment for airports, but cascade in the second decade in this analysis. This will occur as the presumed annual investment of $12.3 billion proves inadequate to maintain our national airport infrastructure in the face of increased demand. Subsequently, air transportation service costs will increase, travel times will grow due to air congestion for passengers, cargo shipments will take longer.

Table 7 shows the total output losses by industry sector due to underinvestment in infrastructure from 2020 to 2029 and 2030 to 2039. Manufacturing, finance, insurance and real estate, and professional services are projected to account for 57% of all losses through 2039. Note, the 15 sectors shown in Table 7 and in subsequent industry tables are consolidated from 64 industries within the Long-term Interindustry Forecasting Tool (LIFT) model.[22]

[22] The full concordance table of the industries shown to the full list of 64 are shown in the appendix.

Table 7. Aggregated Output Losses by Industry Sector in $2019 billion ("+" Signifies Gains)

Sector	2020-2029	2030-2039	2020-2039
Manufacturing	$0	$282	$282
Health Care	+$5	$63	$59
Professional Services	$2	$143	$145
Other Services	$2	$87	$89
Logistics	$3	$83	$86
Finance, Insurance and Real Estate	$8	$189	$197
Construction	$3	$31	$34
Retail trade	$2	$41	$44
Accommodation, Food and Drinking Places	$0	$18	$18
Transportation Services (excluding truck transportation)	$4	$52	$56
Mining, Utilities, Agriculture	$0	$30	$30
Information	$2	$82	$84
Educational Services	$0	$7	$6
Entertainment	$0	$8	$8
Social Assistance	$0	$5	$5
Totals	$20	$1,120	$1,141

Columns and rows may not add due to rounding.
Note: Losses and increases reflect impacts in a given year against national baseline projections. These measures do not indicate declines from 2019 levels.
Sources: EBP and LIFT model, University of Maryland, INFORUM Group, 2020.

5.4 Gross Domestic Product

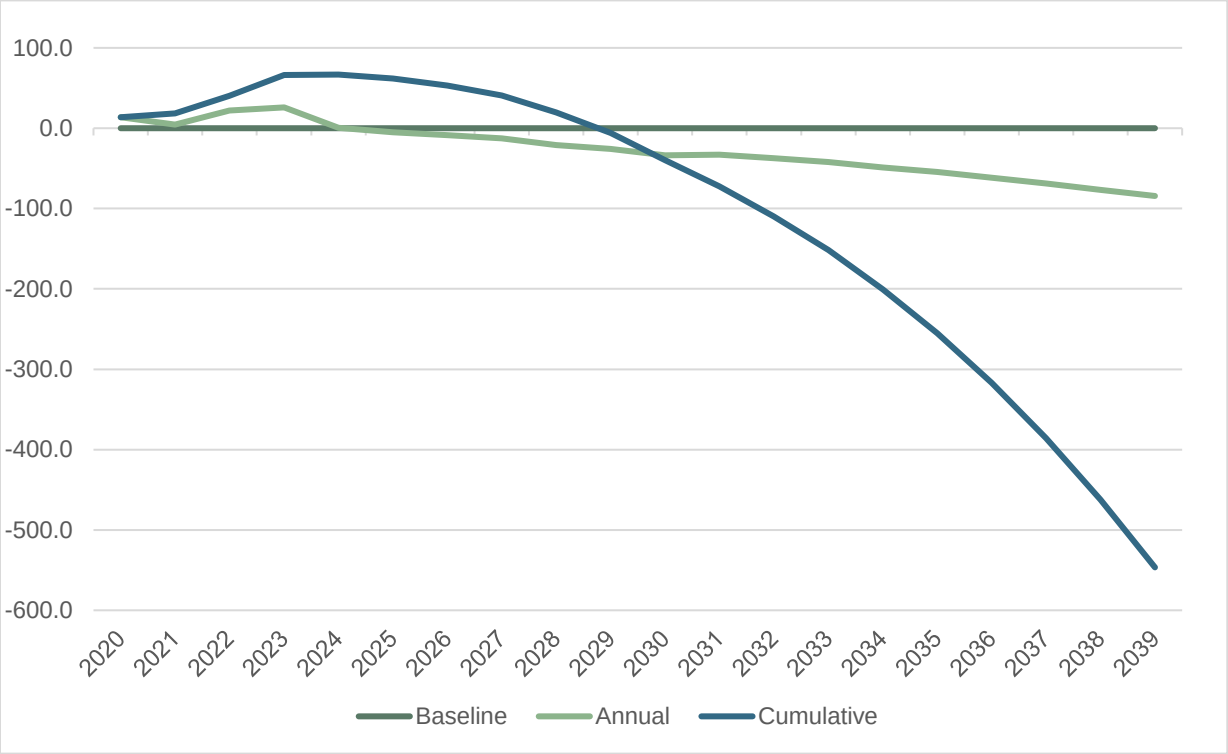
Underinvesting in airport infrastructure from 2021 to 2039 is expected to cost the national economy almost $547 billion of GDP cumulatively. Costs to businesses and households, as well as excess time consumed for business travel and cargo shipments, will affect profit margins and sales. The excess air transportation costs will be absorbed by businesses to retain market share or passed on the customers. These impacts will result in:

- Businesses losing income and profits due to the extended shipping and traveling time associated with subpar airport conditions;
- Loss of sales as higher prices make aviation-dependent businesses less affordable to U.S. consumers and less competitive in global markets, which will stimulate decreasing exports and increasing imports;
- Fewer jobs and lower income being paid to employed workers as consequences to the declines in business income and profits; and
- Higher costs for air travel, leaving less overall purchasing power among households.

Each of these dynamics will become worse over the second decade of this analysis as the impacts generated from recent investments are not sustained. Thus, GDP loss is expected to be $6 billion from 2020-2029, almost inconsequential compared to a $22 Trillion national GDP. However, over $500 billion in GDP is expected to be lost from 2030-2039. Figure 6 illustrates the relationship of annual and cumulative change of GDP from the national economy. Note that the strong recent airport capital investment is projected to generate modest improvement in the U.S. economy from 2020 through 2024. However, if investment levels revert to annul averages, then

national GDP losses will begin to mount starting in 2025. Cumulative impacts on GDP will be negative starting in 2029 and continue to decline through 2039.

Figure 6. U.S. GDP Impacts 2020-2039 from the Gap in Aviation Infrastructure Investment (billion 2019$)



Note: Gains and losses reflect impacts in a given year against national baseline projections (shown as 0). These measures do not indicate declines from 2019 levels.
Sources: EBP and LIFT model, University of Maryland, INFORUM Group, 2020.

5.5 Disposable Income: Purchasing Power

Over the 20-year timespan of this analysis, U.S. households will lose an aggregate total of almost $400 billion of disposable income in 2019 value. Each household in the U.S. stands to lose an average of more than $2,650 in disposable income aggregated across the 20 years, with an average of $260 per household annually from 2020 to 2039 if investment levels revert from the current bump to long term averages.

Disposable income is what is used by households to purchase goods and services. Income reduction will lead to less consumption and/or purchases of cheaper goods. Lower levels of consumer purchases or substitution of less expensive goods will reduce demand and therefore lower industry output and GDP. As income falls over time, fewer goods and services will be purchased (or more purchases will be delayed), leading to even further drops in industry demand. The declining levels of household disposable income over time is shown in Table 8.

Table 8. Losses in Household Disposable Income Over Time ("+" Signifies Gains)

	Total ($2019 billions)	Per Household ($2019)
Annual		
2029	+$11	+$84
2039	$55	$364
Cumulative		
2020-2029	$8	$39
2030-2039	$383	$261
2020-2039	$391	$265

Notes: cumulative losses per household represent the total disposable income losses in each period presented divided by the average number of U.S. households projected for the years shown. Losses and increases reflect impacts in a given year against national baseline projections. These measures do not indicate declines from 2019 levels.
Sources: EBP and LIFT model, University of Maryland, INFORUM Group, 2020.

The uptick in investment seen from 2017 through 2020 will lead to annual increases in disposable income from 2020 through 2024. Moreover, cumulative disposable income is expected to be positive through 2028, even as annualized impacts turn negative by 2025. With the additional disposable income in the economy, annual job impacts are expected to exceed the base case through 2024, peaking in 2023 with about 95,000 jobs above economic forecasts. Leading sectors in terms of job gains are expected to be Manufacturing, Finance, Insurance and Real Estate, and Health Care.

5.6 Employment Losses Through 2039

Given current investment practices, capital investment needs, and changing trends in demand, annual job levels will turn negative in 2024, amounting to 102,000 jobs lost in the year 2029 and 311,000 jobs lost in 2039. By 2039, the national population is expected to approach 382 million people, so it is important to note that these losses are relatively modest in that context. Demand will exist for products and services, even as productivity declines and wages are lowered. Of note, the need for firms to lower costs by reducing employment is mitigated, in part, by the tendency for wage rates to fall as labor productivity weakens. Also, inefficient airport operations create a need for more personnel at airports, including making repairs in lieu of capital improvements and in administering overcrowded terminal and airside conditions for passengers and cargo throughput. As shown in Table 9, the Air Transportation sector is expected to gain 4,000 jobs in 2029 and 8,000 in 2039. The important consideration is that air transportation costs will increase and put at risk jobs in manufacturing, and professional jobs such as those in finance, insurance and real estate and professional services.

Table 9. Potential Employment Losses because of inadequate Airport ***infrastructure, 2029 and 2039 ("+" Signifies Gains)***

Sector	2029	2039
Manufacturing	21,000	36,000
Finance, Insurance and Real Estate	3,000	18,000
Professional Services	8,000	37,000
Other Services	15,000	44,000
Health Care	6,000	48,000
Construction	9,000	24,000
Information	2,000	7,000
Logistics	7,000	25,000
Retail trade	13,000	33,000
Mining, Utilities, Agriculture	3,000	7,000
Transportation Services (excluding truck transportation)	+3,000	+5,000
Air Transportation	+4,000	+8,000
Other Transportation Services (excluding truck)	1,000	3,000
Accommodation, food, and Drinking Places	6,000	15,000
Entertainment	1,000	2,000
Educational Services	2,000	4,000
Social Assistance	11,000	17,000
TOTAL	102,000	311,000

Columns may not add due to rounding.
Note: Losses and increases reflect impacts in a given year against national projections. These measures do not indicate declines from 2019 levels
Other Transportation Services includes rail, water, transit and passenger transportation, pipeline, and other transportation support activities.
Sources: EBP and LIFT model, University of Maryland, INFORUM Group, 2020.

5.7 Less Competitive in International Markets

As noted from the discussions of job losses and output, U.S. manufactured products will be less competitive in international markets due to the added costs of air cargo transportation. Consequently, between 2020 and 2039, U.S. businesses will lose $176 billion in the value of exports, while businesses and households will pay an additional $60 billion for foreign imports. Table 10 shows the cumulative trade effects by quantifying the degree to which exports are expected to decrease, and the amount by which imports are expected to increase.

U.S. industries are expected to see an increase of almost $1 billion through 2024 from impacts borne by the 2017 to 2020 investments excepted in airports. However, without the added boost of investment levels, losses in exports are expected to show an aggregate loss of approximately $6 billion over the years 2020-2029, while the value of imported goods and services are expected to increase by about $11 billion. Moreover, over the second decade of this analysis period, 2030-2039, the U.S. is expected to lose $170 billion in exports, while imports are projected to increase by $49 billion over that period, with the assumption that capital spending reverts to the average rate seen from 2001.

Table 10. Cumulative Trade Effects ($2019 billions)

Period	Cumulative Export Losses	Cumulative Import Increases
2020-2029	$6	$11
2030-2039	$170	$49
2020-2039	$176	$60

Columns and rows may not add due to rounding. Losses and increases reflect impacts in a given year against total national export projections. These measures do not indicate declines from 2019 levels.
Sources: EBP and LIFT model, University of Maryland, INFORUM Group, 2020.

Table 11 lists the 10 exported goods and services that stand to lose the most money through 2039 as consequences of airports falling further behind projected needs. Note that other than wholesale trade, these sectors are comprised of technology industries and services that rely on high educational attainment and produce intellectual capital as well as high-end products.

Table 11. Potential U.S. Export Reductions in Goods and Services 2020- 2039, Ten Largest Affected Sectors ($2019 billions)

Export Sector	2020-2039
Wholesale trade	18.7
Royalties	8.8
Architectural, engineering, and related services	8.1
Software	7.9
Aerospace products and parts	6.6
Other financial investment activities	6.5
Scientific research and development services	6.4
Other chemicals	5.2
Other professional, scientific, and technical services	5.1
Motor vehicles	4.7

Note: Changes reflect impacts in a given year against national baseline projections by year from 2020 through 2039. These measures do not indicate changes from 2019 levels. Totals for pharmaceutical products and other chemicals are the sums of two commodity groups, "Pharmaceutical products" and "Other chemicals".
Sources: EBP and LIFT model, University of Maryland, INFORUM Group, 2020.

6 Conclusions

America's airports bind together the broad geographical span of the United States and link all its regions to the global economy. U.S. airports are the primary means for competitively selling and supplying an array of expensive technology goods used by both consumers and businesses, as well as meeting the requirements for a technologically advanced service economy—vital factors in the nation's economic well-being and standard of living.

This analysis confirms the benefits of investments in airport infrastructure to support the nation's economic health. Modern, reliable airport systems facilitate trade, optimize the supply chain, and enable business and personal travel. Over the last 20 years, investments in the national aviation system have varied significantly, ranging from $13.3 billion in 2001 to $10 billion or less during 2011-2013, before steadily increasing to $15 billion by 2018 through 2020.

The uptick in investments in airport infrastructure are paying dividends for the residents and businesses in the U.S. The increased spending observed over the last three years and forecasted to continue through 2020 is leading to annual increases in disposable income from 2020 through 2024. Moreover, cumulative disposable income is expected to be positive through 2028. With the additional disposable income in the economy, annual job impacts are expected to peak in 2023 with about 95,000 jobs above economic forecasts. Leading sectors in terms of job gains are expected to be manufacturing, finance, insurance and real estate, and health care.

This analysis is not based on assuming that all airport investments are addressed. It does indicate, however, that the recent increases of capital spending support the national economy and sustaining at least that level of investment will allow for flexibly in meeting critical capital needs for the national aviation system.

Despite the pandemic, or possibly because of it, the U.S. Bureau of Transportation Statistics reported that U.S. airlines carried almost 13% more cargo by weight in July 2020 (preliminary) than in July 2019, which is the largest annual increase since 2010. According to BTS, the increase was due to almost 16% growth in domestic cargo while the 4.5% rise in international cargo was the first annual gain since March 2019. Infrastructure investments to support cargo movement are necessary to facilitate just-in-time delivery and other freight movements that are an increasingly integral part of the economy and customer expectations.

Additionally, although airport capacity not currently a problem due to decreases in travel from the COVID-19 pandemic, airports would do well to proactively invest to expand their facilities. Historical trends indicate passenger volumes eventually return after major events, eventually surpassing previous records.

Airports remain critical assets in supporting the U.S. economy. Increasing demand for air cargo, historical travel patterns that suggest passenger volumes will return, and the advent of new technologies with airport applications – such as UAVs – all indicate continued robust investment in aviation infrastructure stands to have a meaningful impact on the economy and quality of life.

Appendix: Primary Sector Definitions

Primary Sector	Sub-sectors
Manufacturing	Food and beverage and tobacco products, Textile mills and textile product mills, Apparel and leather and allied products, Wood products, Paper products, Printing and related support activities, Petroleum and coal products, Chemical products, plastics and rubber products, Nonmetallic mineral products, Primary metals, Fabricated metal products, Machinery, Computer and electronic products, Electrical equipment, appliances and components, Motor vehicles, bodies and trailers and parts, Other transportation equipment, Furniture and related products, Miscellaneous manufacturing
Health Care	Ambulatory health care services, Hospitals, Nursing, and residential care facilities
Professional Services	Legal services, Miscellaneous professional, scientific, and technical services, Computer systems design and related services, Management of companies and enterprises
Other Services	Administrative and support services, Waste management and remediation services, Other services, except government, Civilian government
Logistics	Wholesale trade, Truck transportation, Warehousing, and storage
Finance, Insurance and Real Estate	Federal Reserve banks, credit intermediation, and related activities, Securities, commodity contracts, and investments, Insurance carriers and related activities, Funds, trusts and other financial vehicles, Housing services, Other real estate, Rental and leasing services and lessors of intangible assets
Construction	Construction
Retail trade	Retail Trade
Accommodation, food, and Drinking Places	Accommodation, Food services and drinking places
Transportation Services (excluding truck transportation)	Air transportation, Rail transportation, Water transportation, Transit and ground passenger transportation, Pipeline transportation, Other transportation, and support activities
Mining, Utilities, Agriculture	Farms, Forestry, fishing and related activities, Oil and gas extraction, Mining, except oil and gas, Support activities for mining, Utilities
Information	Publishing industries, except internet (includes software), Motion picture and sound recording industries, Broadcasting and telecommunications, Data processing, internet publishing and other information services
Educational Services	Educational services
Entertainment	Performing arts, spectator sports, Museums and related activities, amusements, Gambling, and recreation industries
Social Assistance	Social assistance