The Economic Impact of Civil Aviation on the U.S. Economy

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Federal Aviation Administration

Contents

Foreword

American aviation means so much for so many people. Things like safety, efficiency, freedom, adventure and commerce come to mind. Aviation accounts for more than 5% of our Gross Domestic Product, contributes $1.6 trillion in total economic activity and supports nearly 11 million jobs. Aviation manufacturing continues to be the nation's top net export.

The FAA is making many efforts to improve these kinds of economic benefits, in keeping with our mission to ensure the safest, most efficient aerospace system in the world. As part of our NextGen modernization effort, we're introducing new airspace innovations every day. These innovations include satellite-based (or performance-based) navigation that enables more point-to-point flying which reduces fuel usage and emissions. We're also putting in place Data Communications which enables air traffic controllers and pilots to communicate using text, in addition to voice. Changes like these are making flying more efficient and environmentally friendly, while ensuring that all safety needs are met.

We're also working to integrate new users like unmanned aircraft and commercial space operations into the national airspace system. These new vehicles are poised to change how we live, in a way not seen since the dawn of the jet age. All of these efforts are bringing positive commercial benefits to our citizens and helping sustain America's leadership in civil aviation.

The FAA's 2016 Economic Impact Report is ideal for policymakers, industry officials and universities. It offers the latest available data from 2014 on the economic benefits of passenger and cargo transportation, from activities by commercial airlines, air couriers, airports, tourism, aircraft and avionics manufacturing, and aviation research and development.

An addition to this year's report is a look at aviation's contribution to productivity growth. While output of the air transportation industry ranked 41st among 63 industries in 2014, it is the seventh leading contributor to the national productivity growth and has the second highest productivity growth rate among the industries.

For more than a century, aviation continues to be one of the greatest sources of inspiration for our nation. The world will look forward to see how this great industry in partnership with the FAA will do next.

Teri L. Bristol

Chief Operating Officer
Air Traffic Organization
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Overview

Promoting Economic Productivity and Prosperity…

Civil aviation transports people and goods around the globe. The connectivity that civil aviation provides is a key factor in increasing a nation's economic productivity and prosperity.

As the U.S. economy continues to improve in spite of recent global economic uncertainty and unrest, other U.S. industries and consumers depend on civil aviation's ability to provide reliable value-added services that facilitate business and personal opportunities.

Some highlights of civil aviation in 2014 include:[1]

- Air carriers operating in U.S. airspace transported 871.8 million passengers with over 1,230.8 billion revenue passenger miles (RPM).
- More than 64.1 billion revenue ton-miles (RTM) of freight passed through U.S. airports.
- Commercial airline operations enabled $310.0 billion of visitor expenditures on goods and services.
- Civil aircraft manufacturing continues to be the top net exporter in the U.S. with a positive trade balance of $59.9 billion.

Energizing the U.S. Economy…

The U.S. air transportation network continues to support the U.S. economy by providing access to markets beyond the local community. Between 2012 and 2014, growth in civil aviation's economic activity outpaced U.S. economic growth. While the U.S. economy averaged 2.0 percent growth per year during this time, the real primary output of civil aviation averaged 3.3 percent growth per year.

This report's estimates reveal that the real growth in civilian commercial aircraft manufacturing output between 2012 and 2014 averaged 6.4 percent per year, outpacing overall U.S. economic growth with sales of new aircraft in both the domestic and overseas markets. Civil aircraft manufacturing continue to fuel the U.S. economy by being the largest U.S net export. According to data from the Bureau of Economic Analysis (BEA) and the U.S. Census Bureau, civil aircraft manufacturing contributed $59.9 billion to the U.S. trade balance (exports less imports) in 2014, averaging 5.1 percent per year growth since 2012.

After facing some of the highest fuel prices in decades, the industry's fuel costs began to decline around late 2014, contributing significantly to the already growing industry profits. Even in light of lower fuel costs, the industry continues to restructure and streamline operations to manage operating costs. Airline industry financial data from the Bureau of Transportation Statistics show that the operating net profit margins of major U.S. airlines [2] rose to 8.0 percent in 2014 versus 3.8 percent in 2012.[3] Furthermore, airline operations (real primary output) grew 4.6 percent between 2012 and 2014.

Resilient and Innovative…

Commercial airlines have long sought to make air travel faster and affordable, while facing formidable economic challenges. The industry continues to enable the transport of more people and cargo than ever, contributing to higher standards of living and new business opportunities.

[1] Data sources include: Bureau of Transportation Statistics T-100 Segment data for passengers and freight; FAA impact report estimates for visitor expenditures; U.S. Department of Commerce data for trade balance.
[2] The major air carriers defined by BTS include: Alaska, American, Atlas Air, Delta, Federal Express, Frontier, Hawaiian, JetBlue, SkyWest, Southwest, United, UPS and US Airways.
[3] U.S Department of Transportation, Bureau of Transportation Statistics, Form 41, Schedules P.11 and P.12. June 2016. http://www.rita.dot.gov/bts/home

New research[4] on air transportation productivity reveals that the industry has an outsized impact on U.S. productivity relative to its size. Despite being ranked 41st in size among the 63 industries in the U.S. economy, air transportation — driven by the forces of productivity and innovation — was found to be the 7th leading contributor to overall productivity in the U.S.

From personal vacations to business meetings, from overnight delivery of time sensitive goods to local air traffic news reports — civil aviation is an essential part of everyday life and commerce in the U.S. Air transportation provides a foundation for businesses and families to connect and re-connect while ensuring economic growth and prosperity.

During 2014, the total U.S. economy generated $17.4 trillion in value-added economic activity and supported 147.4 million jobs.[5] At the same time, civil aviation:

- Accounted for $1.6 trillion in total economic activity,
- Supported 10.6 million jobs, and
- Contributed 5.1 percent to U.S. gross domestic product (GDP).

[4] Matthew Russell, "Economic Productivity and Air Transportation: Multifactor and Labor Productivity Trends, 1990-2014." Internal working paper, Federal Aviation Administration, June 2016.
[5] U.S. Department of Labor, Bureau of Labor Statistics, *Labor Force Statistics from the Current Population Survey*. August 2016. http://www.bls.gov/data/

Trending:

AIR TRANSPORTATION AND ECONOMIC PRODUCTIVITY

Civil aviation is a robust part of the total U.S. economy. According to the Bureau of Economic Analysis (BEA), the government agency responsible for producing macroeconomic statistics of the U.S. economy, output of the air transportation industry ranked 41st among 63 industries in 2014.[6] However, its small size belies its larger impact on the rest of the economy. What is this larger impact? One way to determine this is to estimate the impact of air transportation on total U.S. productivity. This section reviews recent productivity research conducted by the FAA that answers this question.[7]

The aviation industry is much more than just moving passengers and cargo to various destinations. It enables leisure and business travel to most places on the globe within a relatively reasonable period of time. At the individual-level, leisure and business travelers choose air transportation because the benefits exceed the costs. On a society-or economy-wide level, recent FAA productivity research investigates how efficient the air transportation industry is in providing transportation services to its customers.

Estimates from FAA's productivity research appear in this report for the first time. Note, these results are not part of the set of estimates that form the core of the report and, hence, are not shown in the usual report tables. The productivity work uses some of the core data published in this report, as well as other data,[8] and estimation methods from the Bureau of Labor Statistics (BLS) to enable us to determine the impact of air transportation on our nation's economy.[9]

Productivity Measures

Productivity is defined as the relationship between producing a good or service (or output) and the input(s) needed to produce that good or service during a span of time. Why is productivity important? Economy-wide, real productivity measures how efficiently an economy is producing output. Positive real productivity growth means a country is producing more output with the same levels of inputs or producing the same level of output with fewer inputs. This is an indicator of a higher standard of living. At an industry level, it describes the competitiveness of an industry, as well as how much an industry contributes to the nation's overall economic growth.

For airlines, which make up a large part of civil aviation, production is estimated by measuring the services produced (or output). To estimate the productivity of the industry, output is compared to the allocation of purchased or leased inputs into producing those services. Inputs include aircraft,

[6] In the industry account and national economic account estimates published by the BEA, air transportation includes revenues from scheduled air passenger travel. Thus the BEA estimates are consistent with only a subset of the data that form the core of this report.
[7] Russell, *loc. cit.*
A number of previous studies examined air transportation productivity trends, with most finding rapid productivity growth across various time periods. Missing from these studies is a quantifiable way to measure to what extent the industry contributes to the nation's productivity growth (Anthony Apostolides, "An Analysis of Labor and Multifactor Productivity in Air Transportation: 1990-2001," U.S. Department of Transportation; John Duke and Victor Torres, "Multifactor Productivity Change in the Air Transportation Industry," *Monthly Labor Review*, March 2005, pp. 32-45).
[8] This data mainly come from the BEA, the Bureau of Labor Statistics (BLS), and the Bureau of Transportation Statistics (BTS).
[9] The BLS is another of the main U.S. statistical agencies. It publishes national- and industry-level productivity statistics on a quarterly basis.

fuel, flight crew (including pilots and flight attendants), maintenance personnel and materials, check-in staff, and ticketing services. These inputs are divided into five categories: capital, labor, energy, materials, and services. These inputs are abbreviated as KLEMS.

Productivity can be measured in two ways – single or multifactor. Single factor productivity (SFP) measures the change in output due to the change in a single input category, such as labor. Multifactor productivity (MFP) measures the change in output over and above all of the measured inputs. Commonly, MFP is attributed to influences not included in the model, for example research and development, new technology, economies of scale, managerial skill, and changes in the organization of work.[10]

Labor Productivity

Of all of the SFP measures, labor productivity (LP) is the most widely-used. In air transportation, labor productivity captures the growth in output of transporting people and cargo based on the growth of one input, labor. Labor input is the numbers of hours worked by employees in the air transportation industry, taking into account the various skill sets and experience possessed by these workers. During 1997-2014, output rose while labor input declined (**Figure 1**).

A weakness of LP is that it attributes the change in output only to the change in labor. In reality, the change in output may be due to other reasons. These reasons may include changes in technology, employee effort, organizational efficiencies, and changes in other factors of production, which are capital, energy, materials, and purchased services. So LP is difficult to interpret because it focuses on only one input, labor.

According to the FAA's research results using long term data from the Bureau of Transportation Statistics between 1990 and 2014, air transportation industry LP grew 4.1 percent per year (solid line, **Figure 2**), more than twice the 2.0 percent growth of the total U.S. non-farm business sector (dashed line). Between 2002 and 2007, air transportation LP grew 10 percent — the highest among any industry in the U.S. This growth was driven mostly by the output growth of low-cost air carriers. Legacy air carriers contributed to this LP growth through mergers, labor outsourcing, in addition to cutbacks in labor hours. Therefore, due to these reasons, LP may be overstated.

Multifactor Productivity

Another measure of productivity is multifactor productivity (MFP). MFP is a much broader measure than LP and includes all inputs or factors used in the production process, not just labor. MFP is the output growth that cannot be accounted for by the growth in the inputs. Although the source of MFP growth usually cannot be directly identified, again, it may be due to research and development, new technology, economies of scale, managerial skill, and changes in the organization of work.

Results of the research show that air transportation's MFP averaged a 3.3 percent annual growth rate between 1997 and 2014 (**Figure 3**).[11] Air transportation MFP growth outpaced U.S. non-farm business MFP growth by three times during this period, 3.3 versus 1.1 percent (solid versus dashed lines). Air transportation MFP growth was fueled by a moderate rise in output of 2.1 percent per year and a decline in the use of inputs by -1.2 percent per year. The decline in the use of combined inputs was the result of higher information technology capital investments in internet websites and changes to service agreements with travel agents beginning in the late 1990's. The changes in service agreements affected the pricing structure of commissions paid for airline ticket sales and resulted in an increase of ticket sales through airlines' own websites. Further, the outsourcing of maintenance workers began in 2000, bringing an 8 percent decline in labor inputs along with a rise in outside equipment purchased services. Contracting out for maintenance rose 10.5 percent during this time period.[12] Most of these changes occurred prior to 2007, the time period consistent with the highest growth in air transportation MFP. This is shown by the relatively steep slope of the MFP curve (solid line).

[10] U.S. Department of Labor, Bureau of Labor Statistics, "Industry Productivity Measures," *BLS Handbook of Methods*, August 2016. http://www.bls.gov/
[11] KLEMS input estimates first became available in September 2005 for the years 1997-2003. See http://www.bea.gov/scb/pdf/2005/09September/0905_Industry.pdf
[12] FAA calculation using Form 41 Financial data from the Bureau of Transportation Statistics.

Air Transportation Productivity and the Economy

Figure 4 shows the average annual MFP growth rates for the top five and bottom five industries over 1997-2014. The MFP growth rate for the air transportation industry was 3.3 percent during this period, second to the 6.1 percent growth rate for computers and electronic products.

The air transportation industry directly accounts for roughly 1.4 percent of the nation's real GDP growth from 1997-2014; however, it accounts for 7.3 percent share of the nation's multifactor productivity growth (**Figure 5**). Air transportation is the seventh leading contributor to the nation's multifactor productivity growth — the second highest growth among the 63 industries studied. Therefore, the air transportation industry's impact on economy wide productivity is higher than its impact on real GDP.

Figure 1. Air Transportation Output, Labor Input and Employment, 1990-2014

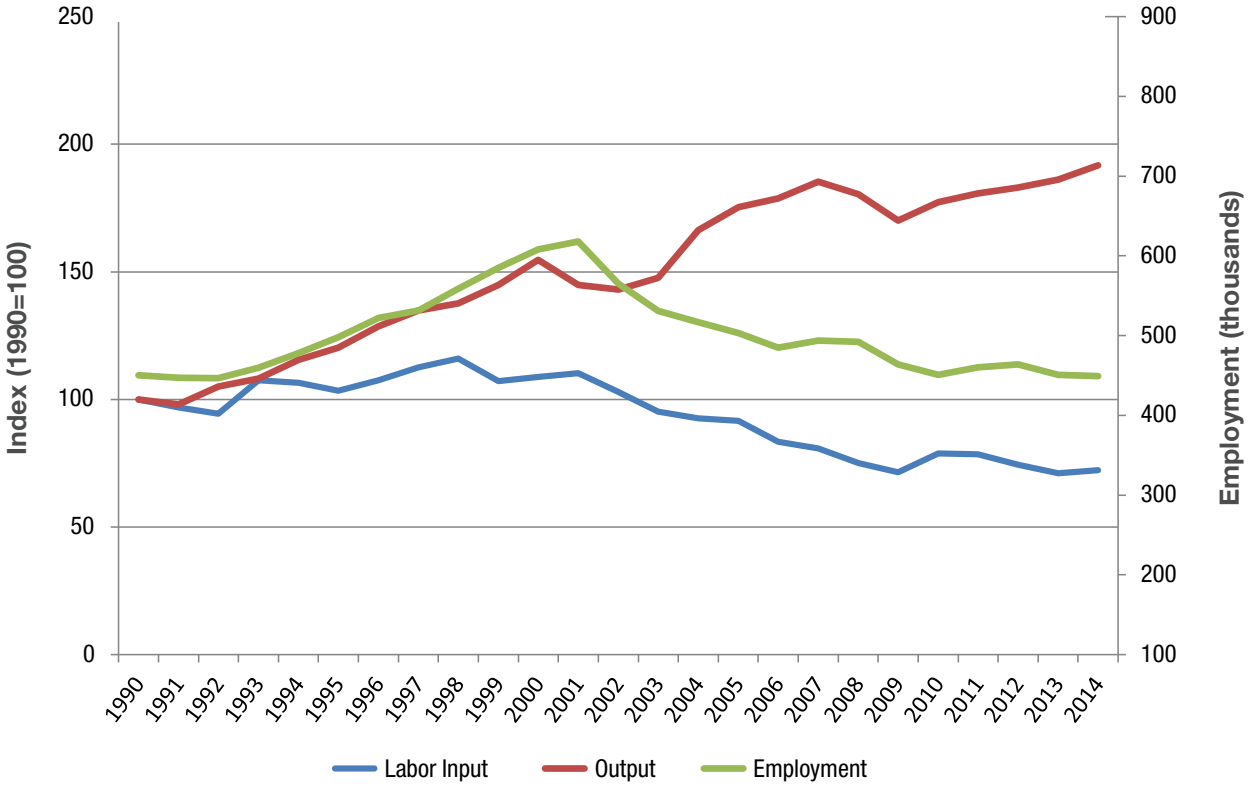


Figure 2. Labor Productivity, 1990-2014

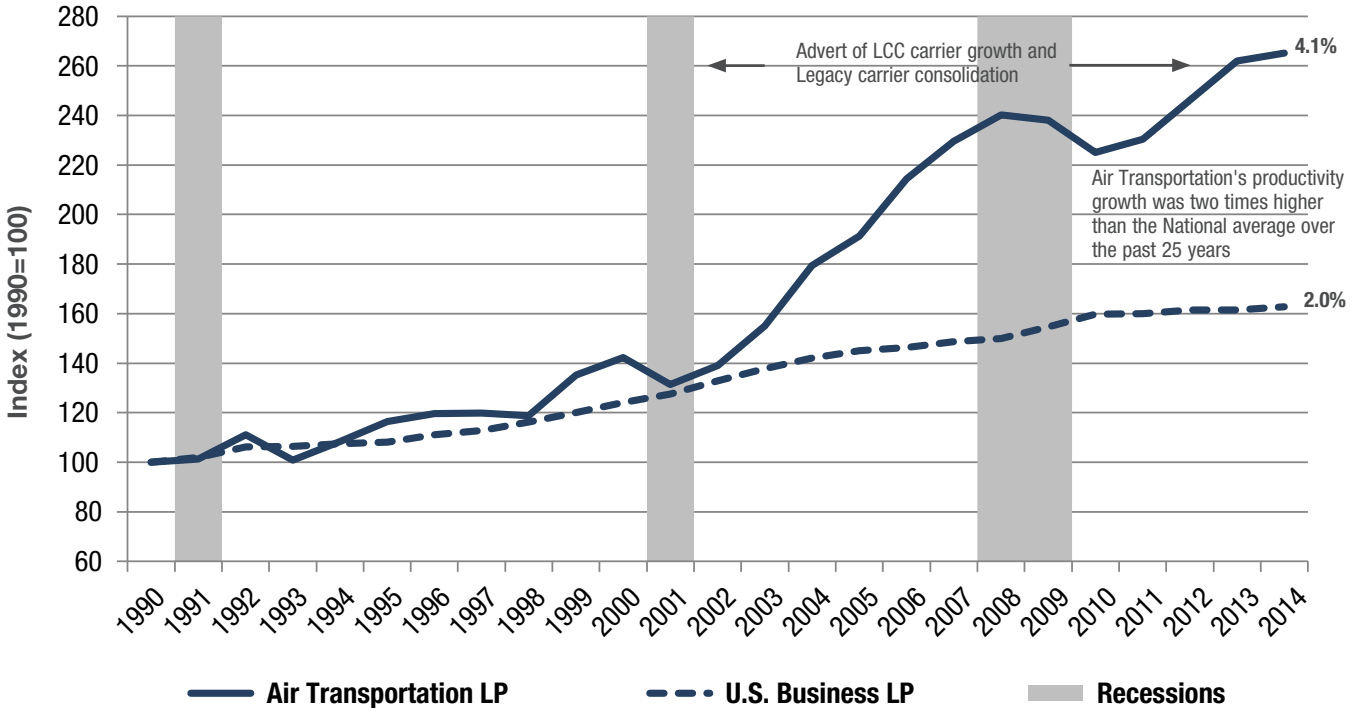


Figure 3. Multifactor Productivity, 1997-2014

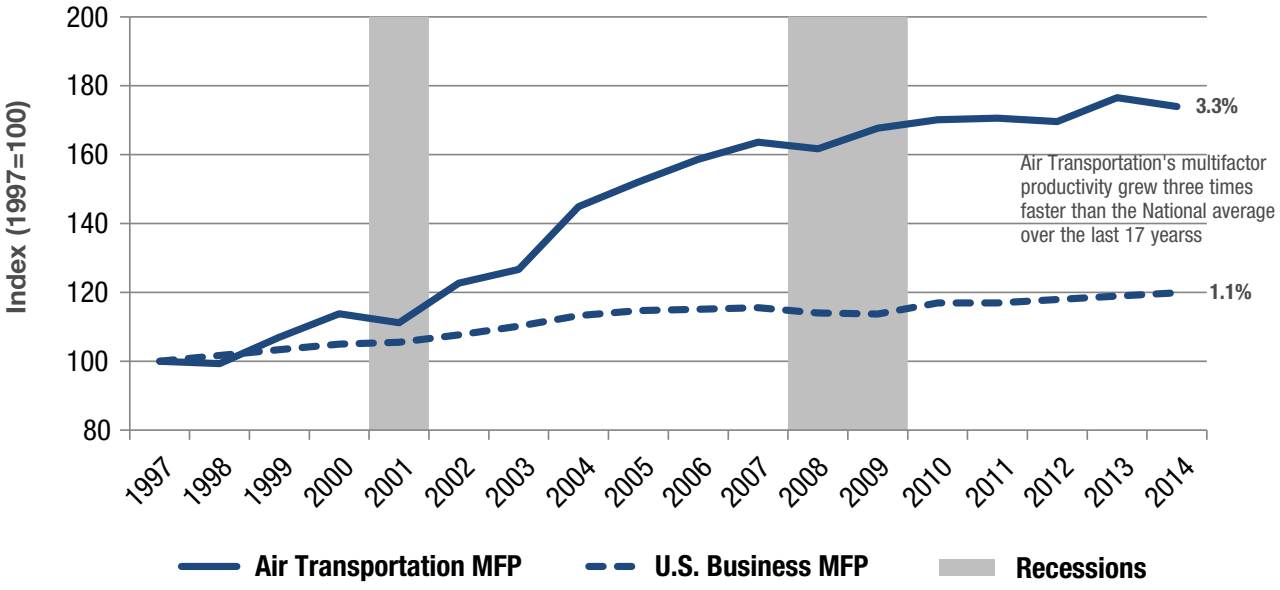


Figure 4. Multifactor Productivity Average Annual Growth by Industry 1997-2014

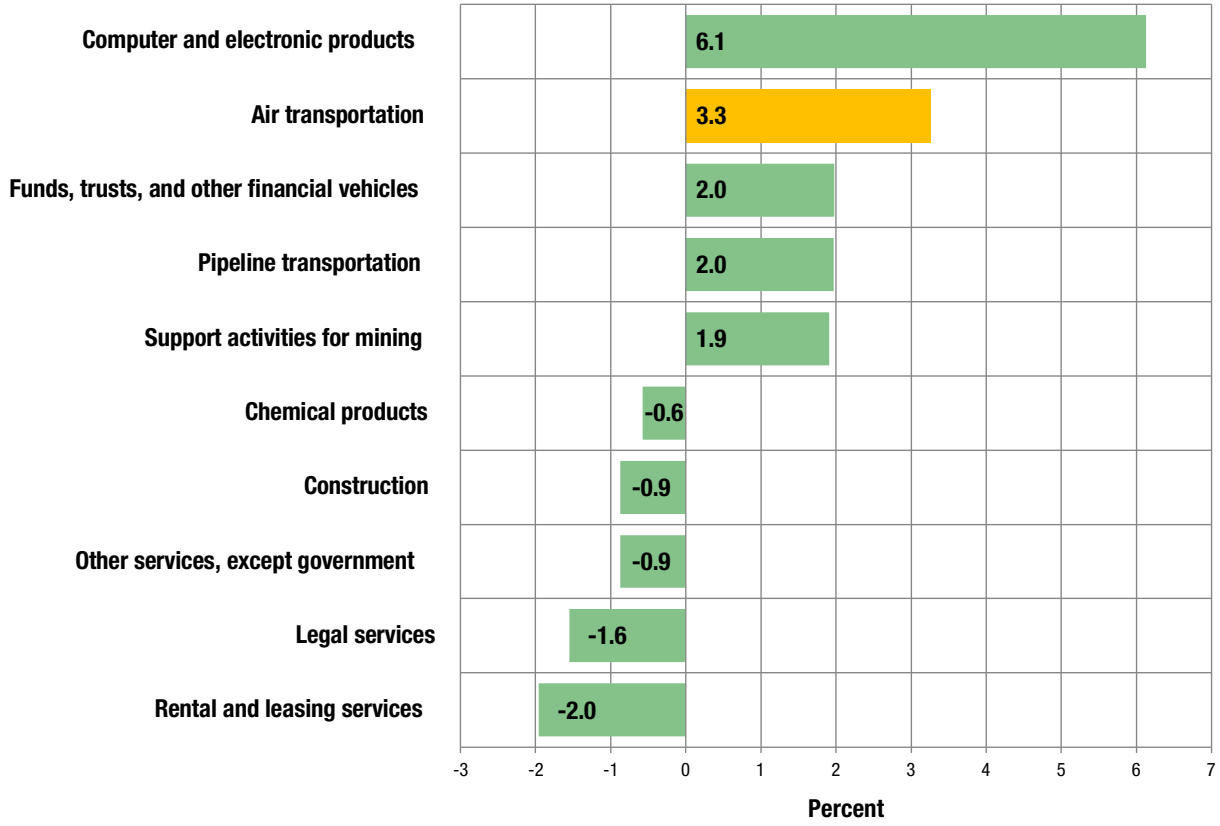
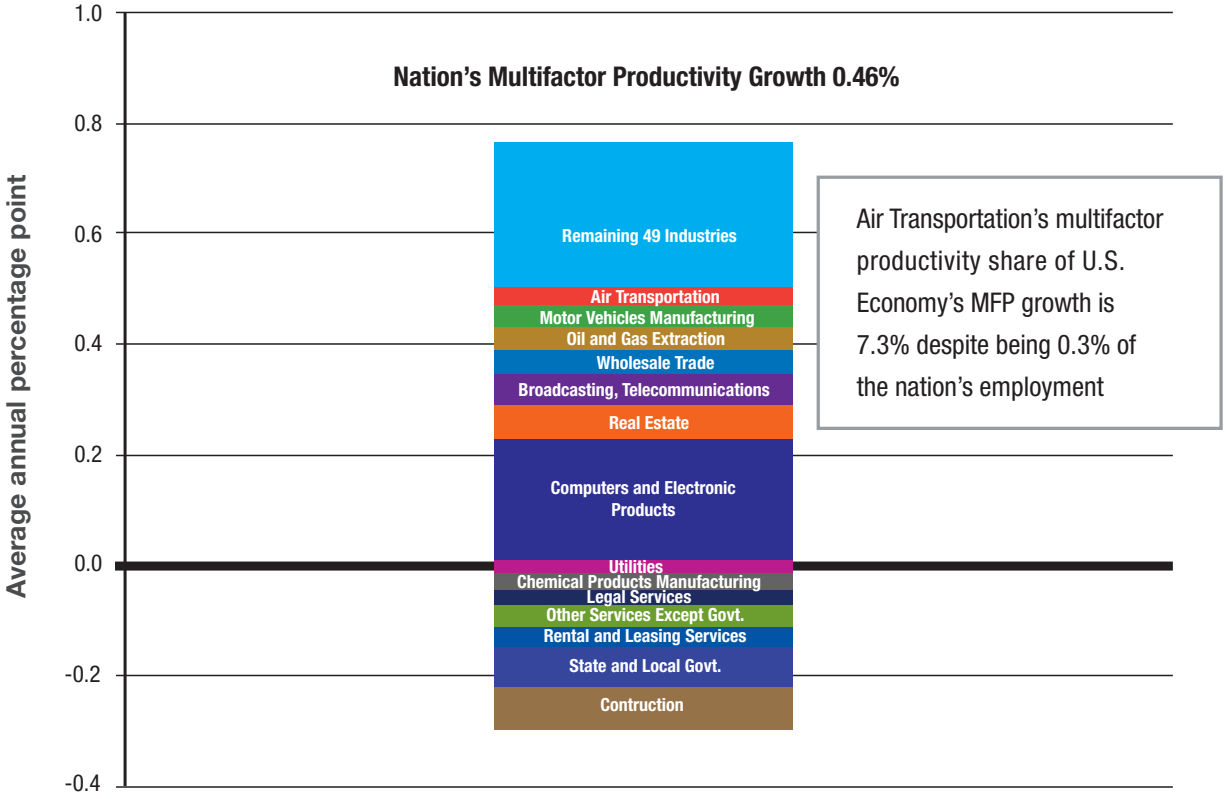


Figure 5. Contribution to Overall U.S. Productivity Growth, 1997-2014




Los Angeles
San Francisco
Kahului, Maui
Honolulu
20
15
10
5
0
-5
-10
-15
-20
-25
2008
2009
2010
Airline Operating
Airline Employment
Baggage Claim A

INTRODUCTION

What's New?

This report incorporates the most recent years' (2012-2014) data from the U.S. Department of Commerce (DOC), Department of Transportation (DOT), Department of Labor (DOL), and the National Science Foundation (NSF). The DOC's Census Bureau completed its 2012 Economic Census data collection and reporting. These data were incorporated into the estimates for manufacturing, air couriers, and travel arrangements.

More recent RIMS II multipliers from the Bureau of Economic Analysis (BEA) reflecting the 2007 input-output benchmark table (I-O table) and the 2013 regional economic accounts are also incorporated in this report. The incorporation of the new I-O table (replacing the previous table from 2002) into the calculation of the new multipliers captured the changes to the structure of the U.S. economy after the Great Recession. The new multipliers have a marked dampening of output, earnings, and jobs growth reflecting the depth of the economic downturn.

Two new categories are included in the economic impact estimates of this report. The categories are: aviation research and development (R&D) and avionics manufacturing. These categories improve the scope of this report by capturing other economic impacts related to civil aviation. R&D is a key element in economic growth and productivity, while avionics accounts for new technology and products that are continually being integrated into aircraft.

Aviation R&D

R&D, which includes innovation, has long been recognized as an important contributor to the economy. As part of the effort to better analyze the effects of R&D on the U.S. economy and improve international comparison of economic accounts, the BEA started to capitalize R&D products as an investment in the measurement of gross domestic product (GDP) starting in 2013.[13]

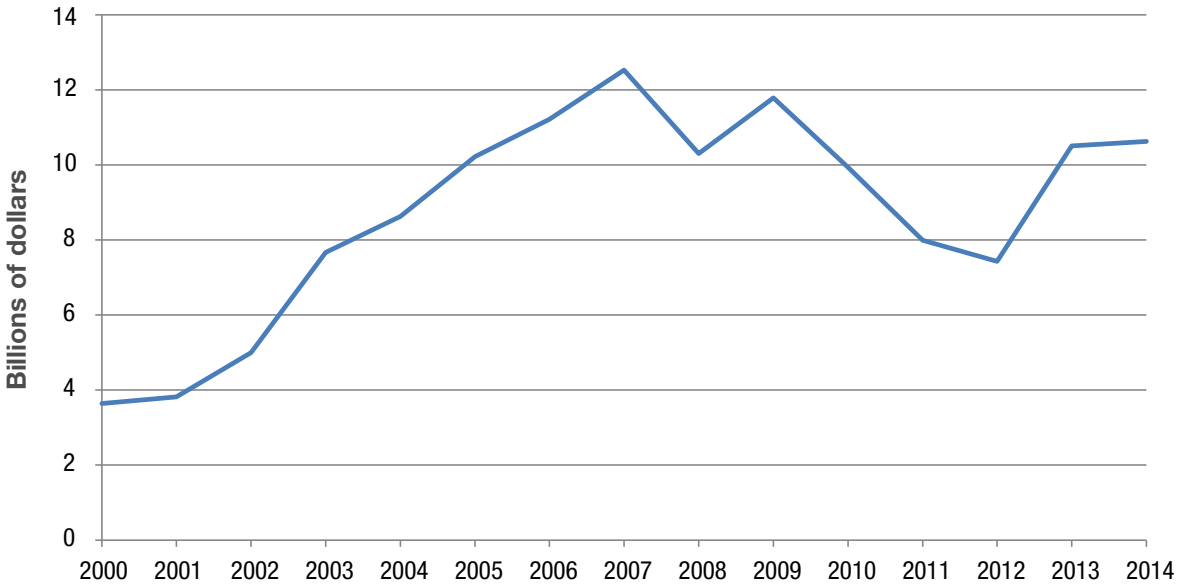
To be consistent in this report's measure of aviation's contribution to U.S. GDP, R&D estimates have been incorporated into the impact estimates for the first time.

The primary source of data for the R&D estimates in this report is the NSF's Business R&D and Innovation Survey (BRDIS). The NSF defines R&D as "planned, creative work aimed at discovering new knowledge or developing new or significantly improved goods and services." In this sense, R&D includes all incidences of innovation conducted by businesses in the production of goods, services, or processes (development).

For this report, R&D conducted by U.S. domestic business in the manufacturing of aircraft and related parts industries — as captured in the NSF Survey — are counted as primary output in the impact estimates.

The estimates of R&D, based on NSF data from 2000-2013 and extrapolated for 2014, are shown in **Figure 6**. In 2014, U.S. domestic businesses spent more than $10 billion in activities related to aviation R&D and innovation.

Figure 6. Aviation Research and Development, 2000-2014



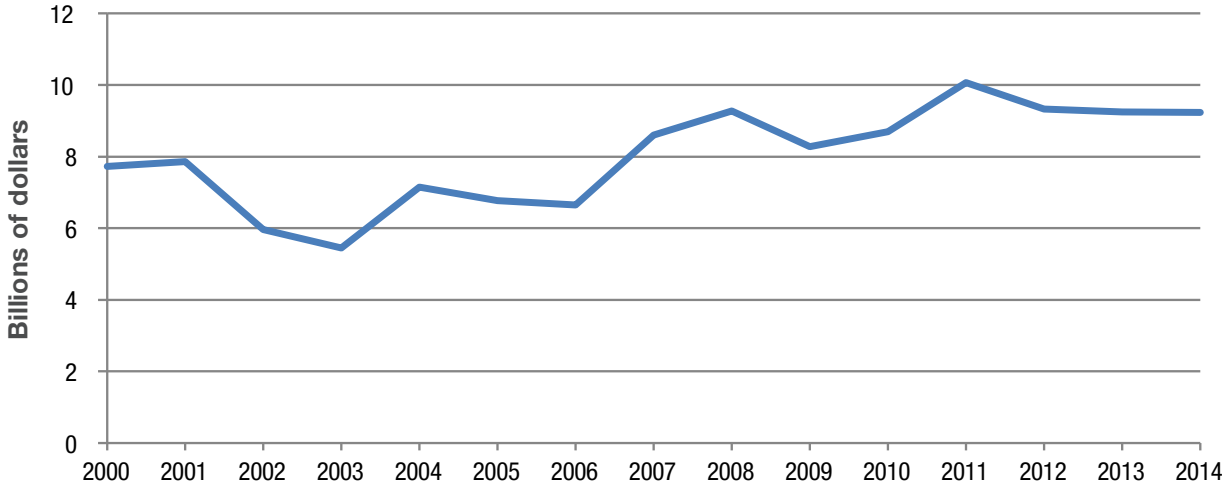
[13] U.S. Department of Commerce, Bureau of Economic Analysis, *National Income and Product Accounts.*

Avionics Manufacturing

Avionics equipment manufacturing is another new data series that appears in this report. Previously, it was assumed all avionics equipment was already included in new aircraft and aircraft parts manufacturing and was therefore accounted for. Research shows this was not the case; instead, some new avionics equipment was also used to update, refurbish, or retrofit existing aircraft.[14]

The avionics data appears on **Figure 7** and includes the years 2000 through 2014. The graph shows in 2014, $9.2 billion in new avionics equipment was manufactured in the U.S. and includes new equipment (including GPS) used to retrofit, refurbish, or replace avionics on existing aircraft, and equipment exported to other countries. The methods employed to estimate this series are very similar to those used by the BEA to produce components of the U.S. GDP and components of the U.S. benchmark I-O tables, and are based mainly on data collected by the U.S. Census Bureau in various national surveys.

Figure 7. Avionics Manufacturing, 2000-2014



[14] Since this report covers civil aviation only, it does not include defense avionic equipment.

What's Forthcoming?

Brief sections on unmanned aircraft systems (UAS) and commercial space are included in this report. The rise in popularity of UAS (also known as drones) is well known. As this segment of the aviation industry matures and more economic data become available, UAS estimates may become part of this report in the not too distant future. The commercial space estimates represent the economic impact of commercial launches of vehicles into orbital or suborbital space carrying payloads for private or government purposes. As the number of commercial space launches and the value of payloads increase, it may also be added to future publications of this report.

Unmanned Aircraft Systems

The rise in the popularity of small unmanned aircraft systems (sUAS), or drones among the public in the U.S. is well recognized. According to the FAA Modernization and Reform Act of 2012, an unmanned aircraft is "an aircraft that is operated without the possibility of direct human intervention from within or on the aircraft." Further, an unmanned aircraft system is "an unmanned aircraft and associated elements (including communication links and the components that control the unmanned aircraft) that are required for the pilot in command to operate safely and efficiently in the national airspace system."[15]

To address this new popularity, Congress tasked the Department of Transportation to develop regulations to safely integrate sUAS operations into the national airspace system (NAS).[16] Following a formal rulemaking process, the Federal Aviation Administration (FAA) promulgated regulations which required all sUAS vehicles weighing 0.55 lbs. or more and below 55 lbs., and obtained before December 21, 2015, to be registered with the FAA by February 19, 2016, through an online process; vehicles acquired on or after December 21, 2015, need to be registered prior to outdoor operation.

On August 29, 2016, new FAA regulations went into effect regarding the civil operation of non-hobbyist drones weighing less than 55 lbs. (Federal Aviation Regulations, Part 107).[17]

Vehicles weighing under 0.55 lbs. do not need to be registered and vehicles weighing over 55 lbs. are currently registered via the paper-based application used for on-board piloted aircraft. By June 2016, 495,000 sUAS vehicles were registered[18] which is considerably higher than the 320,000 registered piloted aircraft. Although the number of drones is relatively high, the total dollar value of the on-board piloted aircraft probably far exceeds the total value of drones.[19]

A widely cited work by Jenkins and Vasigh, commissioned by the FAA in support of the regulatory evaluation, forecasts the impact of drones on the economy covering the years 2015-2025.[20] This forecast is not based on actual data but on telephone surveys of 30 chosen industry experts. According to this study, published in 2013, the drone industry was anticipated to generate $1.1 billion in spending in 2015, growing to $2.3 billion in 2016, and to $5.1 billion in 2025. In 2015, employment was expected to be 11,400, growing to 22,800 in 2016, and to 50,529 in 2025. Over the 10-year period 2015-2025, drones were anticipated to generate 100,000 jobs and $82 billion in direct and induced economic activity. Also noteworthy, Jenkins and Vasigh indicated that agriculture and public safety sectors are expected to make the highest use of drones.

Currently, the report does not include an estimate of the economic impact of drones since comprehensive industry and governmental source data are not currently available. As the drone industry evolves, it will become more feasible to include the economic impact of drones in future editions of this report.

[15] Public Law 112-95, Sections 331(8) and 331(9).
[16] *Ibid,* Section 332.
[17] See FAA, "Summary of Small Unmanned Aircraft Rule (Part 107)," and *FAA News*, June 21, 2016; FAA, "The FAA's New Drone Rules Are Effective Today," August 29, 2016.
[18] Of these registrations, 97.4 percent were flown by hobbyists.
[19] *Interim Final Rule Regulatory Evaluation, Registration and Marking Requirements for Small Unmanned Aircraft*, Federal Aviation Administration, December 2015, p. 55 and *Final Rulemaking Regulatory Evaluation, Small Unmanned Aircraft Systems* (14 CFR Part 107), Federal Aviation Administration, June 2016, p. 53.
[20] *The Economic Impact of Unmanned Aircraft Systems Integration in the United States*, Association for Unmanned Vehicle Systems International, March 2013.

Commercial Space

Commercial space is a relative newcomer to the aviation industry and is making its presence felt in the national airspace. The commercial space industry launches satellites into space; these satellites are owned by companies in other industries or by governments. The services provided by these companies are varied and include: television; mobile, fixed, and broadband communications; and satellite remote sensing. Since the equipment needed to provide such services must be manufactured, satellite systems and ground equipment manufacturing industries are affected. Together, these companies generated about $85 billion in revenues in 2014.[21] In the U.S., one example of such a vehicle is the Space Exploration Technologies (SpaceX) Falcon 9, which began service in 2014. Another example is Orbital Science's Antares 120.[22]

The FAA Office of Commercial Space Transportation (AST) was delegated by the federal government[23] by way of the U.S. Department of Transportation to regulate the safety of commercial space transportation in the U.S. Among other regulations, the FAA requires: All commercial suborbital and orbital space launches must be licensed by AST; all commercial payload launch contracts must be internationally competed among capable service providers; and all such launches must be privately financed.[24]

In 2014, there were 14 available private and government commercial launch sites or spaceports in the U.S. These sites were located in California, Florida, Alaska, Virginia, Texas, Oklahoma, New Mexico, and the Republic of the Marshall Islands.[25] With launches no longer limited to coastal regions, air traffic controllers will need to incorporate commercial space operations into the NAS. As new air management policies are developed for inclusion of commercial space traffic, more information regarding launches will be necessary. Decision makers will need to approve airspace usage based on a variety of factors.

In the years 2012, 2013, and 2014, the numbers of U.S. commercial launches were 2, 6, and 11, respectively.[26] World-wide there were 23 commercial launches, with revenues of $2.36 billion in 2014. However, although the worldwide market for commercial space launches has not increased significantly over the past 10 years, growth is expected to increase in the near future.[27] Annual revenues of U.S. private commercial launch providers were approximately $0.1 billion in 2012, $0.3 billion in 2013, and $1.1 billion in 2014.

In the future, the commercial space industry hopes to send tourists into space as well. Five U.S. companies — Blue Origin, Masten Space Systems, UP Aerospace, Virgin Galactic, and XCOR — Aerospace hope to take passengers to the fringe of space on suborbital reusable vehicles (SRV).[28]

The FAA will continue to study how these and other commercial space industry numbers can be incorporated into future editions of this report.

The next section describes the methodology used to estimate the economic impact of civil aviation on the U.S. economy.

[21] Office of Commercial Space Transportation, Federal Aviation Administration, *The Annual Compendium of Commercial Space Transportation: 2016*, January 2016, p. 9.
[22] The industry is changing with the possible future utilization of reusable suborbital launch vehicles (such as the SpaceX Falcon 9 and the Blue Origin New Shepard rocket), which are capable of being launched into space more than once, thus lowering launch costs and making commercial space transportation more attractive to customers.
[23] Commercial Space Launch Amendments Act of 2004, PL 108-492.
[24] Office of Commercial Space Transportation, Federal Aviation Administration, *The Annual Compendium of Commercial Space Transportation: 2016*, January 2016, p. 57.
[25] Office of Commercial Space Transportation, Federal Aviation Administration, *The Annual Compendium of Commercial Space Transportation: 2014*, February 2015, p. 72.
[26] Office of Commercial Space Transportation, Federal Aviation Administration, *The Annual Compendium of Commercial Space Transportation*, various years.
[27] Office of Commercial Space Transportation, Federal Aviation Administration, *The Annual Compendium of Commercial Space Transportation: 2016*, January 2016, p. 2.
[28] Office of Commercial Space Transportation, Federal Aviation Administration, *The Annual Compendium of Commercial Space Transportation: 2016*, January 2016, p. 19.

NATIONAL IMPACT OF U.S. CIVIL AVIATION

The report estimates the economic contribution of the civil aviation industry to the U.S. economy. Civil aviation has far-reaching economic impacts. While some of these impacts cannot be measured quantitatively, this report captures economic activity generated by direct and indirect air transport of passengers and cargo using the best data available from government and private sources.

Methodology

The total economic impact of an industry is a summation of primary impacts and induced impacts of spending on that particular industry. This definition is standard for economic-impact studies and is used to estimate aviation's unique economic contribution to the national economy. The data used to measure the primary economic impacts of civil aviation were collected from reliable government and private sources. This study estimated those impacts by looking at industry output, earnings, and jobs. These data were entered into the RIMS II Input-Output Model, a model developed by the U.S. Department of Commerce's Bureau of Economic Analysis, to derive the secondary economic impacts of spending. Primary and secondary impacts were then summed to produce a measure of civil aviation's total impact on the U.S. economy.

Types of Economic Impacts

Primary Impacts: The primary impacts of aviation are a summation of direct and indirect impacts of civil aviation on the U.S. economy and include:

- Air transportation and supporting services
- Aircraft, aircraft engines, and parts manufacturing
- Travel and other trip-related expenditures by travelers using air transportation

Induced or Secondary Impacts: Induced impacts result from expenditures made by industries identified in the measurement of primary impacts to supporting businesses and entities, as well as the spending of direct and indirect employees. Induced impacts capture the secondary impacts to the economy as direct/indirect sales, and payroll impacts are circulated to supporting industries through multiplier effects.

Measures of Economic Impacts

Primary expenditure estimates are input into the RIMS II model to estimate the secondary effects of those expenditures on the U.S. economy. The output of the RIMS II model includes the secondary effects on economic output, earnings, and jobs.

Output: The total economic value of goods and services produced.[29]

Earnings: Wages and salaries, other labor income, benefits, and proprietors' income paid to all employed persons who deliver final demand output and services.

Jobs: The number of people employed in the industry that provide civil-aviation services, manufacture aircraft and aircraft engines, or work in other industries that are indirectly affected by activity in the civil air transportation sector.

Results

Table 1 summarizes the total impact of U.S. civil aviation on output, earnings, and jobs. In 2014, economic activity attributed to civil aviation-related goods and services totaled $1.6 trillion, generating 10.6 million jobs with $447 billion in earnings. Aviation contributed 5.1 percent to GDP, the value-added measure of overall U.S. economic activity.

Table 1. Summary - Civil Aviation Economic Impact on U.S. Economy 2012-2014 (Current Dollars)

Year	Output ($Billions)	Earnings ($Billions)	Jobs (Thousands)	Percent of GDP
2014	1,623.8	446.8	10,589	5.1
2013	1,555.0	427.0	10,139	5.1
2012	1,472.3	405.4	9,650	5.0

[29] "Output" includes the sum of all of intermediate goods and services used in production, plus value added by the industry itself. This distinguishes output from gross domestic product, which only counts value added.

Table 2 reports the change from previously published FAA economic-impact estimates for civil aviation. For 2012, the total difference between the current and previously published (June 2014) estimates were about $61 billion lower in total output, or, approximately 0.4 percentage point less in contribution to GDP.

The downward revisions to output, earnings, jobs, and percent of GDP are primarily attributable to the incorporation of more recent RIMS II multipliers (based on the 2007 input-output benchmark table) from the Bureau of Economic Analysis. These new multipliers are lower than the previous multipliers that were based on the 2002 I-O table, which were calculated prior to the Great Recession (2008-2009). The incorporation of these new multipliers from 2012 to 2014, which reflected post-recession economic activities, has an overall effect of dampening the estimates for induced or secondary impacts in this report.

The downward revisions were partly offset by the addition of the two new categories (R&D and avionics, as mentioned above), as well as an upward revision to visitor expenditures – reflecting the change in definition of travel (now including education and medical related spending) in the source data from the U.S. Department of Commerce's International Trade Administration (ITA).

Table 2. Revisions to Previously Published Estimates (Current Dollars)

	Year	Output ($Billions)	Earnings ($Billions)	Jobs (Thousands)	Percent of GDP
Current	**2012**	1,472.3	405.4	9,650	5.0
Previous	**2012**	1,533.8	459.4	11,790	5.4
Difference (Revision)		**(61.5)**	**(54.0)**	**(2,140)**	**(0.4)**

Revision by Category	Output ($Billions)	Earnings ($Billions)	Jobs (Thousands)	Value Added ($Billions)
Airline Operations	-73.5	-42.5	-1118	-41.0
Airport Operations	-2.5	-2.9	-81	-3.5
Civilian Aircraft Manufacturing	-9.7	-2.9	-110	-0.2
Civilian Aircraft Engine and Engine Parts Manufacturing	-5.1	-1.8	-42	-2.4
Civilian Other Aircraft Parts and Equipment Manufacturing	-18.1	-8.4	-203	-7.9
Civilian Avionics Manufacturing	*22.9*	*5.8*	*112*	*12.2*
Civilian Research and Development	*22.7*	*7.2*	*135*	*12.0*
Air Couriers	-28.0	-8.1	-293	-17.6
Visitor Expenditures	41.5	5.8	-339	13.4
Travel Arrangements	0.3	-0.3	-36	-0.6
Subtotal - Commercial	**-49.4**	**-48.2**	**-1976**	**-35.7**
General Aviation Operations	-4.7	-3.7	-104	-2.8
GA Aircraft Manufacturing	-7.0	-1.9	-45	-2.6
GA Visitor Expenditures	-0.4	-0.2	-15	-0.4
Subtotal - General Aviation	**-12.1**	**-5.8**	**-164**	**-5.8**

Table 3. Real Primary Output (2012 Dollars)

Description	2012 (2012 $Billions)	2014 (2012 $Billions)	Percent Change
Airline Operations	125.2	130.9	4.6
Airport Operations	23.9	24.7	3.6
Civilian Aircraft Manufacturing	49.1	55.6	13.2
Civilian Aircraft Engine and Engine Parts Manufacturing	6.9	7.3	6.9
Civilian Other Aircraft Parts and Equipment Manufacturing	25.9	29.1	12.3
Civilian Avionics Manufacturing	9.3	8.9	-4.3
Civilian Research and Development	7.4	10.3	38.3
Air Couriers	20.7	21.7	4.4
Visitor Expenditures	286.4	299.7	4.6
Travel Arrangements	5.7	6.2	9.0
Subtotal - Commercial	**560.5**	**594.4**	**6.1**
General Aviation Operations	14.4	16.1	11.4
GA Aircraft Manufacturing	8.0	11.8	47.3
GA Visitor Expenditures	4.7	4.7	-0.9
Subtotal - General Aviation	**27.1**	**32.5**	**19.9**
Total Primary Output	**587.6**	**626.9**	**6.7**

Table 3 reports real primary output in 2012 dollars and is the basis for calculating the total economic impact of civil aviation for 2012 and 2014. In order to isolate real changes in civil aviation spending from inflationary effects, the real primary output measures are transformed into 2012 constant-dollar measures.

Between 2012 and 2014, real primary output increased by 6.7 percent. Commercial aviation, the bulk of primary output, increased 6.1 percent, while primary output for total general aviation (GA) economic activity increased 19.9 percent. Visitor expenditures, commercial aircraft manufacturing, and airline operations were the drivers of most of the growth in commercial aviation between 2012 and 2014.

Primary output is used to estimate the secondary effects of spending in the economy. Primary output estimates are input into the RIMS II model to calculate the secondary or induced impacts. Total output, or the sum of primary and secondary impacts, is reported in **Table 4**, which shows the following:

- In 2014, commercial aviation accounted for the bulk of civil aviation's economic contribution, with airline operations generating $325 billion in total output
- As domestic and foreign airline passengers to the U.S. reach their destinations, their total expenditures on hotels, rental cars, and entertainment contributed $771 billion in total output, nearly double the output supported by airlines operations
- Total GA accounted for nearly $80 billion of total output in 2014. While the impact is less than commercial aviation, the GA contribution continues to reflect the industry's unique role in the nation's transportation system. GA operations contributed $39 billion to total output.

Table 4. Total Output, Earnings and Jobs Estimates, 2014 (Current Dollars)

Description	Output ($Billions)	Earnings ($Billions)	Jobs (Thousands)
Airline Operations	325.1	79.4	1,528
Airport Operations	76.0	24.2	524
Civilian Aircraft Manufacturing	143.7	36.0	640
Civilian Aircraft Engine and Engine Parts Manufacturing	17.6	4.2	78
Civilian Other Aircraft Parts and Equipment Manufacturing	73.9	18.5	361
Civilian Avionics Manufacturing	22.7	5.7	111
Civilian Research and Development	32.4	10.3	193
Air Couriers	62.7	19.0	505
Visitor Expenditures	771.0	223.7	6,114
Travel Arrangements	18.5	5.4	126
Subtotal - Commercial	**1,543.6**	**426.5**	**10,181**
General Aviation Operations	38.8	9.5	183
GA Aircraft Manufacturing	29.7	7.4	132
GA Visitor Expenditures	11.7	3.4	93
Subtotal - General Aviation	**80.2**	**20.3**	**408**
Total Impact	**1,623.8**	**446.8**	**10,589**

Aviation's Contribution to Gross Domestic Product

In August 2013, the Bureau of Economic Analysis released its comprehensive revision estimates of U.S. GDP data with several notable changes. One notable change that affected the definition of GDP is the new inclusion of research and development (R&D) expenditures as investment — now part of GDP, rather than as intermediate inputs– previously not counted in GDP. This new treatment increased the level of GDP.

Starting with this year's report, R&D is included in the calculation of aviation's contribution to GDP and is consistent with measures of overall GDP from the Bureau of Economic Analysis.

Including R&D, U.S. current-dollar GDP was $17,393 billion in 2014.[30] GDP represents the sum of all value-added activities in an economy, so intermediate goods and services used in the production of goods and services are not included. In the previous section, total output calculation included intermediate goods and services that were purchased as part of the production process. In order to compare aviation's contribution to GDP, these intermediate goods and services must be subtracted from the total output.

In order to estimate civil aviation's contribution to GDP, each impact type is calculated separately using the RIMS II value-added coefficients. The results are shown in **Table 5**. In 2014, aviation-related value-added economic activities totaled $887 billion, or 5.1 percent of U.S. GDP.

In 2014, commercial aviation contributed $846 billion or 4.9 percent to GDP. Within commercial aviation, the largest component is commercial visitor expenditures totaling $451 billion, or 2.6 percent of GDP (Table 5), followed by airline operations at $161 billion, or 0.9 percent of GDP. General aviation, while small in comparison to commercial aviation, still contributed 0.2 percent to GDP, or nearly $41 billion.

See the Appendix for civil aviation's contribution to GDP for the years 2012 through 2014.

Table 5. Civil Aviation's Contribution to GDP, 2014 (Current Dollars)

Description	Value Added ($Billions)	Percent of GDP
Airline Operations	160.9	0.9
Airport Operations	40.8	0.2
Civilian Aircraft Manufacturing	72.6	0.4
Civilian Aircraft Engine and Engine Parts Manufacturing	8.6	0.0
Civilian Other Aircraft Parts and Equipment Manufacturing	39.3	0.2
Civilian Avionics Manufacturing	12.1	0.1
Civilian Research and Development	17.2	0.1
Air Couriers	33.6	0.2
Visitor Expenditures	451.5	2.6
Travel Arrangements	9.9	0.1
Subtotal - Commercial	**846.3**	**4.9**
General Aviation Operations	19.2	0.1
GA Aircraft Manufacturing	15.0	0.1
GA Visitor Expenditures	6.8	0.0
Subtotal - General Aviation	**41.1**	**0.2**
Total Impact	**887.3**	**5.1**

[30] U.S. Department of Commerce, Bureau of Economic Analysis, National Income and Product Accounts.

Real Change from Previous Years

Three measures highlight the economic contribution of the civil aviation sector: the value of total output, earnings paid to employees, and the number of jobs supported by civil aviation. These measures are shown in **Table 6**. The output and earnings are presented in 2012 dollars to remove changes due to inflation.

Real output of civil aviation increased 6.8 percent between 2012 and 2014, while real earnings increased 6.7 percent and total jobs increased 9.7 percent during the same time.

Table 6. U.S. Civil Aviation: Growth of Total Output, Earnings, and Jobs (Real)

	Output (2012 $Billions)			Earnings (2012 $Billions)			Jobs (Thousands)		
Description	**2012**	**2014**	**Percent Change**	**2012**	**2014**	**Percent Change**	**2012**	**2014**	**Percent Change**
Airline Operations	300.4	314.3	4.6	73.4	76.8	4.6	1,412	1,528	8.2
Airport Operations	70.9	73.4	3.6	22.6	23.4	3.6	490	524	7.1
Civilian Aircraft Manufacturing	122.7	138.9	13.2	30.7	34.8	13.2	547	640	17.1
Civilian Aircraft Engine and Engine Parts Manufacturing	15.9	17.0	6.9	3.8	4.1	6.9	71	78	10.6
Civilian Other Aircraft Parts and Equipment Manufacturing	63.6	71.4	12.3	16.0	17.9	12.3	311	361	16.1
Civilian Avionics Manufacturing	22.9	21.9	-4.3	5.8	5.5	-4.3	112	111	-1.0
Civilian Research and Development	22.7	31.3	38.3	7.2	10.0	38.3	135	193	43.0
Air Couriers	58.1	60.6	4.4	17.6	18.4	4.4	468	505	8.0
Visitor Expenditures	712.4	745.4	4.6	206.7	216.3	4.6	5,649	6,114	8.2
Travel Arrangements	16.4	17.9	9.0	4.8	5.2	9.0	112	126	12.7
Subtotal - Commercial	**1,406.0**	**1,492.3**	**6.1**	**388.5**	**412.3**	**6.1**	**9,305**	**10,181**	**9.4**
General Aviation Operations	34.6	38.5	11.4	8.5	9.4	11.4	163	183	12.2
GA Aircraft Manufacturing	20.0	29.5	47.3	5.0	7.4	47.3	89	132	48.4
GA Visitor Expenditures	11.7	11.6	-0.9	3.4	3.4	-0.9	93	93	-0.2
Subtotal - General Aviation	**66.3**	**79.6**	**20.1**	**16.9**	**20.3**	**20.0**	**345**	**408**	**18.2**
Total Impact	**1,472.3**	**1,571.9**	**6.8**	**405.4**	**432.6**	**6.7**	**9,650**	**10,589**	**9.7**

CONCLUSION

The U.S. economy continues to grow since the previous release of this report. From 2012 to 2014, real GDP averaged 2.0 percent growth per year, to $17.4 trillion. Employment grew by over 4 million persons, from 143.3 million to 147.4 million. Meanwhile, the civil aviation industry continues its growth. In 2014, civil aviation accounted for 5.1 percent of the U.S. economy. The total output of civil aviation-related goods and services amounted to $1.6 trillion and generated 10.6 million jobs, with earnings of $447 billion. By contrast, civil aviation contributed 5.0 percent to the economy in 2012, along with 9.7 million jobs and earnings of $405 billion. This report also updates the range of detailed estimates which make up these industry totals.

Along with updates to the industry data, this report includes five new features as well. The first is a summary of a recent FAA air transportation economic productivity study. This study, a stand-alone work and not part of the main set of report estimates, finds that air transportation is a major contributor to overall U.S. economic growth. Among the 63 industries that make up the U.S. economy, air transportation is ranked 41st in terms of output, but is the 7th leading contributor to U.S. economic growth.

The second and third new features, which form part of the main set of report estimates, are aviation research and development (R&D) and avionics equipment manufacturing. Results for 2014 show the current dollar output of aviation R&D and avionics manufacturing amounted to about $10.6 billion and $9.2 billion, respectively.

The fourth and fifth new features, not yet included in the main set of estimates, are unmanned aircraft systems (UAS or drones) and commercial space launches. UAS results for 2014 are not yet available because drone use was not yet high enough to be identified in the source data. The FAA will monitor drones as their popularity grows. The economic impact of commercial space launches extends beyond this industry. The commercial space industry launches satellites that belong to companies in other industries and to governments, thereby influencing other parts of the economy. In the future, the commercial space industry aims to send tourists into space as well. The FAA will continue to monitor the commercial space data and may include it in future publications of this report.

Appendix – Supplemental Tables

Table 7. U.S. Civil Aviation Economic Impact, Total Output: Primary plus Secondary Impacts (Current Dollars)

Output ($Billions)			
Description	**2012**	**2013**	**2014**
Airline Operations	300.4	309.9	325.1
Airport Operations	70.9	74.0	76.0
Civilian Aircraft Manufacturing	122.7	132.3	143.7
Civilian Aircraft Engine and Engine Parts Manufacturing	15.9	16.4	17.6
Civilian Other Aircraft Parts and Equipment Manufacturing	63.6	68.0	73.9
Civilian Avionics Manufacturing	22.9	22.7	22.7
Civilian Research and Development	22.7	32.1	32.4
Air Couriers	58.1	59.9	62.7
Visitor Expenditures	712.4	743.7	771.0
Travel Arrangements	16.4	17.3	18.5
Subtotal - Commercial	**1,406.0**	**1,476.3**	**1,543.6**
General Aviation Operations	34.6	34.4	38.8
GA Aircraft Manufacturing	20.0	27.6	29.7
GA Visitor Expenditures	11.7	11.7	11.7
Subtotal - General Aviation	**66.3**	**73.7**	**80.2**
Total Impact	**1,472.3**	**1,550.0**	**1,623.8**

Table 8. U.S. Civil Aviation Economic Impact, Total Earnings: Primary plus Secondary Impacts (Current Dollars)

Earnings ($Billions)			
Description	**2012**	**2013**	**2014**
Airline Operations	73.4	75.7	79.4
Airport Operations	22.6	23.6	24.2
Civilian Aircraft Manufacturing	30.7	33.2	36.0
Civilian Aircraft Engine and Engine Parts Manufacturing	3.8	3.9	4.2
Civilian Other Aircraft Parts and Equipment Manufacturing	16.0	17.1	18.5
Civilian Avionics Manufacturing	5.8	5.7	5.7
Civilian Research and Development	7.2	10.2	10.3
Air Couriers	17.6	18.1	19.0
Visitor Expenditures	206.7	215.8	223.7
Travel Arrangements	4.8	5.0	5.4
Subtotal - Commercial	**388.5**	**408.3**	**426.5**
General Aviation Operations	8.5	8.4	9.5
GA Aircraft Manufacturing	5.0	6.9	7.4
GA Visitor Expenditures	3.4	3.4	3.4
Subtotal - General Aviation	**16.9**	**18.7**	**20.3**
Total Impact	**405.4**	**427.0**	**446.8**

Table 9. U.S. Civil Aviation Economic Impact, Total Jobs: Primary plus Secondary Impacts

Jobs (Thousands)			
Description	**2012**	**2013**	**2014**
Airline Operations	1,412	1,457	1,528
Airport Operations	490	511	524
Civilian Aircraft Manufacturing	547	589	640
Civilian Aircraft Engine and Engine Parts Manufacturing	71	73	78
Civilian Other Aircraft Parts and Equipment Manufacturing	311	332	361
Civilian Avionics Manufacturing	112	111	111
Civilian Research and Development	135	191	193
Air Couriers	468	482	505
Visitor Expenditures	5,649	5,898	6,114
Travel Arrangements	112	118	126
Subtotal - Commercial	**9,305**	**9,762**	**10,181**
General Aviation Operations	163	162	183
GA Aircraft Manufacturing	89	123	132
GA Visitor Expenditures	93	93	93
Subtotal - General Aviation	**345**	**377**	**408**
Total Impact	**9,650**	**10,139**	**10,589**

Table 10. U.S. Civil Aviation Economic Impact, Value Added (Current Dollars)

Value Added ($Billions)			
Description	**2012**	**2013**	**2014**
Airline Operations	148.7	153.3	160.9
Airport Operations	38.0	39.7	40.8
Civilian Aircraft Manufacturing	62.0	66.8	72.6
Civilian Aircraft Engine and Engine Parts Manufacturing	7.8	8.0	8.6
Civilian Other Aircraft Parts and Equipment Manufacturing	33.8	36.2	39.3
Civilian Avionics Manufacturing	12.2	12.1	12.1
Civilian Research and Development	12.0	17.0	17.2
Air Couriers	31.1	32.1	33.6
Visitor Expenditures	417.1	435.5	451.5
Travel Arrangements	8.8	9.2	9.9
Subtotal - Commercial	**771.5**	**809.9**	**846.3**
General Aviation Operations	17.1	17.0	19.2
GA Aircraft Manufacturing	10.1	14.0	15.0
GA Visitor Expenditures	6.9	6.8	6.8
Subtotal - General Aviation	**34.1**	**37.8**	**41.1**
Total Impact	**805.6**	**847.7**	**887.3**

Table 11. U.S. Civil Aviation Economic Impact, Percent Contribution to GDP

Value Added - Percent of GDP			
Description	2012	2013	2014
Airline Operations	0.9	0.9	0.9
Airport Operations	0.2	0.2	0.2
Civilian Aircraft Manufacturing	0.4	0.4	0.4
Civilian Aircraft Engine and Engine Parts Manufacturing	0.0	0.0	0.0
Civilian Other Aircraft Parts and Equipment Manufacturing	0.2	0.2	0.2
Civilian Avionics Manufacturing	0.1	0.1	0.1
Civilian Research and Development	0.1	0.1	0.1
Air Couriers	0.2	0.2	0.2
Visitor Expenditures	2.6	2.6	2.6
Travel Arrangements	0.1	0.1	0.1
Subtotal - Commercial	**4.8**	**4.9**	**4.9**
General Aviation Operations	0.1	0.1	0.1
GA Aircraft Manufacturing	0.1	0.1	0.1
GA Visitor Expenditures	0.0	0.0	0.0
Subtotal - General Aviation	**0.2**	**0.2**	**0.2**
Total Impact	**5.0**	**5.1**	**5.1**

Glossary of Economic Terms

Annual Rates

Published time series data often represent flows which take place over a month, quarter, or year. One example is revenue passenger miles, which is often reported at rates of RPM per month, per quarter, or per year. Therefore, these data are at different rates, meaning RPM per year are far higher than RPM per month and RPM per quarter, making it difficult to compare the data. To annualize or present the monthly or quarterly data at annual rates, multiply the data by 12 and 4, respectively.

Earnings

Earnings are wages and salaries and other labor income, such as overtime, benefits and proprietors' income, paid to all employed persons by employers for a given unit of work or time. The BLS publishes earnings data.

Employment (Jobs)

Employment is the implicit or explicit contractual relationship which exists between an employer and employee, whereby the employee voluntarily agrees to provide work effort to the employer in exchange for cash or in-kind remuneration.[1] The Bureau of Labor Statistics (BLS) is responsible for collecting and publishing data on the number employed within the U.S. According to BLS:

> Employment data refer to persons on establishment payrolls who received pay for any part of the pay period that includes the 12th day of the month. Data exclude proprietors, the unincorporated self-employed, unpaid volunteer or family workers, farm workers, and domestic workers. Salaried officers of corporations are included. Government employment covers only civilian employees; military personnel are excluded. Employees of the Central Intelligence Agency, the National Security Agency, the National Imagery and Mapping Agency and the Defense Intelligence Agency also are excluded.[2]

Gross Domestic Product

Gross domestic product (GDP) is the dollar measure of overall economic production during a period of time. It is the current dollar value of all final goods and services produced within a country during a specified time period, such as a year or quarter. These goods and services include consumption, investment, government expenditures and net exports. GDP also can be viewed in value added terms as the sum or aggregate of value added over each stage of production over the entire economy. The Bureau of Economic Analysis (BEA) publishes annual and quarterly measures of GDP.

Gross Output

For an industry, gross output is the dollar value of goods or services produced by the industry and made available for use outside that industry during a specified time period.[3] It is measured as total sales or receipts, plus other operating income, commodity taxes (sales and excise taxes) and changes in inventories; or, equivalently, as value added, plus goods and services purchased for use in production. For an entire nation, total gross output is equal to total intermediate inputs plus GDP. Therefore, total gross output exceeds GDP. The BEA publishes annual national- and industry-level estimates of gross output.

Induced Impact

Induced impacts result from expenditures identified in the measurement of primary impacts, as well as spending by employees.

Input

Input is the total monetary value of goods and services consumed or used to produce a final good or service. These inputs include capital, labor, energy, materials and services.

[1] United Nations, *System of National Accounts*, 2008, p. 136.
[2] U.S. Department of Labor, Bureau of Labor Statistics, *Handbook of Labor Statistics*. March 2011.
[3] Organisation for Economic Co-operation and Development, "Glossary of Statistical Terms," 2002.

Multipliers

Multipliers measure the impact of particular spending on the rest of the economy. In particular, these coefficients gauge the effects of spending on output, earnings and employment. The BEA publishes industry-level multiplier estimates.

Output

Output is the current dollar production of goods or services by a production unit and is measured by total sales or receipts of that unit, plus other operating income, commodity taxes (sales and excise taxes) and changes in inventories.

Primary Impact

Primary impact refers to expenditures on air transportation and support services; aircraft, aircraft engines and parts manufacturing; and travel and other trip-related expenditures by travelers using air transportation.

Recession

A recession is the period between an economic peak and an economic trough and is characterized by a significant decline in economic activity across the economy, lasting from a few months to more than a year. The timing of economic peaks and troughs are based on measures of economic activity such as real GDP, employment, retail sales and industrial production.[4] Recessions are declared by the Business Cycle Dating Committee of the National Bureau of Economic Research (NBER). The most recent U.S. business-cycle contraction or recession officially began in December 2007 and ended in June 2009. It was labeled the Great Recession by the press, due to the length and severity of the recession. An official definition for the term does not exist.[5]

Seasonally Adjusted, at Annual Rates

This term refers to time series data which have been both seasonally adjusted and annualized. See, Annual Rates and Seasonal Adjustment.

Seasonal Adjustment

Many aviation-related time series data display seasonal patterns or seasonality. For example, travel tends to pick up during the summer and the end-of-year holiday season and slow down in the spring. Seasonal adjustment is a statistical process which removes such patterns to reveal underlying trends. In other words, seasonal adjustment removes the effects of recurring seasonal influences from time series. This process "quantifies seasonal patterns and then factors them out of the series to permit analysis of non-seasonal"[6] trends in the data.

Secondary Impact

Secondary impact is used interchangeably with Induced Impact.

Total Economic Activity

Total economic activity is a term used interchangeably with Gross Output.

Total Impact

Total impact is the sum of primary and induced impacts.

Value Added

Value added refers to the current dollar contribution to production by an individual producer, industry or sector during a specified time period. It is measured as the difference between gross output and goods and services purchased for use in production. (These purchased goods and services are also called input purchases or intermediate inputs.) Equivalently, value added consists of employee compensation, production-related taxes, imports less subsidies and gross operating surplus. Value added can be summed or aggregated across individual producers over an entire sector, industry or nation; at the national level, total value added equals GDP. The BEA publishes national- and selected sector-level annual and quarterly measures of value added, as well as selected annual industry measures.

[4] National Bureau of Economic Research, "Statement of the NBER Business Cycle Dating Committee on the Determination of the Dates of Turning Points in the U.S. Economy."
[5] Catherine Rampell, "'Great Recession': A Brief Etymology." *New York Times.* March 11, 2009; Courtney Schlisserman, "'Great Recession' Gets Recognition as Entry in AP Stylebook," *Bloomberg,* February 23, 2010; Neil Irwin, "It's Official: The Great Recession Ended Last Summer." *Washington Post*, September 20, 2010.
[6] Bureau of Labor Statistics, "Fact Sheet on Seasonal Adjustment in the CPI." February 23, 2010.

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