CHAPTER 4 – AVIATION TRENDS AND PROJECTIONS

4.1 Introduction

As a context for preparing and analyzing aviation demand forecasts for the comprehensive statewide system plan for the public-use airports in Washington, it is important to have an understanding of recent and anticipated trends for both commercial service and general aviation demand as well as cargo activity. Some trends in the aviation industry will undoubtedly have a greater impact on Washington airports than others; some trends may have no significant impact on aviation demand in the state. Information related to aviation demand trends and recent developments in air cargo will be included in this chapter when available.

The historical aviation demand trends examined consider commercial service airports separately from general aviation airports. These trends provide information and insight that were applied to the development of the aviation demand forecasts provided in this chapter. The forecasts include projections for commercial service airport enplanements and commercial operations as well as general aviation operations and based aircraft.

Because the trends (both recent and projected) in commercial service activity and general aviation activity are slightly different, varying methodologies were used to develop the forecasts for each. For commercial service airports, individual airport master plan demand forecasts and the Federal Aviation Administration's (FAA) Terminal Area Forecast (TAF) available as of March 2015 (2015 FAA TAF) were used and applied to 2014 activity data, as collected during the inventory process. The general aviation forecasts were developed using industry forecasts, with refinements for the application of growth rates by airport classification (i.e., major, regional, community, local, general use as discussed and defined in Chapter 5).

The following sections are included in the remainder of this chapter:

- Aviation demand profile and forecast
  - Industry trends
  - Washington aviation trends
  - Projections of Washington aviation demand
- Air cargo market profile and forecast
  - Air cargo industry background
  - North American West Coast and regional air cargo activity
  - Washington State air cargo
  - Washington State air cargo hub airports
  - Washington State air cargo forecast

4.2 Aviation Demand Profile and Forecast

Table 4-1 presents an overview of the results of the forecast. Details regarding the methodology used to develop these forecasts is provided later in this chapter.

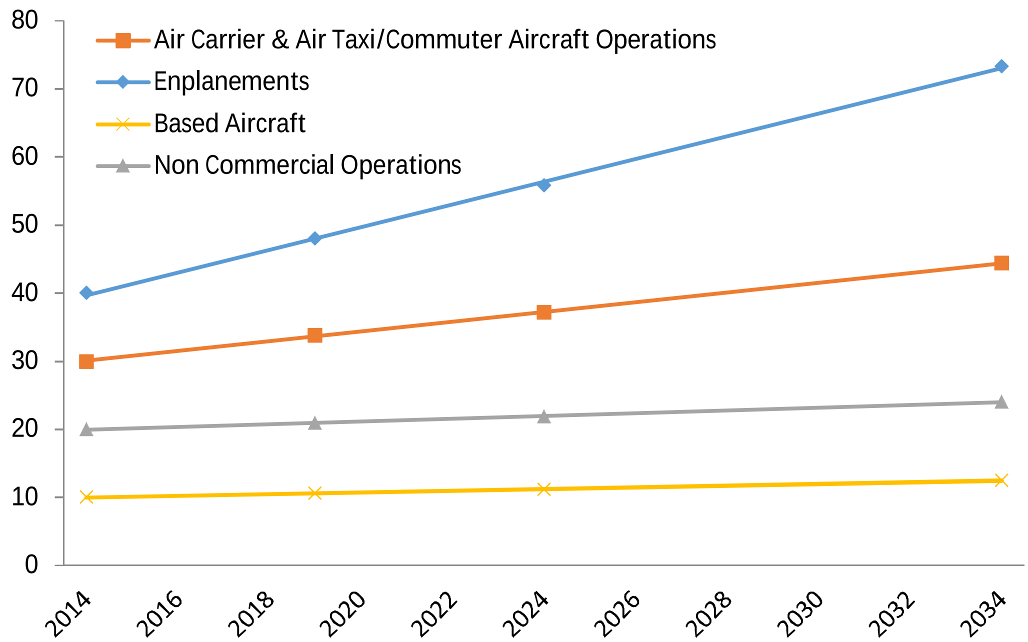
Table 4-1: Forecast Summary

Forecast Element	2014	2019	2024	2034	Total Change 2014–2034	Average Annual Growth Rate
Enplanements	21,266,635	25,507,926	29,662,115	38,975,299	83%	3.1%
Air Carrier and Air Taxi/ Commuter Aircraft Operations	594,438	670,398	738,004	879,595	48%	2.0%
Non-commercial Aircraft Operations	2,770,273	2,896,993	3,029,460	3,335,224	20%	0.9%
Based Aircraft	7,209	7,608	8,081	9,010	25%	1.1%

Source: Compiled by WSP | Parsons Brinckerhoff

Figure 4-1 graphically presents the elements of the aviation demand forecast. Details regarding the methodology used to develop these forecasts is provided later in this chapter. Note the data in the chart is not to scale and only illustrative of the growth in the elements of the demand forecast.

Figure 4-1: Illustrative Forecast Summary



Source: Compiled by WSP | Parsons Brinckerhoff

4.2.1 Industry Trends

Trends in the commercial airline industry could substantially impact air service in Washington, particularly as they relate to how the state's demand for commercial airline travel will be served in the future. Trends in general aviation are also important to consider because almost every airport in the Washington system, even the air carrier airports, accommodates some segment of general aviation activity. Because the vast majority of Washington airports support only general aviation aircraft operations, having an understanding of general aviation trends is important in considering the future demand for this component of the industry.

While there has been no overall growth from 2004 to 2014 in enplanements, it is expected that they will increase at an approximately average annual growth rate of 2% through 2035 over 2014 levels.

This section reviews trends for both commercial service airports and general aviation airports. Trends that influence aviation demand, such as fuel prices, presented in this chapter are generally for the U.S. as a whole and are intended to provide insight into the factors that have recently and are anticipated to influence future aviation demand. The trends analysis sets the stage for an understanding of how aviation activity in Washington compares to aviation in the country, and it establishes a basis for predicting how aviation may be expected to grow and change in the future.

The demand for commercial service and general aviation over time has remained strong. During 2004 and 2005, demand returned to pre-September 11, 2001 (9/11), levels with additional growth through 2007. However, the economic crises that began in 2008 caused aviation activity levels to fall once again. Since that time, aviation demand has increased steadily but at rates much slower than during previous recoveries.

Commercial Aviation Trends

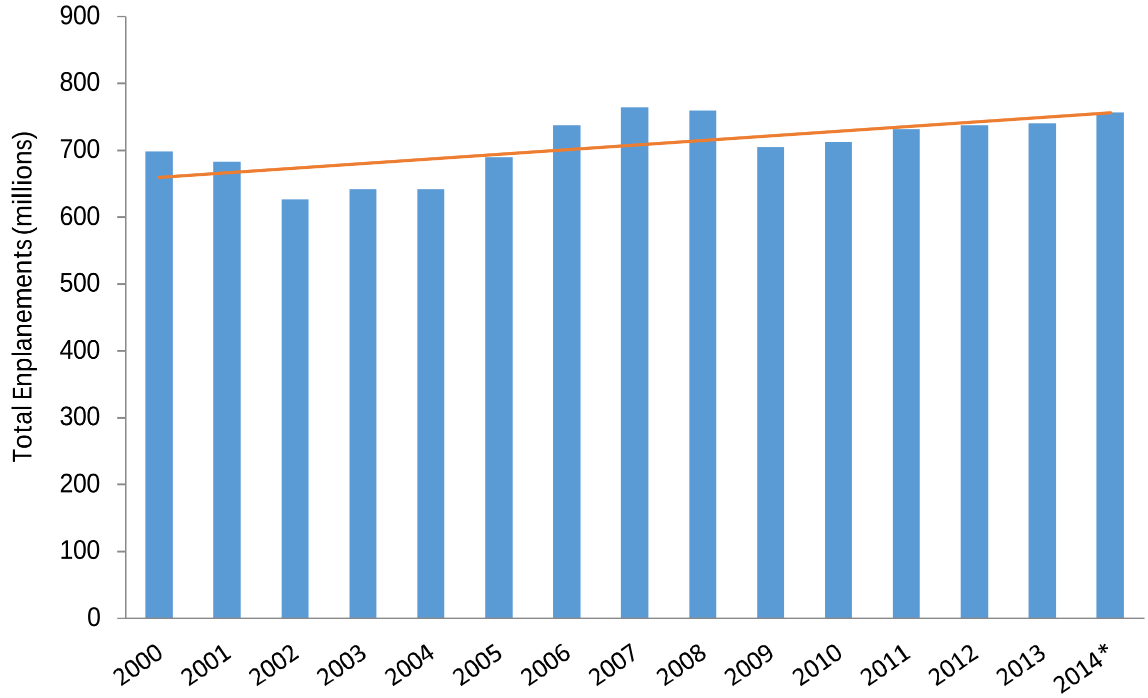
This section presents an overview of the historical and anticipated commercial aviation trends for aviation demand in the U.S. It includes an overview of historical enplanements as well as overall capacity in the system. These trends will assist in informing the forecast for these types of airports in the state. Key observations related to the information compiled for this section include the following:

- Enplanements have experienced fluctuations in the last 15 years due to factors such as the events of 9/11 and the Great Recession of 2007, which ended in 2009.
- Enplanements were almost to pre-9/11 levels when the economic downturn occurred and were nearly back to those levels by 2014.
- Airline consolidation has impacted historical trends, resulting in a decrease in the number of aircraft operations. This is primarily due to airlines "right sizing" markets through the use of larger aircraft (movement from 50-seat regional jets to 70- and 90-seat aircraft) with less frequency as well as an increase in the overall load factor.
- While there has been no overall growth from 2004 to 2014 in enplanements, it is expected that they will increase at an approximately average annual growth rate of 2 percent through 2035 over 2014 levels.
- The largest growth in enplanements will be seen in the international markets over domestic activity.
- The trends related to aircraft size and load factors are expected to continue through 2035, with load factors increasing from 83.4 percent in 2014 to 84.2 percent by 2027 and remaining fairly stable through 2035.

Recent Commercial Trends

Following the events of 9/11, aviation forecasters anticipated that it would take about five years for commercial demand to return to levels experienced in 2000. However, by 2005, commercial traffic levels at almost all commercial service airports exceeded year 2000's levels and continued to grow through 2007. After the 2007 recession and 2008 collapse of the financial markets, commercial traffic levels again dropped and were not expected to recover until the economy as a whole recovered. In 2014, U.S. enplanements had still not reached levels that surpassed those from before the recession and financial collapse. Figure 4-2 presents the trend in total U.S. enplanements since 2000, as compiled from the *FAA Aerospace Forecasts, Fiscal Years 2015–2035* (*FAA Aerospace Forecasts*)[1].

Figure 4-2: Historical U.S. Enplanements



Source: FAA Aerospace Forecasts, Fiscal Years 2015–-2035; compiled by WSP | Parsons Brinckerhoff
* 2014 data is an FAA Estimate.

The economic impacts to the airlines following the events of 9/11 and the economic recession of 2008 resulted in major changes to the airline industry. These factors are discussed below.

- **Economic Cycles:** There is a strong relationship between growth in enplanements and the U.S. gross domestic product. This trend clearly indicates that the airline industry and commercial passenger traffic are significantly impacted by upturns and downturns in the U.S. economy. The economic downturn subsequent to the economic recession beginning in 2008 had a profound effect on the level of air traffic in the U.S.

[1] All data presented herein and referred to from the *FAA Aerospace Forecasts* is taken from the FAA Aerospace Forecasts, Fiscal Years 2015–-*2035.*

Economic conditions have also spurred numerous airline mergers and acquisitions over the past decade. Table 4-2 presents an overview of the mergers and acquisitions that have occurred in the U.S. airline industry since 2000.

Table 4-2: U.S. Mainline Carriers (2000–2015)

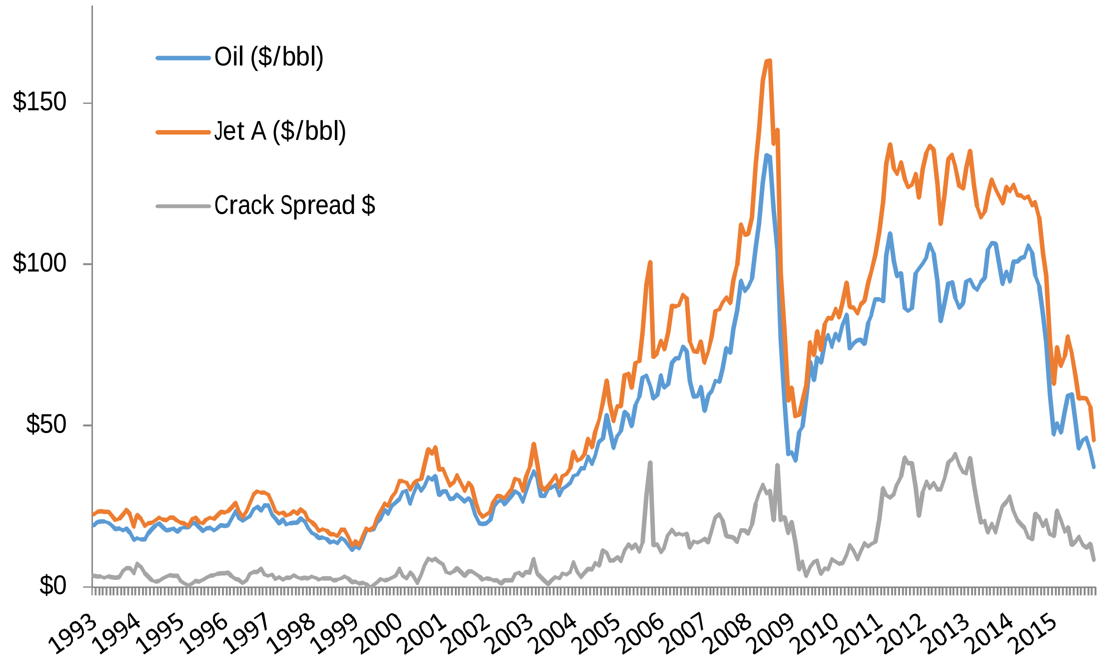
Airline	Airline Acquired	Acquired By	Currently Operating	Current Operating Name
American Airlines	TWA – 2001	U.S. Airways – 2013	Yes	American Airlines
Continental Airlines	–	United – 2011	No	United Airlines
Delta Air Lines	Northwest – 2008	–	Yes	Delta Air Lines
Northwest Airlines	–	Delta – 2008	No	Delta Air Lines
Trans World Airlines (TWA)	–	American – 2001	No	American Airlines
United Airlines	Continental – 2011	–	Yes	United Airlines
U.S. Airways	American – 2013	–	No	American Airlines

Source: Compiled by WSP | Parsons Brinckerhoff

- **Fuel Prices**: Despite a continuing increase in passenger demand, the cost of fuel continues to disrupt the financial stability of commercial airlines and their ability to maintain profitability. Figure 4-3 presents the pricing trends of crude oil and jet fuel (referred to as Jet A). Since 1991, there have been three major spikes in the price of oil. In the 1990s, the price fluctuated between $20 and $30 per barrel increasing to $35 per barrel briefly after 9/11. Oil prices continued to steadily climb until late 2005 when Hurricane Katrina hit the U.S. Gulf Coast, sending oil prices to nearly $70 per barrel. Leading up to the collapse of the financial markets in the Fall 2008, the price of oil climbed to an all-time high of around $140 per barrel. After the collapse and onset of the ensuing recession, oil prices fell to below $40 per barrel. Since that time, oil prices made a fairly steady recovery and as of mid-2014 were in the range of $90 to $100 per barrel. However, at the end of 2014, oil prices declined rapidly averaging around $50 per barrel throughout 2015. In addition, the difference between crude and jet fuel cost per barrel, known as the "crack spread," increased as well, from a historical average of $5 to around $20 in early 2015.

  The uncertainty related to fuel prices can have an adverse effect on commercial aviation if these fluctuations result in an increase in airfares. Additionally, airlines have "right-"sized aircraft to the market being served based on the demand as well as all but eliminated the use of 50-seat regional jets, which have one of the highest cost-per-seat-mile to operate.

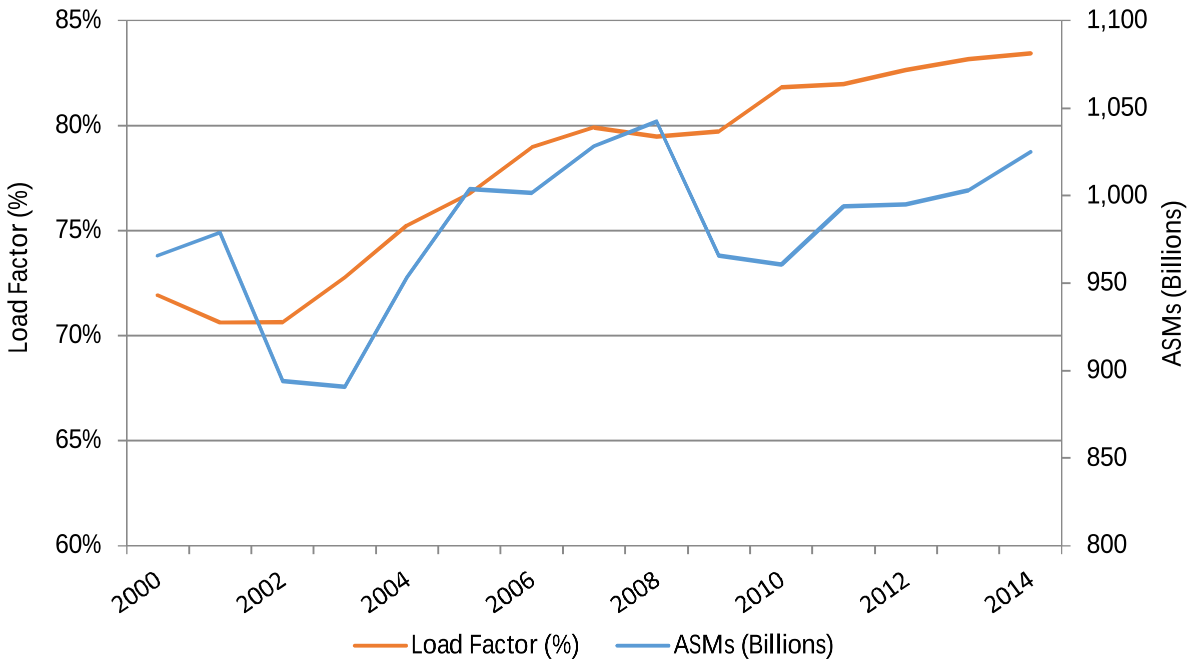
Figure 4-3: Monthly Average U.S. Oil and Jet A Prices



Source: U.S. Energy Information Administration; compiled by WSP | Parsons Brinckerhoff

- **Airline Capacity and Load Factors:** One way to evaluate the revenue drivers of the airline industry is to look at airline capacity and load factors. Airline capacity is often measured by available seat miles (ASM), which is a measure of an airline flight's passenger carrying capacity. It is equal to the number of seats available multiplied by the number of miles flown. Load factors are the percentage of available seats that are occupied. Throughout the late 1990s and early 2000s, load factors were approximately 70 percent. However, beginning in 2002, the U.S. domestic load factor increased, reaching more than 80 percent by 2010 and 84 percent in 2014. Capacity (ASMs) increased in the early 2000s in the aftermath of 9/11 and then remained relatively stable from 2009 through 2012. In 2013 and 2014, ASMs increased approximately 1 percent and 2 percent, respectively, over prior year levels. Figure 4-4 presents historical ASMs and load factors for the U.S. commercial carriers. The load factors experienced in recent years are unprecedented and have resulted in a decrease in commercial aircraft operations across the country.

Figure 4-4: Historical U.S. Commercial Carrier Capacity and Load Factors



Source: FAA Aerospace Forecasts, Fiscal Years 2015–2035; Compiled by WSP | Parsons Brinckerhoff
2014 data is an FAA Estimate

Anticipated Commercial Trends

The FAA projects that total domestic passenger enplanements on large U.S. carriers and regional/commuter carriers combined will increase from approximately 668.4 million in 2014 to approximately 951.0 million in 2035, representing an average annual growth rate of approximately 1.7 %.

The preceding descriptions of historical commercial airline trends are the background upon which the FAA has developed forecasts of future levels of commercial passenger activity. The forecasts of commercial passenger activity presented in the FAA Aerospace Forecasts indicate anticipated growth over the study period in both domestic and international passenger activity at U.S. airports. The following paragraphs summarize the FAA forecasts of future commercial airline passenger activity.

Based on the FAA 2014 forecast of slight economic recovery in 2013 and steady economic expansion in the U.S. for the remainder of the forecast period, commercial passenger enplanements in the U.S. are anticipated to experience sustained growth throughout the forecast period. The FAA projects that total domestic passenger enplanements on large U.S. carriers and regional/commuter carriers combined will increase from approximately 668.4 million in 2014 to approximately 951.0 million in 2035, representing an average annual growth rate of approximately 1.7 percent.

The international passenger activity from the *FAA Aerospace Forecasts* are based on the assumption that the world economy (based on international gross domestic products [GDP]) will grow at a pace that exceeds the U.S. GDP growth over the forecast period. Based on this assumption, international passenger enplanements on U.S. carriers are projected to increase from approximately 88.0 million in 2014 to approximately 185.5 million in 2035. This growth represents a relatively robust forecasted average annual growth rate of approximately 3.6 percent. The strongest growth in total international passenger traffic on U.S carriers is anticipated to be experienced in the Latin American and Pacific markets, which are forecast to grow at an average annual rate of approximately 4.0 percent and 3.5 percent, respectively. The average annual growth rate in the European market is projected at approximately 2.5 percent between 2014 and 2035.

The strongest growth in total international passenger traffic on U.S carriers is anticipated to be experienced in the Latin American and Pacific markets, which are forecast to grow at an average annual rate of approximately 4.0 percent and 3.5 percent, respectively. The average annual growth rate in the European market is projected at approximately 2.5 percent between 2014 and 2035.

Table 4-3[2] presents a summary of historical passenger enplanement levels at U.S. airports and the FAA domestic and international passenger enplanement forecasts on U.S. carriers (large air carriers and regional/commuter carriers) from 2015 to 2035. Another factor that may influence aviation demand in the future is the potential shortage of pilots. It is anticipated that approximately 18,000 pilots will retire from the big four airlines (American, Delta, Southwest, and United) between 2014 and 2018. These pilots likely will be replaced by pilots currently working for regional airlines (i.e., Republic, SkyWest). The high training costs for becoming a commercial pilot, recently increased number of training hours required to fly for a commercial airliner, as well as low pay, has resulted in less college students working toward becoming pilots. The outcome is regional carriers may see a shortage of pilots, which could result in a lower number of regional operations that may need to be picked up by the mainline carriers or eliminated. The most likely airports to be affected by this would be small and non-hub commercial service airports.

[2] Much of the historical data presented in this chapter begins in 2007, which is the date for the last historical data collected in the previous WASP. In addition, in 2007 historical aviation was at an all-time high for many of the categories presented in this chapter, showing the rate of recovery from the economic crises that began in 2008, where applicable.

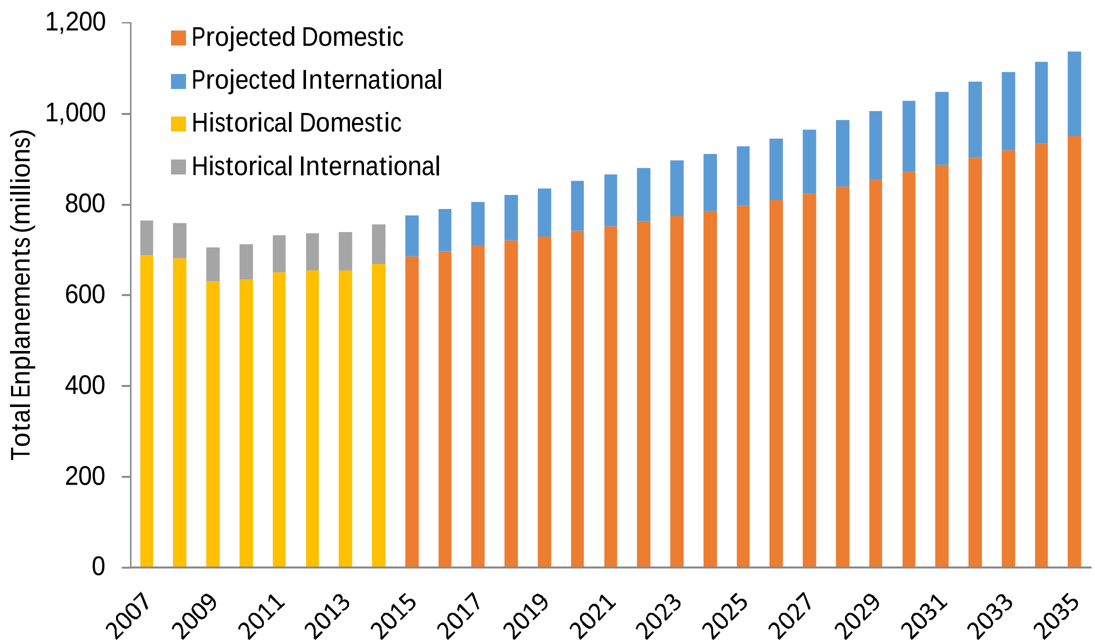
Table 4-3: Projection of U.S. Carrier Enplanements (millions)

Fiscal Year	Domestic Enplanements	International Enplanements	Total [1]
Historical			
2007	688.5	75.3	763.8
2008	680.7	78.3	759.1
2009	630.8	73.6	704.4
2010	634.8	77.3	712.1
2011	650.1	81.0	731.1
2012	653.8	82.9	736.7
2013	654.4	85.1	739.5
2014 [2]	668.4	88.0	756.3
Average Annual Growth Rate (2007-2014)	*-0.3%*	*1.7%*	*-0.1%*
Forecast			
2015	685.6	90.2	775.8
2016	696.2	93.4	789.5
2017	708.8	97.0	805.8
2018	720.6	100.5	821.1
2019	729.5	104.6	834.1
2020	742.0	109.1	851.1
2021	752.0	113.3	865.3
2022	762.4	117.5	879.9
2023	774.2	121.9	896.1
2024	784.9	126.2	911.1
2025	796.6	130.8	927.4
2026	809.2	135.5	944.7
2027	823.8	140.4	964.2
2028	839.4	145.5	984.9
2029	855.1	150.7	1,005.8
2030	871.0	156.1	1,027.1
2031	886.4	161.5	1,048.0
2032	902.6	167.1	1,069.7
2033	918.9	173.0	1,091.9
2034	935.3	179.1	1,114.4
2035	951.0	185.5	1,136.5
Average Annual Growth Rate (2014-2035)	*1.7%*	*3.6%*	*2.0%*

Source: FAA Aerospace Forecasts, Fiscal Years 2015–2035; Compiled by WSP | Parsons Brinckerhoff
[1] Totals may not add up due to individual rounding.
[2] 2014 data is an FAA estimate.

U.S. carrier total passenger enplanement data presented in Table 4-3 is depicted on Figure 4-5.

Figure 4-5: Historical and Projected U.S. Enplanements

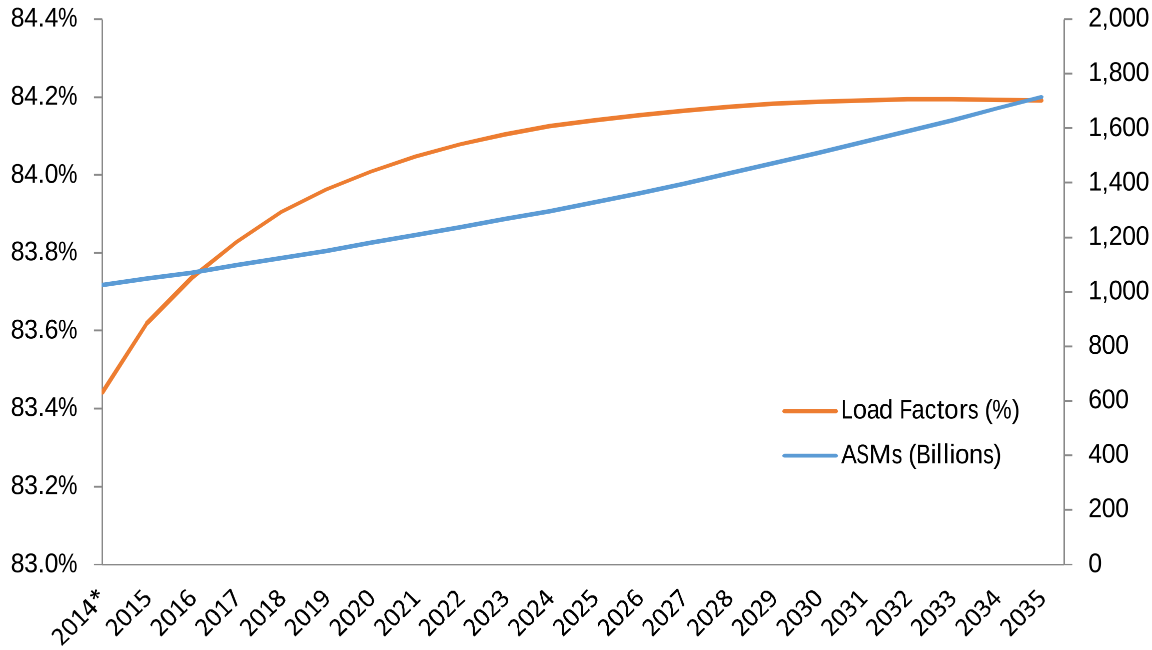


Source: FAA Aerospace Forecasts, Fiscal Years 2015–2035; compiled by WSP | Parsons Brinckerhoff
*2014 data is an FAA Estimate.

As reflected on Figure 4-5, the FAA projects near-term commercial passenger activity for U.S. carriers to be stable and reflect modest but steady growth in both domestic and international enplanements at U.S. airports. Domestic passenger enplanements are projected to increase at an average annual rate of approximately 1.7 percent from 2014 to 2035, which is much greater than the growth experienced at U.S. airports between 2007 and 2014 during the economic recovery. International passenger enplanements are projected to increase at an average annual rate of approximately 3.6 percent over the forecast period, a rate greater than the 2.3-percent average annual growth rate experienced in this category of enplanements between 2007 and 2014.

The FAA also forecasts other factors related to U.S. commercial air carrier passenger activity. According to the *FAA Aerospace Forecasts*, between 2014 and 2035 ASMs are projected to increase from 1,024.8 billion to 1,714.4 billion, average passenger trip length is expected to increase from 1,130.6 miles to 1,270.1 miles, average seats per aircraft mile will increase from 145.2 to 163.8, and the average load factor is expected to increase slightly from 83.4 percent to 84.2 percent. Figure 4-6 presents projected ASMs and load factors through 2035. The sharper projected increase in load factor indicates a flattening or decrease in the number of commercial aircraft operations, which is evidenced by the right-sizing of aircraft to markets and serving some markets with less frequency using larger regional jets (moving from 50-seat aircraft to 70- and 90-seat aircraft). This phenomenon has resulted in cost savings for the air carriers, as they are using more efficient aircraft with less frequencies. For passengers, right-sizing has resulted in higher fares as the supply of seats has decreased. In addition, passengers experience greater inconvenience when the system is backed up due to weather or there is an equipment failure as the lower frequency in flights results in less options to get to their destinations.

Figure 4-6: Projected U.S. Commercial Carrier Capacity and Load Factors



Source: FAA Aerospace Forecasts, Fiscal Years 2015–2035; compiled by WSP | Parsons Brinckerhoff
* 2014 data is an FAA Estimate.

Trends Affecting General Aviation

General aviation includes all civil aviation except scheduled passenger or air cargo operations. It includes personal transportation, business and corporate flights, air taxi (defined as "any common carrier for hire that holds an air taxi operating certificate and primarily operates small aircraft without fixed routes"), and helicopter operations.

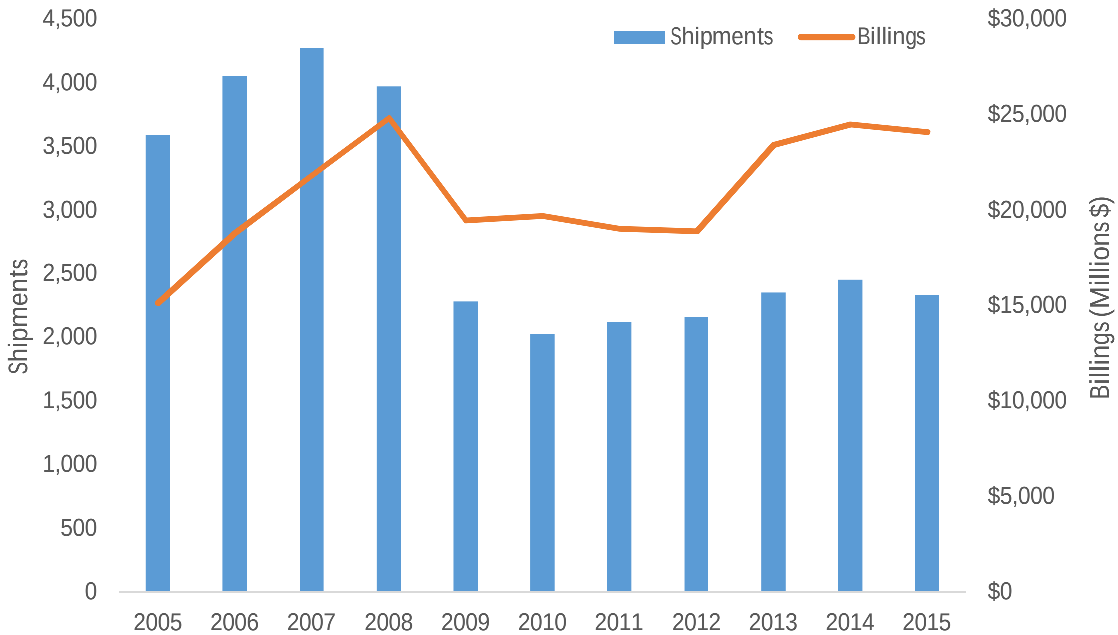
Across the U.S., general aviation aircraft are flown for a wide variety of uses, including business travel, agricultural spraying, flight instruction, emergency airlift, firefighting, recreation, and search and rescue. These aircraft include home-built/experimental, glider, agricultural, military surplus, antique and classic WarBirds, ultra-light airplanes, helicopters, single and multi-engine aircraft, and corporate and private jets.

Specific trends related to general aviation activity, as identified in the *FAA Aerospace Forecasts*, and forecasts developed by the U.S. Department of Transportation and other national groups, are identified in following sections. These anticipated future trends are discussed in terms of the number of aircraft shipments and billings, active aircraft and pilots, changes in the active aircraft fleet mix, and business use of general aviation aircraft.

Aircraft Shipments and Billings

The economic recession that began at the end of 2007 had a marked effect on the general aviation industry. Figure 4-7 presents the historical general aviation aircraft shipments from 2005 to 2015, compared to billings (value of the shipments) for the same time period. According to the General Aviation Manufacturers Association (GAMA), delivery of general aviation aircraft was down nearly 50 percent in 2009 compared to 2008 and was the second year of declining shipments compared to the three previous years, which experienced increases. Since 2009, general aviation aircraft shipments have remained relatively stable.

Figure 4-7: Historical General Aviation Aircraft Shipments and Billings



Source: GAMA; compiled by WSP | Parsons Brinckerhoff

General aviation aircraft billings also showed increases from 2005 to 2008 but decreased in the wake of the recession in 2009. General aviation billings remained relatively stable at approximately $20 billion from 2009 to 2012. However, in 2013 there was an increase of approximately 25 percent over 2012 to $23.4 billion and nearly 5 percent from 2013 to 2014 to $24.5 billion, which is the second highest level of billings on record next to 2008.

The statistics presented by GAMA indicate a decline in the overall general aviation aircraft manufacturing industry. It is important to note that even with the decline in general aviation aircraft manufacturing, the strongest growth appears to be occurring in the jet and turboprop segments of the market. Despite the significant decreases in total shipments during and since the economic recession, the combined share of jet and turboprop aircraft has increased from 40 percent in 2001 to nearly 55 percent in 2015. The growth in these segments can be attributed to increased business use of aircraft and the demand of corporations for safe, efficient, high-performance aircraft. These high-performance aircraft require airport facilities to be developed to a relatively higher and more demanding standard.

Active Pilots

In 2014, the four largest segments of the pilot population were student pilots, private pilots, commercial pilots, and airline transport pilots. With the exception of private pilots, each group experienced growth from 2007 to 2014. As a result, the total number of active pilots increased to approximately 593,500 pilots in 2014, an increase of 3,100 pilots compared to 2007. One of the strongest average annual growth rates was experienced in the student pilot population, which increased by approximately 5.2 percent during the same period. This increase was primarily due to an increase in the duration of validity for student pilot certificates for pilots under the age of 40 from 36 months to 60 months. According to the FAA, the long-term effects of this change are still undetermined and this category of pilots is projected to decrease at an average annual rate of 0.3 percent through 2024. Also noteworthy is the 6.8-percent average annual growth rate in the number of instrument-rated pilots from 2007 to 2012. Currently, approximately 52 percent of the total active pilot population is instrument-rated—another reflection of the increased sophistication of aircraft and pilots.

The FAA has developed forecasts of the future pilot population, by certificate type, based on historical trends, as well as anticipated future trends. These projections estimate that the total active pilot population in the U.S. will increase from approximately 593,500 in 2014 to 617,000 by 2035, representing an average annual growth rate of approximately 0.2 percent. Table 4-4 presents historical and projected active pilots by certificate type.

As shown in Table 4-4, the largest categories of pilots (student, private, commercial, and airline transport) are anticipated to remain relatively stable over the 20-year forecast period. Figure 4-8 presents the share of each type of pilot as presented in Table 4-4.

Figure 4-9 compares the average annual growth rate projected for each pilot type through 2014 to 2035. As shown in the figure, there is little growth in the number of active pilots, with the highest growth rates being in the sport and other categories.

Table 4-4: Historical and Projected Active Pilots by Certificate Type

Fiscal Year	Student [1]	Sport	Private	Commercial	Airline Transport	Other [2]
Historical						
2007	84,339	2,031	211,096	115,127	143,953	33,803
2008	80,989	2,623	222,596	124,746	146,838	35,954
2009	72,280	3,248	211,619	125,738	144,600	36,800
2010 [1]	119,119	3,682	202,020	123,705	142,198	36,864
2011	118,657	4,066	194,441	120,865	142,511	36,588
2012	119,946	4,493	188,001	116,400	145,590	36,146
2013	120,285	4,824	180,214	108,206	149,824	35,733
2014	120,546	5,157	174,883	104,322	152,933	35,658
Average Annual Growth Rate (2007-2014)	*5.2%*	*14.2%*	*-2.7%*	*-1.4%*	*0.9%*	*0.8%*
Forecast						
2015	119,650	5,600	173,750	104,250	153,000	35,440
2016	119,650	6,000	174,100	104,800	153,200	35,440
2017	119,300	6,450	174,200	105,100	153,400	35,505
2018	119,000	6,850	173,500	105,400	153,600	35,620
2019	118,600	7,300	172,750	105,300	153,800	35,975
2020	118,250	7,700	171,950	105,550	154,300	36,475
2021	117,900	8,100	171,250	105,750	155,100	37,200
2022	117,500	8,550	170,650	106,050	156,000	37,905
2023	117,100	9,000	170,000	106,300	156,800	38,590
2024	116,650	9,450	169,300	106,650	157,400	39,320
2025	116,300	9,900	168,650	107,050	158,100	40,130
2026	115,950	10,350	168,100	107,450	158,900	40,835
2027	115,550	10,850	167,500	107,950	159,900	41,550
2028	115,150	11,350	166,950	108,450	160,800	42,130
2029	114,750	11,900	166,400	109,050	161,800	42,595
2030	114,350	12,450	165,900	109,700	162,900	42,950
2031	113,900	13,050	165,400	110,350	164,000	43,240
2032	113,450	13,650	164,800	111,050	165,100	43,480
2033	113,050	14,300	164,350	111,750	166,300	43,735
2034	112,600	14,950	163,950	112,550	167,400	44,000
2035	112,200	14,950	163,600	113,350	168,600	44,300
Average Annual Growth Rate (2014–2035)	*-0.3%*	*5.2%*	*-0.3%*	*0.4%*	*0.5%*	*1.0%*

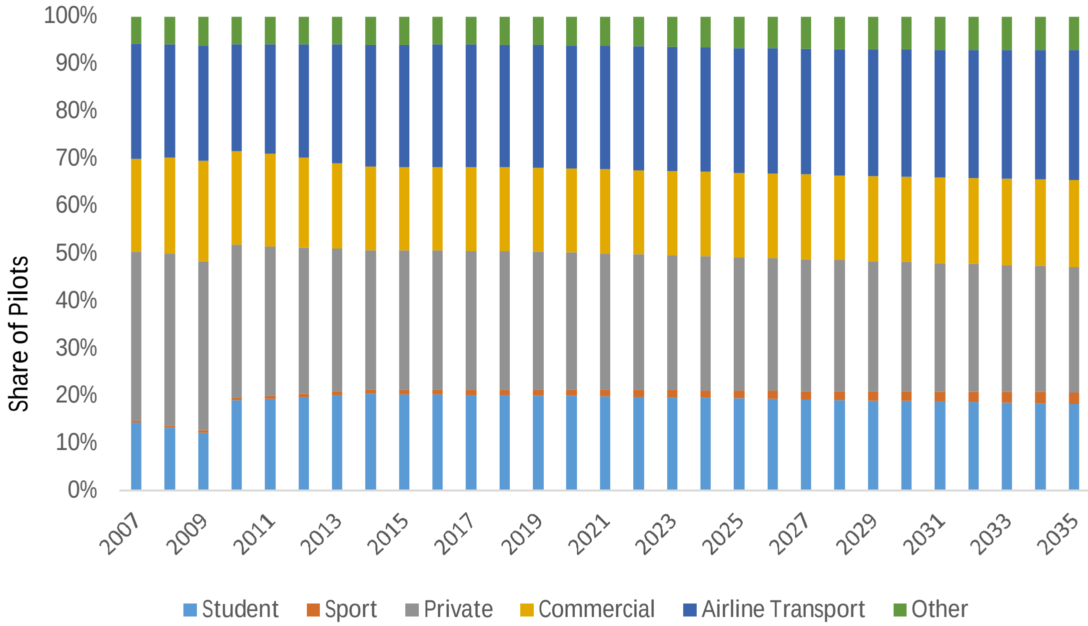
Sources: FAA Civil Airman Statistics; FAA Aerospace Forecasts, Fiscal Years 2015–2035; compiled by WSP | Parsons Brinckerhoff

[1] In July 2010, the FAA issued a rule that increased the duration of validity for student pilot certificates for pilots under the age of 40 from 36 to 60 months. This resulted in the increase in active student pilots to 119,119 from 72,280 at the end of 2009.

[2] Includes pilots with recreational, rotorcraft-only, and glider-only certificates.

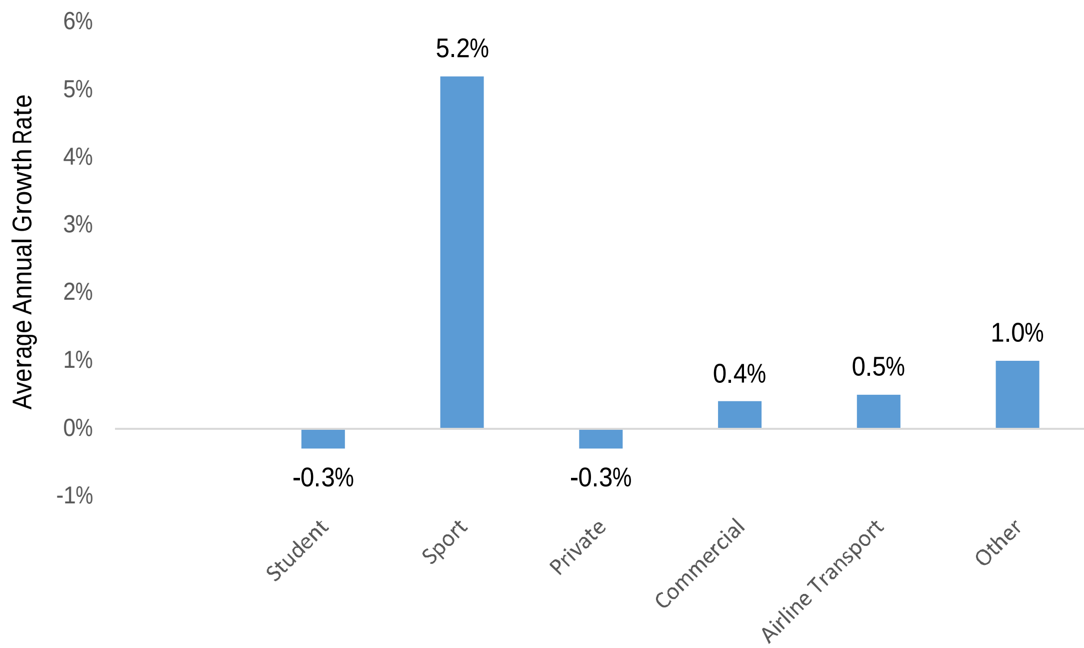
[3] Totals may not add up due to individual rounding.

Figure 4-8: Active Pilots Share by Aircraft Certificate Type (2007–2035)



Source: FAA Aerospace Forecasts, Fiscal Years 2015–2035; compiled by WSP | Parsons Brinckerhoff

Figure 4-9: Projected Growth of Active Pilots (2014–2035)



Source: FAA Aerospace Forecasts, Fiscal Years 2015–2035; compiled by WSP | Parsons Brinckerhoff

General Aviation Aircraft Fleet

The FAA uses the economic forecasts and trends in general aviation aircraft deliveries to develop its forecast of active general aviation aircraft. Table 4-5 presents the number of historical and FAA-projected general aviation aircraft. As shown in the table, the total number of active fixed-wing piston aircraft decreased since 2004, while the number of fixed-wing turbine aircraft has increased. From 2004 to 2014, the number of fixed-wing piston and fixed-wing turbine aircraft fluctuated from approximately 173,400 in 2004 to a high of approximately 187,000 in 2007 to an estimated 146,100 in 2014, representing an overall decrease from 2004 to 2014 of nearly 16 percent.

Table 4-5: Historical and Projected General Aviation Fleet Mix

Aircraft Type	2004	2014 [1]	2035	Average Annual Growth Rate 2014–2035
Single-engine piston	146,613	123,440	108,810	-0.6%
Multi-engine piston	18,469	13,215	12,135	-0.4%
Turbine	8,379	9,485	12,970	1.5%
Jet	9,298	11,750	20,815	2.8%
Rotorcraft	7,821	10,085	17,110	2.5%
Other [2]	28,739	30,885	42,420	1.5%
Total [3]	*219,319*	*198,860*	*214,260*	*0.4%*

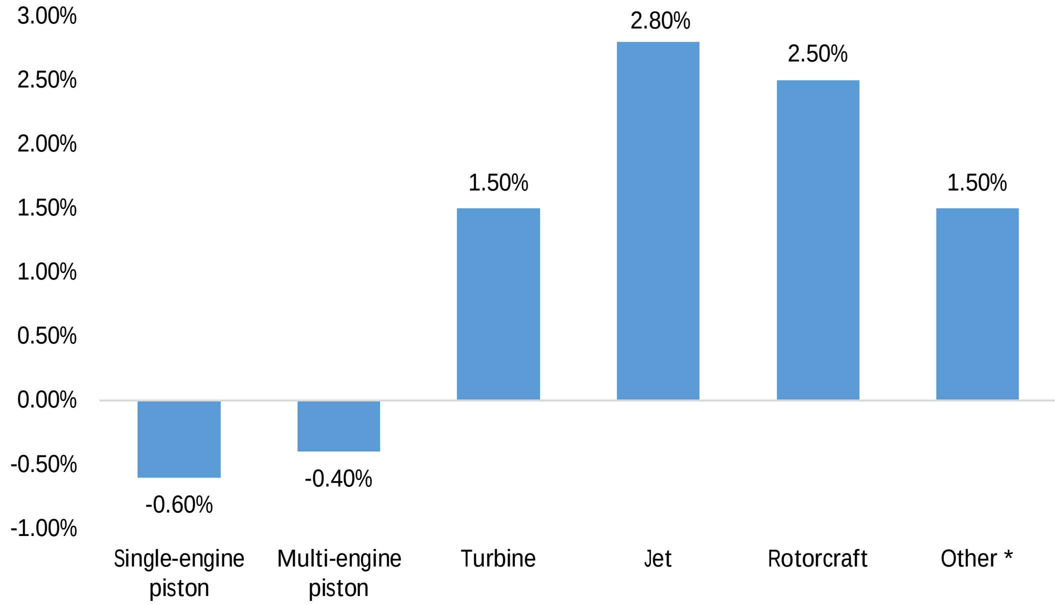
Sources: FAA Aerospace Forecasts, Fiscal Years 2015–2035; compiled by WSP | Parsons Brinckerhoff
[1] 2014 data is an FAA estimate.
[2] Includes aircraft classified by the FAA as sport and experimental.
[3] Totals may not add up due to individual rounding.

As shown in Table 4-5, the total active aircraft fleet is forecast to experience an average annual growth rate of well below 1 percent. One of the most important trends identified in these forecasts is the relatively strong growth anticipated in active jet aircraft. This trend illustrates a trend in the general aviation community toward higher performing, more demanding aircraft. This trend will impact the types of activities occurring at general aviation airports and the types of facilities that may be required at those airports. In addition, rotorcraft are projected to increase at an average annual growth rate of 2.5 percent and both turbine aircraft and other aircraft projected to increase at an average annual growth rate of 1.5 percent.

Figure 4-10 compares the projected average annual growth rate for each type of aircraft in the fleet mix over the period 2014 through 2035, and Figure 4-11 presents the trend in general aviation aircraft fleet mix. Figure 4-10 illustrates the extent to which the growth in jet aircraft are projected to significantly outpace growth in all other components of the aircraft fleet. As shown, the categories with the highest growth rates are jet and rotorcraft aircraft, with growth rates of 2.8 percent and 2.5 percent, respectively. As also shown, the number of active single- and multi-engine piston aircraft is anticipated to decrease over the forecast period.

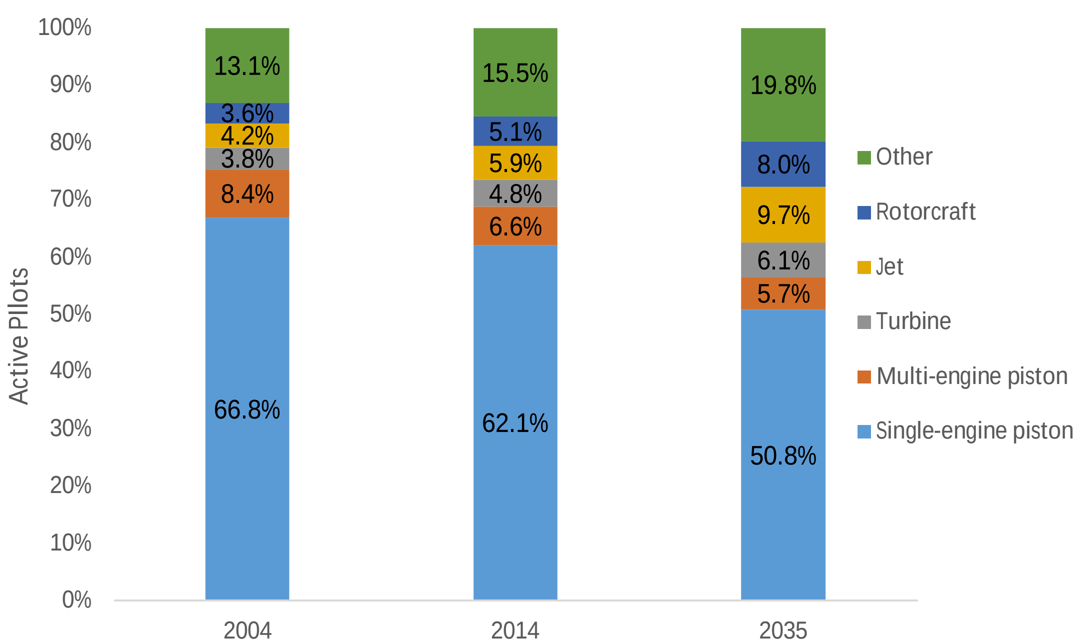
It is also useful to examine the existing and anticipated active aircraft fleet in terms of the percentage of the total fleet that each aircraft class represents or the aircraft fleet mix. Figure 4-11 presents a comparison of the existing general aviation fleet mix for 2004 and 2014 with the projected general aviation fleet mix for 2035.

Figure 4-10: Projected Growth of General Aviation Aircraft (2014 –2035)



Source: FAA Aerospace Forecasts, Fiscal Years 2015–2035; Compiled by WSP | Parsons Brinckerhoff
* Includes aircraft classified by the FAA as sport and experimental.

Figure 4-11: Aircraft Fleet Mix by Aircraft Type



Source: FAA Aerospace Forecasts, Fiscal Years 2015–2035; compiled by WSP | Parsons Brinckerhoff

As shown on Figure 4-11, the majority of the active aircraft in the current fleet (2014) is single-engine piston aircraft. It is anticipated that the percentage of single-engine piston aircraft will decline from approximately 62.1 percent (2014) to 50.8 percent (2035) of the active fleet, as older aircraft are retired and replaced. The share of jets, rotorcraft, and other aircraft are expected to increase during the projection periods, which is a continuation of the trend from 2004 to 2014.

Forecast data developed by the FAA indicates that each component of the general aviation aircraft fleet mix will either remain relatively steady (multi-engine piston and turbine) or grow in terms of total number of active aircraft. Data depicted in the previous tables and figures indicates that jet, rotorcraft, and other aircraft will be the components of the general aviation aircraft fleet mix that will see the largest growth in share of the active fleet over the forecast period.

Jet aircraft are anticipated to grow from approximately 6 percent of the active general aviation fleet mix in 2014 to approximately 10 percent of the active fleet by 2035, indicating the relative increase in sophistication that is anticipated in the active aircraft fleet and pilot population. As with the single-engine piston aircraft, this is a continuation of the trend from 2004 to 2014. The "other" category of aircraft is also forecast to become a larger component of the active fleet, primarily because of expected growth in experimental aircraft, from approximately 16 percent of the fleet to 20 percent of the fleet by 2035.

Current and forecasted trends affecting general aviation can be summarized as follows:

- The number of annual general aviation aircraft shipments has stabilized from the decline due to the Great Recession of 2007.
- The overall number of general aviation licensed pilots will stabilize; relatively strong growth is expected in the number of sport and "other" pilots.
- Moderate growth is expected in the number of active aircraft.
- Jet aircraft are expected to see even more growth from 2014 to 2035, continuing historical trends from 2004 to 2014.

4.2.2 Washington State Aviation Trends

Data regarding historical activity levels at Washington airports is presented in the following sections. Airport activity data typically provides a good indication of the total amounts of activity occurring at an airport as well as recent increases or declines in activity levels at Washington facilities. Data will be presented for the following components of airport activity:

- Enplanements
- Commercial aircraft operations
- Based aircraft
- Non-commercial and general aviation aircraft operations

Enplanements, based aircraft, and aircraft operations data from the public-use airports included in the WASP are reported annually to the FAA. The data reported to the FAA includes information from public-use airports that are a part of the National Plan of Integrated Airport Systems (NPIAS).[3] The FAA publishes the information and provides projections of activity for each airport in its TAF. For consistency with the national trends presented earlier in this chapter, historical data presented in this section is

[3] The NPIAS identifies nearly 3,400 existing and proposed airports that are significant to national air transportation and thus eligible to receive Federal grants under the Airport Improvement Program (AIP).

extracted from the 2015 FAA TAF rather than using the data collected for this Study. However, the data collected as part of the survey was used as the base to develop the aviation demand forecasts. This section presents historical comparisons of public-use airports in Washington as presented in subsequent sections.

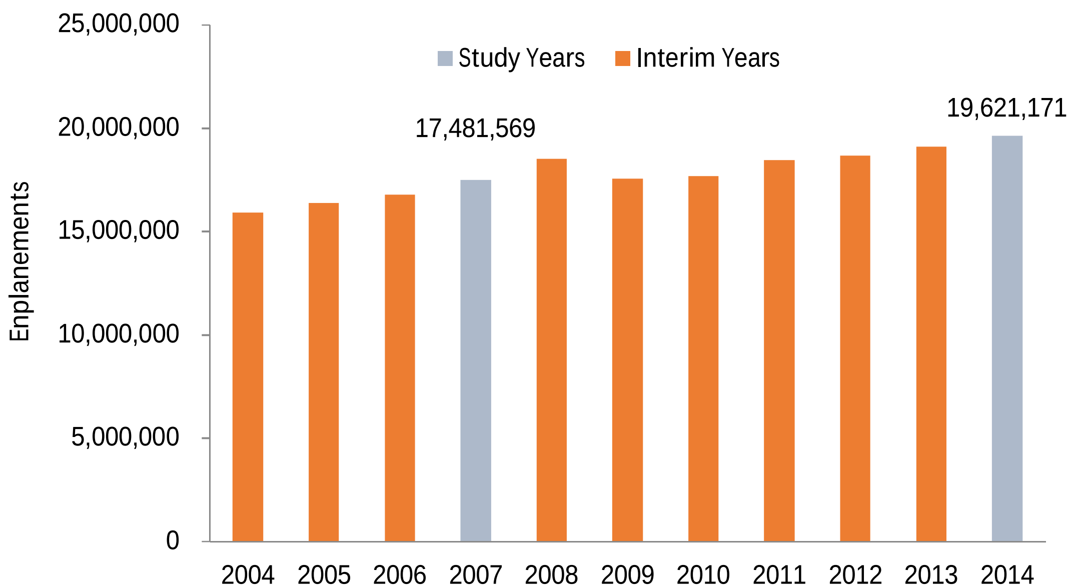
A summary of the findings related to a comparison of U.S. trends with the trends in Washington are as follows:

- Enplanements at Washington's commercial service airports increased at an average annual growth rate that was greater than the U.S. and the FAA's Northwest Mountain Region between 2004 and 2014.
- Air carrier and air taxi/commuter aircraft operations decreased at an average annual rate of 2.1 percent compared to an average annual decrease of 2.3 percent for the U.S. between 2007 and 2014. These rates of decrease are both higher than the respective rates of decrease for enplanements during the same time period, indicating a trend toward higher aircraft load factors and increased seats per departure.
- Recent trends in based aircraft indicate decreases both in Washington and the U.S., primarily due to the economic recession.
- Combined non-commercial and general aviation aircraft operations in Washington decreased at virtually the same average annual rate as general aviation operations in the U.S. from 2007 to 2014.

Enplanements

Figure 4-12 presents historical enplanement data for Washington's NPIAS airports. An enplanement is a passenger boarding a commercial service flight. The number of enplanements is largely reflective of the population, employment, and income of an airport's primary market area. In addition, enplanement levels can also be influenced by decisions by the air carriers to use an airport facility as a hub for connecting passengers.

Figure 4-12: Historical Enplanements at Washington State Airports



Source: 2015 FAA TAF; compiled by WSP | Parsons Brinckerhoff

Of the 64 NPIAS airports in Washington State, there are 10 airports that are considered commercial service or primary airports. Total enplanements for all NPIAS airports were approximately 17.5 million in 2007 (the year of the last WASP), increasing to 19.6 million in 2014. Enplanements at Washington's NPIAS airports have increased at average annual growth rate of 1.7 percent from 2007 to 2014.

Table 4-6 presents a comparison of the enplanements for Washington, the FAA's Northwest Mountain Region, and the U.S. from 2004 to 2014. As shown in the table, Washington's share of the Northwest Mountain Region's enplanements has ranged from 26.4 percent (2007) to 28.1 percent (2014). During the same time period, Washington's share of U.S. enplanements has increased from a low of 2.3 percent in 2006 to the current high of 2.6 percent. Washington's enplanement growth has also outpaced both the FAA's Northwest Mountain Region and the U.S. with an average annual growth rate of 2.1 percent compared to 2.0 percent and 1.7 percent, respectively, for the FAA's Northwest Mountain Region and the U.S.

Table 4-6: Comparison of Washington State Enplanements to Northwest Mountain Region and U.S.

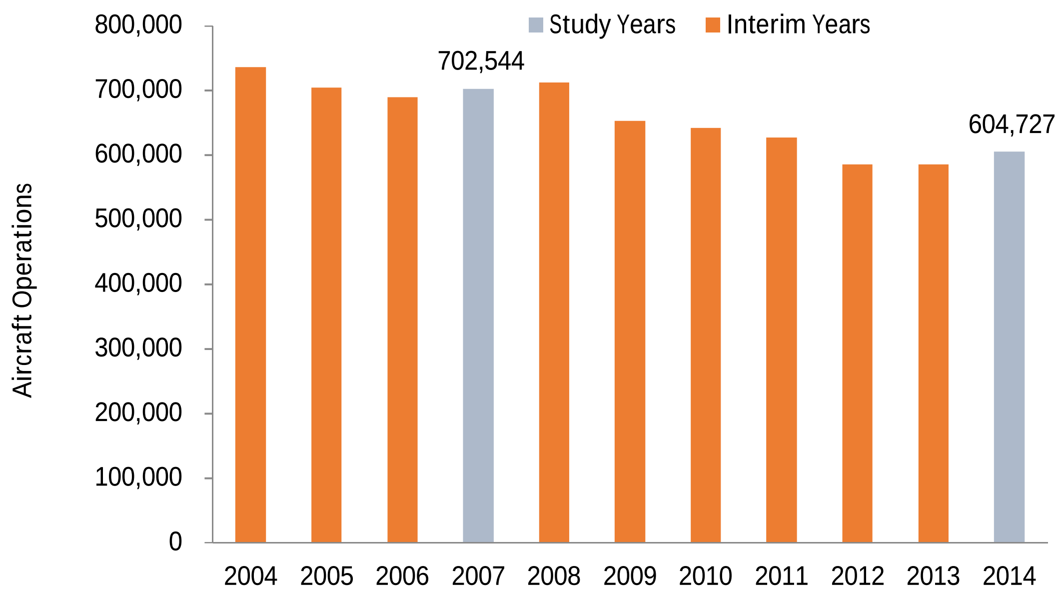
Fiscal Year	Washington	% Change	Northwest Mountain Region	% Change	WA share of NWM Region	U.S. System (in millions)	% Change	WA Share of U.S. System
2004	15,898,945		57,352,050		27.72%	641.2		2.48%
2005	16,374,531	3.0%	60,896,618	6.2%	26.89%	689.0	7.5%	2.38%
2006	16,778,067	2.5%	63,436,986	4.2%	26.45%	737.0	7.0%	2.28%
2007	17,481,569	4.2%	66,185,320	4.3%	26.41%	763.8	3.6%	2.29%
2008	18,497,508	5.8%	67,655,054	2.2%	27.34%	759.1	-0.6%	2.44%
2009	17,530,971	-5.2%	64,247,237	-5.0%	27.29%	704.4	-7.2%	2.49%
2010	17,658,548	0.7%	65,451,243	1.9%	26.98%	712.1	1.1%	2.48%
2011	18,432,030	4.4%	67,510,844	3.1%	27.30%	731.1	2.7%	2.52%
2012	18,664,260	1.3%	67,863,588	0.5%	27.50%	736.7	0.8%	2.53%
2013	19,085,989	2.3%	68,249,733	0.6%	27.96%	739.5	0.4%	2.58%
2014	19,621,171	2.8%	69,874,233	2.4%	28.08%	756.3	2.3%	2.59%
Average Annual Growth Rate (2004-2014)	*2.1%*		*2.0%*			*1.7%*		

Sources: 2015 FAA TAF; FAA Aerospace Forecasts, Fiscal Years 2015–2035; compiled by WSP | Parsons Brinckerhoff

Air Carrier and Air Carrier/Air Taxi Aircraft Operations

Figure 4-13 and Table 4-7: Washington State Air Carrier and Air Taxi/Commuter Aircraft Operations presents a comparison of 2007 and 2014 air carrier and commuter/air taxi operations at the NPIAS airports in Washington, according to the 2015 FAA TAF. As shown in the figure, these aircraft operations have decreased from approximately 702,500 in 2007 to 604,700 estimated in 2014—an average annual decrease of 2.1 percent compared to an annual decrease of 2.3 percent estimated in the *FAA Aerospace Forecasts* for the nation. The decrease in air carrier/air taxi operations is greater than the decrease in enplanements primarily due to the decreases in ASMs during the same time period. This is primarily the result of the right-sizing of aircraft in over-serviced markets and the reduction of frequencies due to the shifting from 50-seat regional jets to 70- and 90-seat regional jets.

Figure 4-13: Historical Air Carrier and Air Taxi/Commuter Operations in Washington State



Source: 2015 FAA TAF; compiled by WSP | Parsons Brinckerhoff

Table 4-7: Washington State Air Carrier and Air Taxi/Commuter Aircraft Operations

Fiscal Year	Aircraft Operations	% Change
2004	735,943	0.7%
2005	704,358	-4.3%
2006	689,052	-2.2%
2007	702,544	2.0%
2008	712,401	1.4%
2009	652,417	-8.4%
2010	641,912	-1.6%
2011	627,192	-2.3%
2012	585,213	-6.7%
2013	584,951	-0.0%
2014	604,727	3.4%
Average Annual Growth Rate (2004-2014)	*-1.9%*	

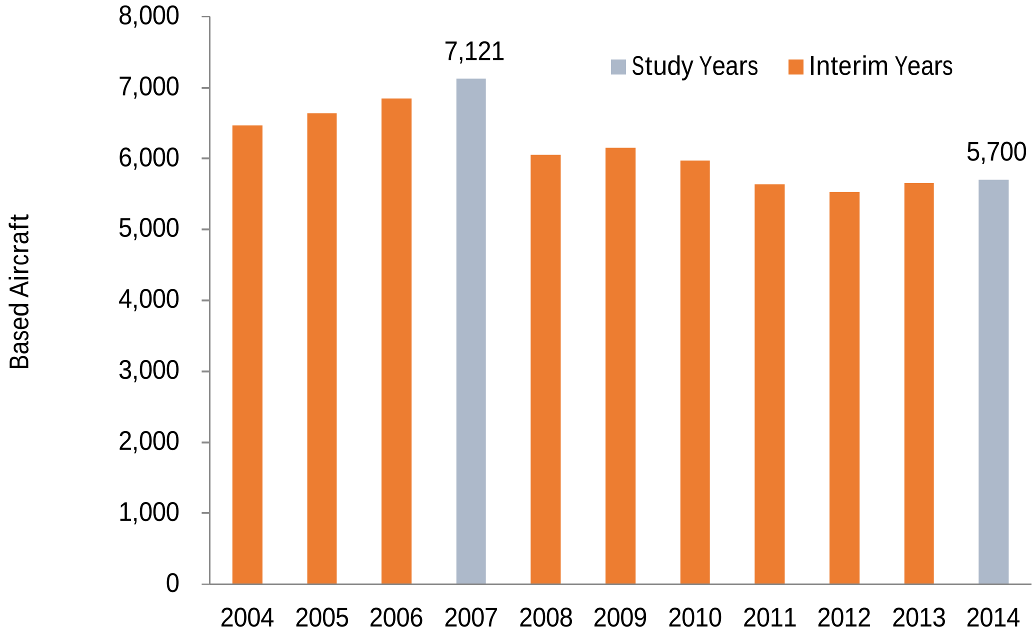
Sources: 2015 FAA TAF; FAA Aerospace Forecasts, Fiscal Years 2015–2035; compiled by WSP | Parsons Brinckerhoff

Based Aircraft

Figure 4-14 and Table 4-8 present based aircraft data for Washington's airports from 2004 to 2014. Based aircraft are general aviation aircraft that are permanently stored at an airport, either in aircraft storage hangar units or tied down. Because commercial aircraft are typically not permanently based, they are not included in based aircraft statistics. Based aircraft numbers are primarily general aviation aircraft at airports and frequently fluctuate due to a number of factors, including pilot preferences and availability of aircraft storage hangar units. The FAA recently implemented a based-aircraft website to allow airport operators/managers to report actual based aircraft numbers. This process has helped bring the reported based aircraft numbers into NPIAS reporting developed by the FAA.

According to the 2015 FAA TAF, the total number of based aircraft at Washington airports was 7,121 in 2007, the year of the last WASP. Over the seven-year period ending in 2014, total based aircraft in the state has decreased by 20 percent to 5,700. From 2004 to 2014, the number of total based aircraft has decreased approximately at an average annual rate of 1.3 percent, this compares to average annual decreases of approximately 0.4 percent and 1.0 percent for the FAA's Western Region and the U.S., respectively.

Figure 4-14: Historical Commercial Based Aircraft in Washington State



Source: 2015 FAA TAF; compiled by WSP | Parsons Brinckerhoff

Table 4-8: Washington State Based Aircraft

Fiscal Year	Aircraft Operations	% Change
2004	6,467	-0.1%
2005	6,631	2.5%
2006	6,845	3.2%
2007	7,121	4.0%
2008	6,048	-15.1%
2009	6,148	1.7%
2010	5,963	-3.0%
2011	5,637	-5.5%
2012	5,529	-1.9%
2013	5,651	2.2%
2014	5,700	0.9%
Average Annual Growth Rate (2004-2014)	*-1.3%*	

Sources: 2015 FAA TAF; FAA Aerospace Forecasts, Fiscal Years 2015–2035; compiled by WSP | Parsons Brinckerhoff

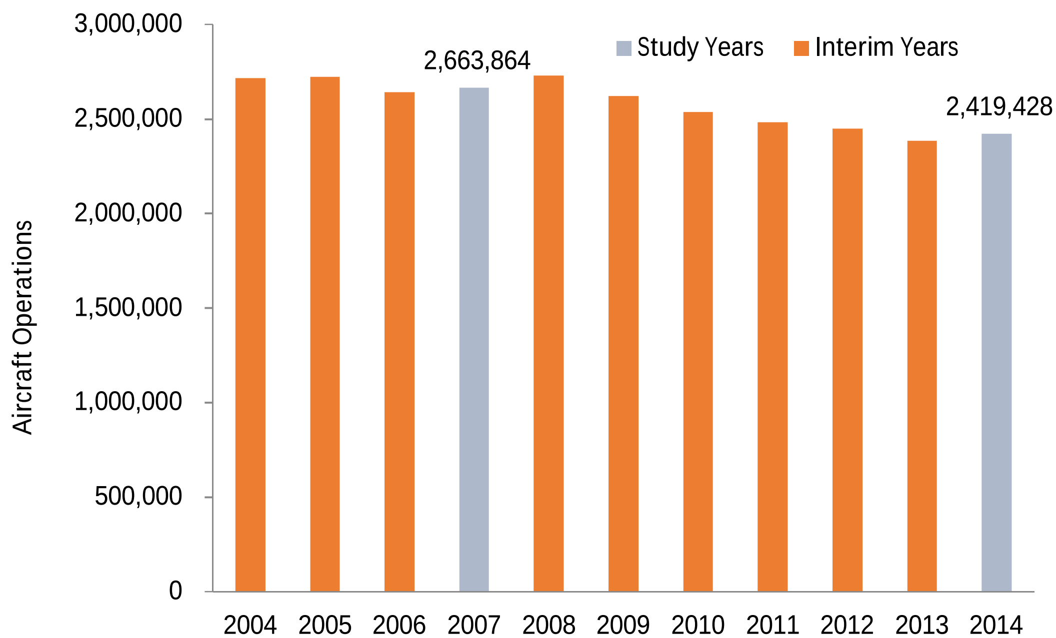
Non-commercial and General Aviation Aircraft Operations

Historical total non-commercial and general aviation operations data for Washington public-use airports is presented on Figure 4-15 **and** Table 4-9: Washington State Non-commercial and General Aviation Aircraft Operations. These consist of primarily general aviation aircraft activity at all Washington public-use airports coupled with comparatively minor amounts of non-scheduled aircraft charter/air taxi aircraft activity at general aviation airports and military aircraft operations at all airports statewide as reported in the 2015 FAA TAF.

Non-commercial and general aviation aircraft operations at WASP airports were approximately 2.7 million in 2007. Over the seven-year period ending in 2014 it is estimated non-commercial and general aviation aircraft operations in the state decreased by 9.2 percent to 2.4 million. On an average annual basis, non-commercial and general aviation aircraft operations have decreased at a rate of approximately 1.4 percent, which is less than the average annual decrease of 3.1 percent for based aircraft during the same time period. Comparatively, combined general aviation and military aircraft operations recorded by the FAA at U.S. towered airports decreased at an average annual rate of 3.4 percent between 2007 and 2014.

A portion of the data used to develop forecasts of non-commercial and general aviation activity was obtained from airports that do not have an air traffic control tower (either FAA operated or contract operated). The methods used to obtain this data are not consistent from one airport to another; therefore, the accuracy of the data for non-towered airports is not consistent with the accuracy of the data from towered airports. For example, some non-towered airports may actually count aircraft operations, while others may just sample data for a specific time period and extrapolate annual data from the sample.

Figure 4-15: Historical Non-commercial and General Aviation Aircraft Operations in Washington State



Source: 2015 FAA TAF; compiled by WSP | Parsons Brinckerhoff

Table 4-9: Washington State Non-commercial and General Aviation Aircraft Operations

Fiscal Year	Aircraft Operations	% Change
2004	2,715,609	-2.3%
2005	2,722,894	0.3%
2006	2,641,280	-3.0%
2007	2,663,864	0.9%
2008	2,729,463	2.5%
2009	2,620,912	-4.0%
2010	2,536,487	-3.2%
2011	2,481,690	-2.2%
2012	2,446,620	-1.4%
2013	2,384,805	-2.5%
2014	2,419,428	1.5%
Average Annual Growth Rate (2004-2014)	*-1.1%*	

Sources: 2015 FAA TAF; FAA Aerospace Forecasts, Fiscal Years 2015–2035; compiled by WSP | Parsons Brinckerhoff

4.2.3 Projections of Washington State Aviation Demand

Developing aviation activity projections for Washington's aviation system is a critical step in assessing the need for and phasing of future development requirements. The methodologies used to prepare aviation demand projections contained in this chapter and the resulting forecasts are discussed in the following sections:

- General forecast methodologies
- Enplanement projections
- Air carrier and air taxi/commuter aircraft operations projections
- Based aircraft projections
- Non-commercial and general aviation aircraft operations projections
- Forecast summary

General Forecast Methodologies

There are several approaches used to develop aviation forecasts. The following bullets outline these various methodologies and discuss the preferred approach for developing the forecasts contained herein.

- **Socioeconomic Trends/Regression Analyses:** This methodology typically uses regression analysis to determine the strength of the relationships between aviation demand and socioeconomic factors (i.e., population, income, employment) and to produce equations that weight the various factors that contribute to aviation demand.

- **Subset's Share of a Total:** This method includes comparing the historical aviation demand in a particular area with the activity during the same time period in a larger region. For example, the activity at a particular airport or subset of airports would be compared to the activity in its region or the entire nation. Trends, if any, are identified and then applied to develop the forecasts.

To develop the forecasts contained herein, various applications of the above described methodologies were used, including the use of already prepared forecasts. The review of historical and projected aviation trends for the nation discussed in previous sections is included to provide a context for the aviation demand forecast presented in the following sections. These methods are appropriate for developing a statewide aviation demand forecast, as they result in projections to determine what facilities are needed for the entirety of Washington State, rather than for one specific airport. Forecasts prepared for individual airports typically use regression analyses to determine if there is a relationship between historical activity and one or more socioeconomic factors, such as population, income, and employment for the market the airport serves.

Enplanement Projections

To prepare the enplanement projections developed for this study, growth rates for individual airports' Master Plans or enplanement growth rates from the 2015 FAA TAF were utilized. These growth rates were applied to the actual 2014 enplanement numbers collected during the data collection/survey phase of this study. In the case of Seattle-Tacoma International Airport (SEA), the actual Master Plan forecasts were used, since the base year is the same as this study (2014). For three other airports (Spokane, Pasco, and Bellingham) that contributed approximately 11 percent of enplanements in 2014, growth rates from the most recent individual airport master plans were used and applied to actual 2014 enplanements as reported in the data collection/survey. For the remaining airports, an individual airport's growth rates from the 2015 FAA TAF were applied to the 2014 enplanements as reported in the data collection/survey. In cases where specific airport information for 2014 was not available, the 2015 FAA TAF data was used.

Table 4-10 presents the enplanement forecasts. As shown in the table, enplanements for Washington State are forecast to increase from approximately 21.3 million in 2014 to 39.0 million in 2034. This reflects an overall increase of approximately 83 percent over 2014 levels (an average increase of nearly 1 million each year) and an average annual growth rate of 3.1 percent, which compares to the *FAA Aerospace Forecasts* long-term growth rate of 2.0 percent for the nation. This outpacing of national growth projected for Washington State is consistent with historical trends (See Table 4-6). The average projected annual growth rate from 2014 to 2034 for enplanements of 3.1 percent compares to the 2015 TAF growth rate of 2.6 percent for Washington during the same time period.

As also shown in Table 4-10, both Spokane International and Tri-Cities Airports are expected to increase in their overall share of enplanements for the state from 6.7 percent and 1.6 percent to 7.6 and 2.9 percent, respectively. These increases in share are essentially taken away from SEA, as the top four airports maintain the 99-percent share they have of total enplanements in 2014. Figure 4-16 presents the air carrier and air taxi/commuter enplanement forecast by study classification.

The enplanement forecasts contained herein are reasonable given their consistency in historical trends and when compared to the forecasts for the FAA's NorthWest Mountain Region and the nation, as well as to the FAA approved forecasts for the individual airports that make up approximately 97 percent of the overall enplanement activity.

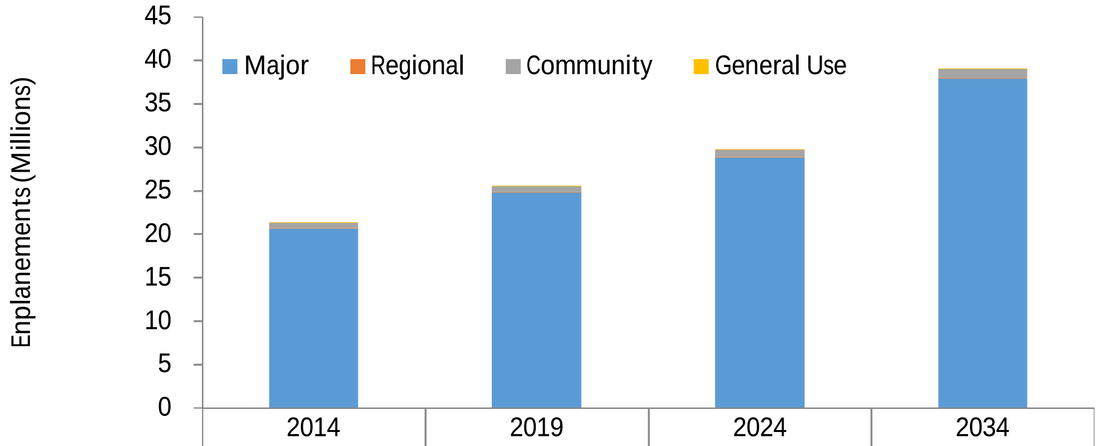
Table 4-10: Projected Enplanements

Airport Name	Airport Code	Associated City	NPIAS Category[1]	Study Classification	2014	2019	2024	2034	Total Change 2014–2034	Average Annual Growth Rate	% Share 2014	% Share 2034
Seattle/Tacoma International	SEA	Seattle	P	Major	18,716,615	22,407,600	25,913,700	33,493,432	79%	3.0%	88.0%	85.9%
Spokane International	GEG	Spokane	P	Major	1,434,496	1,716,405	2,054,139	2,943,270	105%	3.7%	6.7%	7.6%
Tri-Cities	PSC	Pasco	P	Major	329,653	449,724	613,529	1,141,861	246%	6.4%	1.6%	2.9%
Bellingham International	BLI	Bellingham	P	Community	557,176	671,224	785,272	1,029,933	85%	3.1%	2.6%	2.6%
Pangborn Memorial	EAT	East Wenatchee	P	Major	56,572	64,012	72,422	92,712	64%	2.5%	0.3%	0.2%
Pullman-Moscow Regional	PUW	Pullman	P	Regional	41,525	55,018	64,078	79,474	91%	3.3%	0.2%	0.2%
Yakima Air Terminal	YKM	Yakima	P	Major	54,921	59,049	63,500	73,401	34%	1.5%	0.3%	0.2%
Walla Walla Regional	ALW	Walla	P	Major	34,689	38,856	43,525	54,615	57%	2.3%	0.2%	0.1%
Boeing Field	BFI	Boeing	P	Major	15,303	17,786	20,676	27,969	83%	3.1%	0.1%	0.1%
Friday Harbor	FHR	Friday Harbor	P	Regional	11,827	13,306	14,975	18,958	60%	2.4%	0.1%	0.0%
Orcas Island	ORS	Eastsound	CS	Community	6,858	7,975	9,290	12,592	84%	3.1%	0.0%	0.0%
William R. Fairchild Int'l	CLM	Port Angeles	CS	Regional	3,604	3,604	3,604	3,604	0%	0.0%	0.0%	0.0%
Kenmore Air Seaplane Base	S60	Seattle	GA	General Use	1,734	1,734	1,734	1,734	0%	0.0%	0.0%	0.0%
Anacortes	74S	Anacortes	GA	Community	927	964	1,001	1,075	16%	0.7%	0.0%	0.0%
Lopez Island	S31	Lopez	GA	Community	454	454	454	454	0%	0.0%	0.0%	0.0%
Grant County International	MWH	Moses Lake	GA	Major	115	115	115	115	0%	0.0%	0.0%	0.0%
Floathaven Seaplane Base	0W7	Bellingham	N/A	General Use	100	100	100	100	0%	0.0%	0.0%	0.0%
Snohomish County/Paine Field	PAE	Everett	R	Major	59	59	59	59	0%	0.0%	0.0%	0.0%
Bowerman Field	HQM	Hoquiam	GA	Regional	4	4	4	4	0%	0.0%	0.0%	0.0%
Bremerton National	PWT	Bremerton	GA	Regional	3	3	3	3	0%	0.0%	0.0%	0.0%
Total					*21,266,635*	*25,507,992*	*29,662,181*	*38,975,365*	*83.3%*	*3.1%*	*100.0%*	*100.0%*
Major					20,642,423	24,753,547	28,781,607	37,827,374	83%	3.1%	97.1%	97.1%
Regional					56,963	71,928	82,657	102,036	79%	3.0%	0.3%	0.3%
Community					565,415	680,617	796,017	1,044,054	85%	3.1%	2.7%	2.7%
General Use					1,834	1,834	1,834	1,834	0%	0.0%	0.0%	0.0%
Total					*21,266,635*	*25,507,926*	*29,662,115*	*38,975,299*	*83.3%*	*3.1%*	*100.0%*	*100.0%*

Sources: Individual airport master plans; WSP | Parsons Brinckerhoff analysis

[1] P = Primary, CS = Commercial Service, GA = General Aviation, R = Reliever, N/A = not applicable

Figure 4-16: Projected Enplanements by Study Classification



	2014	2019	2024	2034
General Use	1,834	1,834	1,834	1,834
Community	565,415	680,617	796,017	1,044,054
Regional	56,963	71,928	82,657	102,036
Major	20,642,423	24,753,547	28,781,607	37,827,374

Source: Individual airport master plans; WSP | Parsons Brinckerhoff analysis

Air Carrier and Air Taxi/Commuter Aircraft Operations Projections

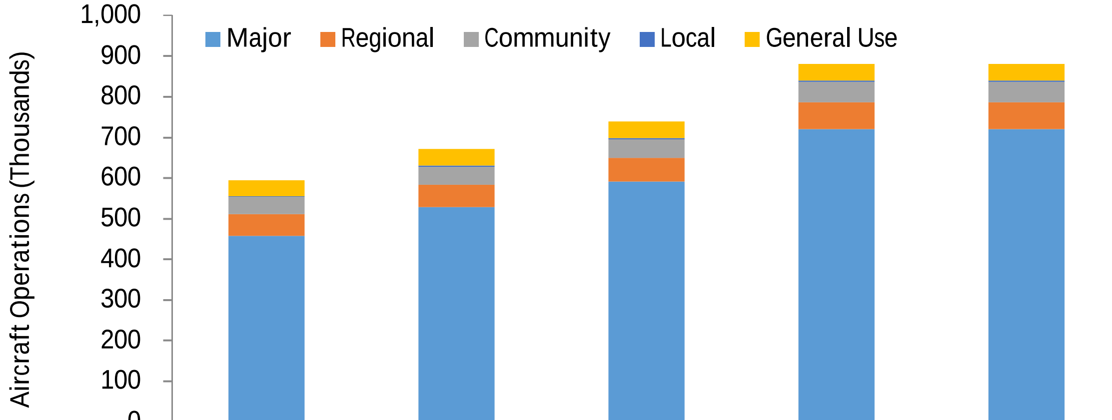
Air carrier and air taxi/commuter aircraft operations projections were also developed using TAF growth rates for the same type of aircraft operations applied to the base 2014 air carrier and air taxi/commuter aircraft operations by facility. With the exception of SEA, the base number for 2014 was established using the data collection/survey data, combined with information from the TAF to obtain correct allocations between air carrier and air taxi/commuter air craft operations and non-air carrier (general aviation and military) aircraft operations. Once the 2014 air carrier and air taxi/commuter operations number was determined, the operations growth rates by facility were applied to develop the forecasts. For SEA, the airport's Master Plan forecast was used, as the base year is the same as this Study.

In addition to the facilities presented on Table 4-10, several facilities in Washington State have non-scheduled enplanements (not included in the TAF data) or air taxi aircraft operations for non-scheduled service (in particular air taxi carriers with Part 135 Operating Certificates). The TAF growth rate was used for the aircraft operations at facilities with air taxi operations and no scheduled enplanements, which are summarized at the bottom of the table under the "Other" classifications shown.

Table 4-11 presents the air carrier and air taxi/commuter aircraft operations forecasts. As shown in the table, these aircraft operations for Washington State are forecast to increase from approximately 600,000 in 2014 to 880,000 in 2034. This reflects an overall increase of approximately 48 percent over 2014 levels and an average annual growth rate of 2.0 percent, which compares to the *FAA Aerospace Forecasts* long-term growth rate of 1.5 percent for the nation. The projected trend for Washington State to outpace national growth is consistent with historical growth, as the combined Washington State air carrier and air taxi operations decreased at an average annual rate of approximately 2.0 percent compared to 2.3 percent for the nation. The projected growth rate of 1.5 percent annually from 2014 to 2034 compares to 2.1 percent average annual growth for air carrier and air taxi operations for the same time period for Washington State from the 2015 FAA TAF.

The Major airport classification's share of this category of enplanements is expected to increase during the forecast period from approximately 77 percent to 82 percent of total air carrier and air taxi/commuter operations. Table 4-11 presents the air carrier and air taxi/commuter aircraft operations forecast by study classification.

Figure 4-17: Air Carrier and Air Taxi/Commuter Aircraft Operations by Study Classification



	2014	2019	2024	2029	2034
General Use	39,885	39,820	39,820	39,820	39,820
Local	1,007	3,950	3,950	3,950	3,950
Community	42,734	44,105	45,860	49,729	49,729
Regional	53,223	54,071	57,723	66,121	66,121
Major	457,590	528,453	590,651	719,975	719,975

Source: Individual airport master plans; WSP | Parsons Brinckerhoff analysis

Table 4-11: Projected Air Carrier and Air Taxi/Commuter Aircraft Operations

Airport Name	Airport Code/ Number	Associated City	NPIAS Category[1]	Study Classification	2014	2019	2024	2034	Total Change 2014-2034	Average Annual Growth Rate	% Share 2014	% Share 2039
Seattle/Tacoma International	SEA	Seattle	P	Major	336,238	394,470	444,310	545,961	62%	3.0%	56.6%	62.1%
Spokane International	GEG	Spokane	P	Major	43,491	49,255	53,873	62,939	45%	2.3%	7.3%	7.2%
Boeing Field	BFI	Seattle	P	Major	42,605	48,048	54,188	68,931	62%	3.1%	7.2%	7.8%
Kenmore Air Seaplane Base	S60	Seattle	GA	General Use	35,000	35,000	35,000	35,000	0%	0.0%	5.9%	4.0%
Bellingham International	BLI	Bellingham	P	Community	20,539	21,250	22,732	25,952	26%	1.5%	3.5%	3.0%
Friday Harbor	FHR	Friday Harbor	P	Regional	13,400	14,796	16,335	19,909	49%	2.5%	2.3%	2.3%
Tri-Cities	PSC	Pasco	P	Major	12,170	13,296	14,579	17,728	46%	2.4%	2.0%	2.0%
Grant County International	MWH	Moses Lake	GA	Major	10,307	10,455	10,614	10,985	7%	0.4%	1.7%	1.2%
Lopez Island	S31	Lopez	GA	Community	8,000	8,000	8,000	8,000	0%	0.0%	1.3%	0.9%
Pullman-Moscow Regional	PUW	Pullman	P	Regional	6,100	6,381	6,575	6,864	13%	0.7%	1.0%	0.8%
Snohomish County/Paine Field	PAE	Everett	R	Major	5,982	5,982	5,982	5,982	0%	0.0%	1.0%	0.7%
Yakima Air Terminal	YKM	Yakima	P	Major	4,854	4,934	5,019	5,199	7%	0.4%	0.8%	0.6%
Orcas Island	ORS	Eastsound	CS	Community	3,439	3,566	3,715	4,087	19%	1.1%	0.6%	0.5%
Anacortes	74S	Anacortes	GA	Community	1,727	1,727	1,727	1,727	0%	0.0%	0.3%	0.2%
Walla Walla Regional	ALW	Walla	P	Major	1,685	1,740	1,800	1,933	15%	0.9%	0.3%	0.2%
William R. Fairchild Int'l	CLM	Port Angeles	CS	Regional	388	388	388	388	0%	0.0%	0.1%	0.0%
Pangborn Memorial	EAT	East Wenatchee	P	Major	259	272	286	317	23%	1.3%	0.0%	0.0%
Floathaven Seaplane Base	0W7	Bellingham	N/A	General Use	200	200	200	200	0%	0.0%	0.0%	0.0%
Bremerton National	PWT	Bremerton	GA	Regional	55	65	77	105	91%	4.0%	0.0%	0.0%
Other Regional	12			Regional	33,280	32,440	34,349	38,856	17%	1.1%	5.6%	4.4%
Other Community	4			Community	9,029	9,562	9,686	9,963	10%	0.6%	1.5%	1.1%
Local	3			Local	1,007	3,950	3,950	3,950	292%	7.1%	0.2%	0.4%
Other General Use	2			General Use	4,685	4,620	4,620	4,620	-1%	-0.1%	0.8%	0.5%
Total					*594,438*	*670,398*	*738,004*	*879,595*	*48.0%*	*2.0%*	*100.0 %*	*100.0%*
Major					457,590	528,453	590,651	719,975	57%	2.8%	77.0%	81.9%
Regional					53,223	54,071	57,723	66,121	24%	1.5%	9.0%	7.5%
Community					42,734	44,105	45,860	49,729	16%	1.0%	7.2%	5.7%
Local					1,007	3,950	3,950	3,950	292%	7.1%	0.2%	0.4%
General Use					39,885	39,820	39,820	39,820	0%	0.0%	6.7%	4.5%
Total					*594,438*	*670,398*	*738,004*	*879,595*	*48.0%*	*2.0%*	*100.0 %*	*100.0%*

Source: WSP | Parsons Brinckerhoff analysis

[1] P = Primary, CS = Commercial Service, GA = General Aviation, R = Reliever, N/A = not applicable

Non-Commercial Aircraft Operations Projections

Non-commercial aircraft operations consist of general aviation and military aircraft operations. The forecast for these types of aircraft operations were developed in a way similar to the air carrier and air taxi/commuter operations presented above. Once the 2014 base number was established using the data collection/survey and TAF information, general aviation and military operations were separated using information related to their share of total aircraft operations from the TAF. Growth rates for general aviation and military aircraft operations were applied to this number to develop the forecast. For the non-NPIAS airports that are not included in the TAF, overall, a combined growth rate for the TAF airports in the same airport classification was used.

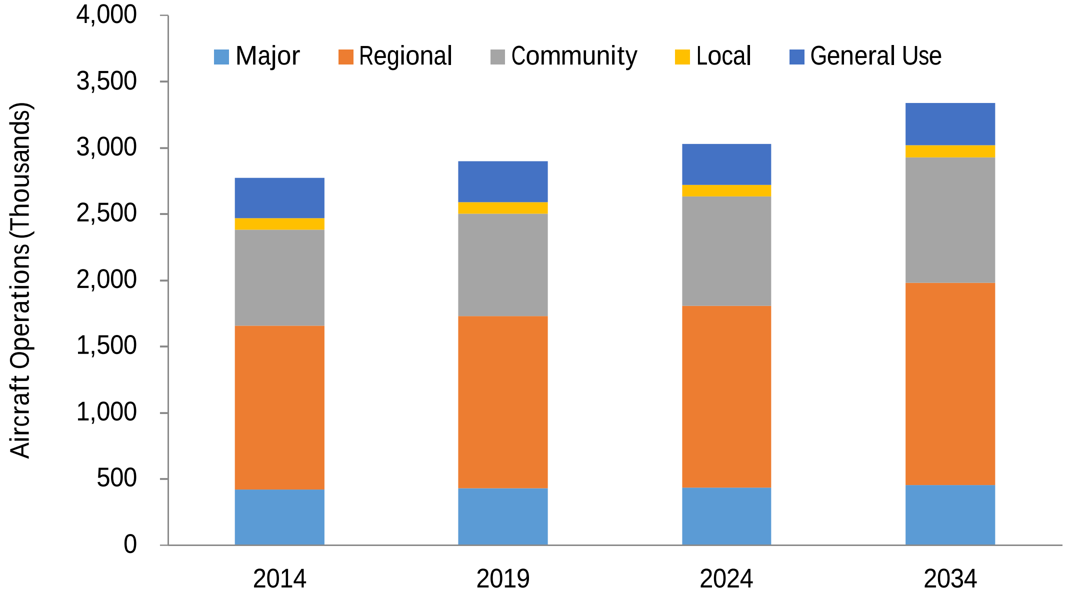
Table 4-12 presents the non-commercial aircraft operations projections for all 135 of the airports in Washington State that are included in this study. These operations are projected to increase from 2.7 million in 2014 to 3.3 million in 2034. This represents an overall increase of nearly 20 percent and an average annual growth rate of 0.7 percent. The average annual growth rate of 0.7 percent compares to the 2015 FAA TAF's growth rate of 1.0 percent for the same time period. Over the forecast period, airports with regional and community classifications are forecast to have a higher share of total non-commercial operations, while the share at airports with major, general use, and local classifications is projected to decrease. Figure 4-18 presents the non-commercial aircraft operations forecast by study classification and Figure 4-19 presents share of non-commercial aircraft operations by classification during the projection period.

Table 4-12: Non-commercial Aircraft Operations Projections

Airport Classification	Number	Study Classification	2014	2019	2024	2034	Total Change 2014–2034	Average Annual Growth Rate	% Share 2014	% Share 2034
NPIAS Major	9	Major	419,921	425,589	433,766	450,953	7%	0.4%	15.2%	13.5%
NPIAS Regional	20	Regional	1,233,720	1,302,511	1,370,314	1,527,361	24%	1.1%	44.5%	45.8%
NPIAS Community	18	Community	452,099	481,232	513,274	588,151	30%	1.3%	16.3%	17.6%
NPIAS Local	14	Local	12,043	12,146	12,255	12,497	4%	0.2%	0.4%	0.4%
NPIAS General Use	3	General Use	138,597	141,107	143,263	148,109	7%	0.3%	5.0%	4.4%
Other Community	17	Community	275,944	293,725	313,283	358,985	30%	1.3%	10.0%	10.8%
Other Local	23	Local	72,681	73,997	75,128	77,669	7%	0.3%	2.6%	2.3%
Other General Use	31	General Use	165,267	166,686	168,178	171,499	4%	0.2%	6.0%	5.1%
Total	*135*		*2,770,273*	*2,896,993*	*3,029,460*	*3,335,224*	*20.4%*	*0.7%*	*100.0%*	*100.0%*
Major	9		419,921	425,589	433,766	450,953	7%	0.4%	15.2%	13.5%
Regional	20		1,233,720	1,302,511	1,370,314	1,527,361	24%	1.1%	44.5%	45.8%
Community	35		728,043	774,957	826,557	947,136	30%	1.3%	26.3%	28.4%
Local	37		84,724	86,143	87,383	90,166	6%	0.3%	3.1%	2.7%
General Use	34		303,864	307,793	311,441	319,608	5%	0.3%	11.0%	9.6%
Total	*135*		*2,770,273*	*2,896,993*	*3,029,460*	*3,335,224*	*20.4%*	*0.7%*	*100.0%*	*100.0%*

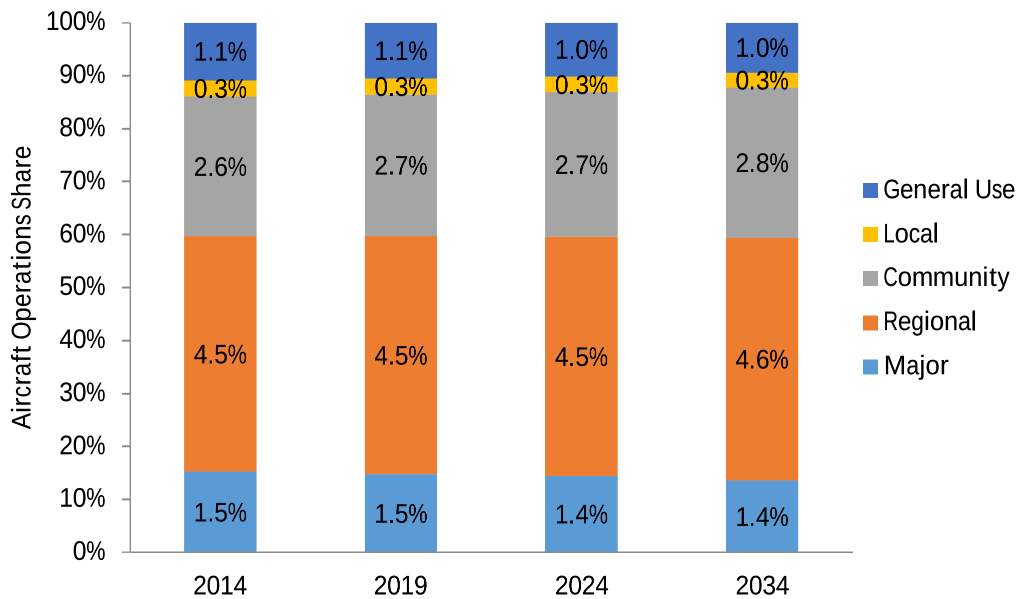
Source: WSP | Parsons Brinckerhoff analysis

Figure 4-18: Non-commercial Aircraft Operations by Study Classification



Source: FAA TAF; WSP | Parsons Brinckerhoff analysis

Figure 4-19: Share of Non-Commercial Aircraft Operations by Study Classification



Source: FAA TAF; WSP | Parsons Brinckerhoff analysis

Based Aircraft Projections

The FAA defines a "based aircraft" as an aircraft that is operational and air worthy that is based at a specific facility for a majority of the year. For airports in the FAA NPIAS, the number of based aircraft is used to determine an airport's NPIAS classification and can factor into eligibility for airport improvement projects and subsequently FAA funding. The based aircraft projections developed for this study were developed in a manner similar to that of general aviation and military aircraft operations. TAF growth rates were applied to the data reported during the survey/data collection process for each individual NPIAS airport. The growth rates by airport classification were applied to the non-NPIAS airports' based aircraft for 2014.

Table 4-13 presents the based aircraft projections. Based aircraft are projected to increase from approximately 7,200 in 2014 to 9,000 in 2034. This represents an overall increase of approximately 25 percent and an average annual growth rate of 1.1 percent. This growth rate compares to the FAA's long-term projected average annual increase in general aviation aircraft of 0.4 percent for the U.S. and the 1.0 percent increase for Washington State from the 2015 FAA TAF.

Table 4-13: Based Aircraft Projections

Airport Classification	Number	2014	2019	2024	2034	Total Change 2014–2034	Average Annual Growth Rate	% Share 2014	% Share 2034
NPIAS Major	9	1,550	1,629	1,710	1,858	20%	0.9%	25.7%	25.0%
NPIAS Regional	20	3,195	3,343	3,502	3,779	18%	0.8%	52.9%	50.8%
NPIAS Community	18	1,166	1,260	1,385	1,665	43%	1.8%	19.3%	22.4%
NPIAS Local	14	76	76	78	78	2%	0.1%	1.3%	1.0%
NPIAS General Use	3	55	56	57	57	3%	0.2%	0.9%	0.8%
Total NPIAS Airports	*64*	*6,042*	*6,364*	*6,732*	*7,435*	*23.1%*	*1.0%*	*100.0%*	*100.0%*
Major	9	1,550	1,629	1,710	1,858	20%	0.9%	21.5%	20.6%
Regional	35	3,195	3,343	3,502	3,779	18%	0.8%	44.3%	41.9%
Community	20	2,106	2,276	2,502	3,006	43%	1.8%	29.2%	33.4%
Local	37	207	207	211	211	2%	0.1%	2.9%	2.3%
General Use	34	151	154	156	156	3%	0.2%	2.1%	1.7%
Total All Airports	*135*	*7,209*	*7,608*	*8,081*	*9,010*	*25.0%*	*1.1%*	*100.0%*	*100.0%*

Source: WSP | Parsons Brinckerhoff analysis

Aviation Demand Forecast Summary

Table 4-14 presents a summary of the elements of aviation demand forecast for this study. The aviation demand forecasts developed using the methodologies described herein are reasonable, in that they are consistent with both historical trends and are similar to the results of the nationally recognized forecasts developed by the FAA in the 2015 FAA TAF and the 2015 FAA TAF; FAA Aerospace Forecasts.

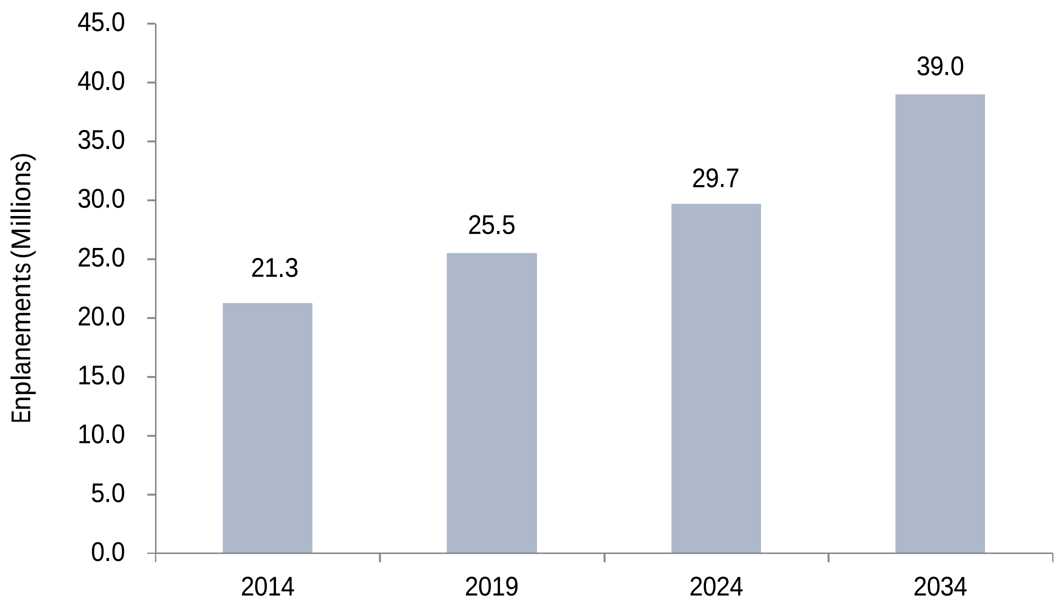
Table 4-14: Forecast Summary

Forecast Element	2014	2019	2024	2034	Total Change 2014–2034	Average Annual Growth Rate	2015 TAF Growth Rate (2014-2034)	2019 (2015 TAF)	Forecast Variance from TAF (%)
Enplanements (millions)	21.3	25.5	29.7	39.0	83%	3.1%	2.6%	24.3	4.9%
Air Carrier & Air Taxi/Commuter Aircraft Operations	594,438	670,398	738,004	879,595	48%	2.0%	2.1%	713,391	-6.0%
Non-Commercial Aircraft Operations	2,770,273	2,896,993	3,029,460	3,335,224	20%	0.9%	1.0%	2,536,102	14.2%
Based Aircraft NPIAS Airports	6,042	6,364	6,732	7,435	23%	1.0%	1.0%	5,999	6.1%
Based Aircraft WASP Airports	7,209	7,608	8,081	9,010	25%	1.1%	n/a	n/a	n/a

Source: 2015 FAA TAF; WSP | Parsons Brinckerhoff analysis

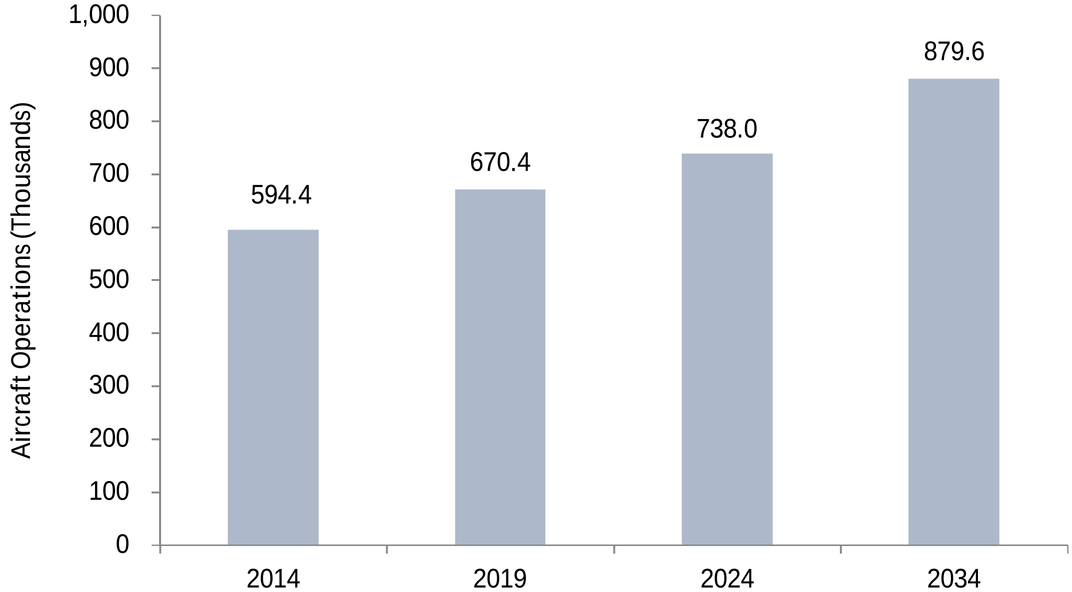
Figure 4-20, Figure 4-21, Figure 4-22, and Figure 4-23 graphically present individual elements of the aviation demand forecast presented in this chapter.

Figure 4-20: Enplanement Projections (in millions)



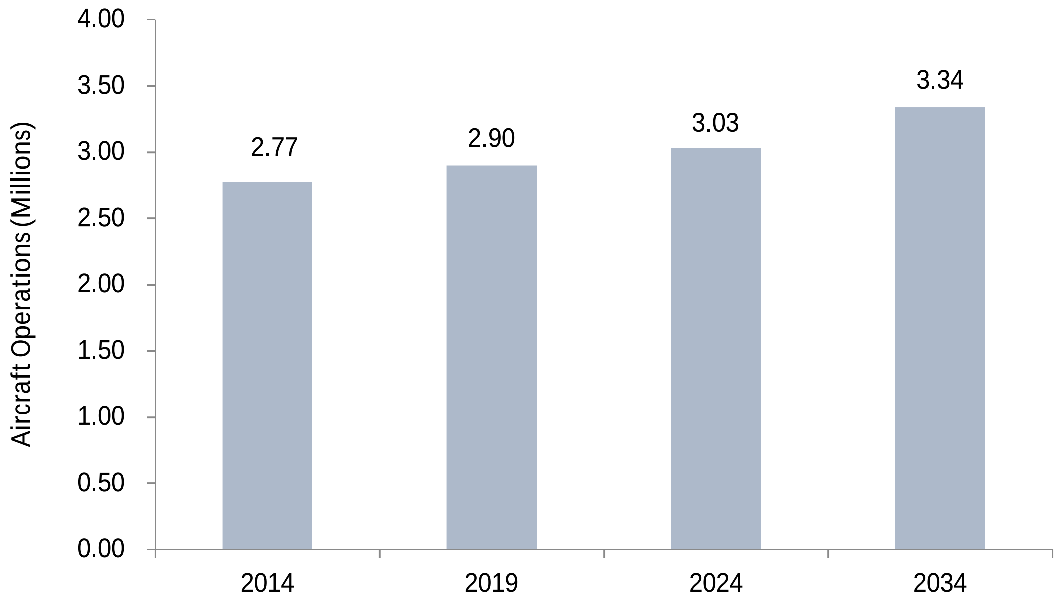
Source: Compiled by WSP | Parsons Brinckerhoff analysis

Figure 4-21: Air Carrier and Air Taxi/Commuter Aircraft Operations Projections (in thousands)



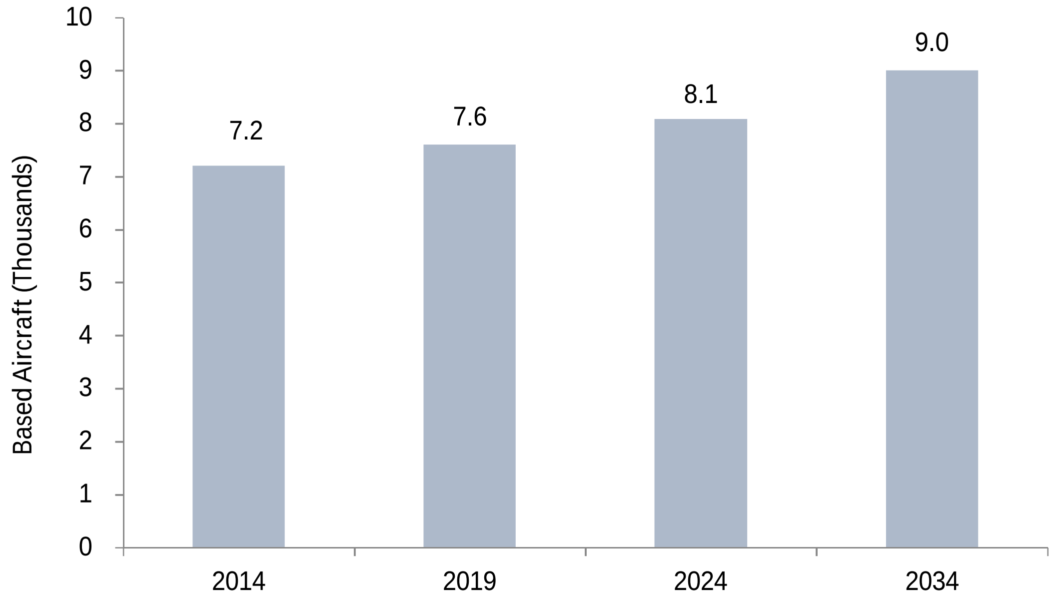
Source: Compiled by WSP | Parsons Brinckerhoff analysis

Figure 4-22: Non-commercial Aircraft Operations Projections (in millions)



Source: Compiled by WSP | Parsons Brinckerhoff analysis

Figure 4-23: Based Aircraft Projections (in thousands)



Source: FAA TAF; compiled by WSP | Parsons Brinckerhoff analysis

4.3 Air Cargo Market Profile and Forecast

This report profiles the air cargo market in Washington State. The information and analysis presented in this report will become the basis for the Washington State Air Cargo Forecast. Problematic to this effort was the lack of reliable historical airport air cargo data. Air cargo data for many Washington State airports does not exist or the data is often incomplete or inconsistent.

To remedy this situation, this reports relies heavily on historical air cargo data published by the U.S. Department of Transportation Bureau of Transportation Statistics in Form 41 T-100 Market data. Historical data for Seattle-Tacoma International Airport was provided by the Port of Seattle. Air cargo tonnages used in this report are in metric tons unless otherwise noted.

4.3.1 Air Cargo Industry Background

Economic growth, international trade, and transport are inextricably linked. Global GDP is forecasted by the World Bank to average 3.2 percent in 2017. The FAA/HIS Global Insight forecast predicts an average world GDP growth at 3.2 percent per year to 2034. With air cargo typically outpacing GDP growth by a factor of two, Boeing predicts that the volume of global air cargo will at least double in two decades.

Air cargo is a $67 billion business, representing 15 percent of total traffic revenue of the airline business and supports approximately 32 million jobs worldwide. Air cargo is an increasingly important component of the U.S. economy. In 2008, air freight accounted for 24 percent of the total U.S. merchandise trade of $3.4 trillion (America’s Freight Gateways November 2009, published by U.S.DOT). From 1990 to 2008, the value of inbound and outbound air cargo handled at the U.S. gateway airports grew at an average annual rate of about 8 percent. Overall, U.S. air cargo exports represented 48 percent of the total air trade. In comparison, U.S. maritime exports represented only 29 percent of the total ocean-borne trade.

Air Cargo Carriers

In its simplest form, the air cargo market is made up of freight and mail. Air mail in the U.S. is contracted out by the U.S. Postal Service and travels in the belly hold of commercial passenger aircraft and on freighters operated by contractors. Air freight refers to all cargo other than mail. Air cargo carriers can be divided into a number of components: the passenger airlines, the traditional all-cargo carriers, and the service-oriented integrated/express all-cargo carriers.

Air cargo carriers operate under two distinct business models: the door-to-door model and the airport-to-airport model. Each model is based on distinctly differing characteristics, varies in its deployment of resources, has differing levels of required capitalization, and yields significantly different levels of return on investment. The importance of these business models, and the companies that provide support services, cannot be underemphasized since airports cannot engage in air cargo operations without the support structure in place at or near their airports.

The more traditional air cargo business model is the airport-to-airport service. As the name implies, this model is based on the carriage of freight from an originating airport to a destination airport. Freight is delivered to the originating airport from the shipper's dock by a third party service, typically a freight forwarder, who will then tender it to the airline. At the destination airport, a third party service, typically an agent of the originating freight forwarder will take possession of the freight for delivery to the consignee. This type of airport-to-airport carriage is provided by both the passenger and all-cargo airlines.

The cargo carrying passenger airlines, such as American Airlines and Delta Air Lines, emphasize the use of lower deck, or "belly space," of their scheduled passenger aircraft, while the traditional air cargo airlines, such as Polar Air Cargo, Cargolux, and Nippon Cargo Airlines, have entire fleets dedicated to air cargo and have few limits on cargo size or type. Some passenger carriers, such as Alaska Airlines, China Airlines, and Korean Air, also have dedicated freighter aircraft and others may operate "combis," i.e., aircraft that are designed to carry a combination of both cargo and passengers on the main deck.

The carriers using the door-to-door model are referred to as the integrator/express carriers because they integrate the complete line of services in the air cargo logistics chain from initial pick up from the shipper's dock to final delivery at the consignee's door into one complete package. Unique to the integrator/express carriers is that they typically own and operate their own aircraft, ground transport, and IT systems and essentially provide complete custodial control of the shipment and offer real time shipment tracking. These assets, all under control of one organization, make possible the seamless flow of goods that provide shippers with substantial reductions in their lead times, a critical service element for most of the industries around the world. The two primary integrator/express air cargo carriers are FedEx and UPS. International express traffic has continued to grow faster than the average world air cargo growth rate, expanding 8.9 percent in 2012 and 5.8 percent in 2013.

The distinction between express and general air cargo, however, are beginning to blur. Traditional providers are expanding their time-definite offerings, and express carriers, freight airlines, and postal authorities are consolidating. Ultimately, the air cargo customer benefits from increased service options and lower prices as market pressure brings competing products into the market.

In both airline business models, third party logistics services are provided both in-house and by contract management companies. For the traditional air cargo carrier, the freight forwarder is the primary customer. In the case of the integrator/express carrier, offering supply chain management services are a core competency and a significant part of their business.

The top 10 air cargo airlines in 2014 based on total weight are shown in Table 4-15.

Table 4-15: Top Air Cargo Airlines (2014)

Rank	Airline	2014 Tonnage	Carrier Type	Home Region
1	FedEx Express	16,020	Integrator	North America
2	Emirates SkyCargo	11,240	Pax & Freighters	Middle East
3	UPS Airlines	10,936	Integrator	North America
4	Cathay Pacific Cargo	9,464	Pax & Freighters	Asia
5	Korean Air Cargo	8,079	Pax & Freighters	Asia
6	Lufthansa Cargo	7,054	Pax & Freighters	Europe
7	Singapore Airlines Cargo	6,019	Pax & Freighters	Asia
8	Qatar Airways Cargo	5,997	Freighters	Middle East
9	Cargolux	5,753	Pax & Freighters	Europe
10	China Airlines Cargo	5,266	Pax & Freighters	Asia

Source: http://www.iata.org/publications/Pages/wats-freight-km.aspx; June 2016

Important to note from Table 4-15 is that with the exception of FedEx and UPS, the top world air cargo airlines are the international flag combination passenger and freighter operators. Most domestic freight in the U.S. moves by truck rather than by air. This situation limits the amount of air cargo growth that can be expected at non-hub Washington State airports serving the domestic passenger market.

Third Party Logistics Companies

As with the airlines, third party logistics (3PL), or contract logistics management companies, offer a variety of services based on differing business models. Within the air cargo industry, the core of 3PL providers are the freight forwarders, sometimes referred to as indirect carriers. As freight forwarders attempt to compete with the integrator/express airlines for yield and market share, many forwarders are offering value added services to the list of services they have traditionally offered.

The 3PL concept has been evolving for many years, but the basic premise remains unchanged: provide outsourced logistics services, freeing the client to focus on running core operations.

Freight Forwarders

Freight forwarders are 3PL companies that concentrate on originating traffic from shippers. They serve both the shipper and air carrier by consolidating small shipments into larger consignments, palletize or containerize shipments for intermodal movement, issue their own documents for the intermodal haul, take legal responsibility for the goods being moved, provide through rates, perform pickup and delivery service, and render other useful functions to simplify the intermodal process and move freight expeditiously. They rely on the airlines to provide line-haul carriage and, in some cases, other third party providers for customs clearance and final delivery. Under the new TSA security regime, freight forwarders may also provide air cargo screening and inspection as a regulated Certified Cargo Screening Facility.

The basic forwarder's business model is based on obtaining a wholesale rate from the airline by consolidating many small shipments into single containers. By obtaining a lower container rate from the air carrier, the forwarder maximizes the spread between the charges it pays the carriers and the charges it collects on each individual shipment loaded into the container. This spread is its operating margin.

However, not all of an air freight forwarder's terminal locations produce large consolidations. Smaller cities often do not have a large enough market to produce the required volume to build consolidations for a single destination. For this reason, the forwarder will move some individual shipments from smaller cities to a larger city in its system. At the larger airport cities, sometimes known as gateway or hub cities, these small shipments are included into the consolidation being built at that location. The ability to move these smaller shipments in another terminal's larger consolidation is an important advantage for the air freight forwarder's operation.

Many forwarders have large multinational networks, such as Panalpina, Kuehne & Nagel, Expeditors International of Washington, and Schenker, while others specialize in specific local markets, such as Alaska Freight Forwarding and Pacific Alaska Freightways.

Integrated Forwarder

In between the traditional forwarder and the integrator/express carriers are the integrated forwarding companies that are a hybrid of airline and 3PL providers. These types of companies offer pick-up and delivery services using their own fleet of ground vehicles, provide real time shipment tracking, and often control large amounts of air cargo pallet positions with the airlines. The two leaders in this field are DHL Express and TNT. DHL owns 49 percent of Polar Air Cargo Airline and serves over 500 airports around the world. TNT's networks are concentrated in Europe and Asia, but the group is expanding its operations worldwide, including in the Middle East and South America. In recent years, it acquired several road freight companies in China, India, and Brazil.

Fourth Party Logistics Providers/ Lead Logistics Providers

A fourth party logistics provider (4PL)/lead logistics provider (LLP) is typically a non-asset-based logistics consultant. The 4PL provider differs from 3PL providers in that the organization is often a separate entity established as a joint venture or long-term contract between a primary client and one or more partners. 4PL organizations act as a single interface between the shipper/client and multiple logistics service providers. Ideally, all aspects of the client's supply chain are managed by the 4PL organization. Often, many major 3PL providers form a 4PL organization within their existing structure. Primary examples of 4PL providers are UPS Supply Chain Logistics, CEVA Logistics, and Ryder.

Table 4-16 shows the leading global 3PL service providers based on 2012 total gross revenues in 2012.

Table 4-16: Top International Third Party Logistics Service Providers (based on 2012 gross revenues)

Provider	2012 Gross Revenues (millions $)	Provider	2012 Gross Revenues (millions $)
DHL Supply Chain & Global Forwarding	$31,432	Damco	$3,212
Kuehne & Nagel	$22,587	Norbet Denbressangle Group	$2,782
DB Schenker Logistics	$19,732	Kintetsu World Express (KWE)	$2,718
Nippon Express	$17,317	Kerry Logistics Network, Ltd.	$2,575
C.H. Robinson Worldwide	$12,752	Pantos Logistics	$2,546
CEVA Logistics	$8,517	Ryder Supply Chain Solutions	$2,280
DSV Solutions Holding A/S	$8,140	Fiege Logistics	$2,090
Sinotrans	$7,738	Coyote Logistics	$2,000
Panalpina	$7,293	XPO Logistics	$2,000
SDV International Logistics	$7,263	BDP International	$1,900
DACHSER GmbH & KG	$6,627	Wincanton Logistics	$1,695
DACHER	$6,627	Logwin AG	$1,611
Toll Holdings Limited	$6,266	APL Logistics	$1,586
Expeditors International of Washington	$6,080	Total Quality Logistics	$1,621
Geodis	$5,828	Americold Logistics, Inc.	$1,580
UPS Supply Chain Solutions	$5,492	Logwin	$1,611
GEFCO	$5,300	Nissin Corporation	$1,555
JB Hunt	$5,224	Menlo Worldwide Logistics	$1,540
Uti Worldwide	$4,441	GENCO Supply Chain Solutions	$1,509
Agility	$4,415	BLG Logistics Group	$1,470
NYK Logistics /Yusen Air & Sea Services	$4,042	Transplace	$1,400
IMPERIAL Logistics	$3,923	FedEx Supply Chain Services	$1,387
Hellmann Worldwide Logistics	$3,433	Landstar	$1,301
Unyson Logistic	$3,374	OHL	$1,290

Source: Armstrong & Associates, Inc. , A&A's Top Global Third-Party Logistics

There are a lot of both multinational and regional air freight forwarders with a physical presence in Washington State, including Hellmann's, UPS Supply Chain Logistics, Panalpina, Kuehne & Nagel, Schenkers/Bax Global, and Expeditors International of Washington.

To be discussed in a later section, the future for air cargo growth in Washington relies to a significant extent on perception of the international forwarder community toward Seattle as a cost effective and efficient place to do business.

Air Truckers

Trucking is an important component of the air cargo industry. As with the all-cargo airlines, air truckers provide a variety of services. Some air truckers specialize in local pickup and delivery, while others provide nationwide long-haul service. Air trucking companies, such as Jet Airways of the U.S., are registered airlines and do not operate any aircraft. Rather, they provide regularly scheduled service between North American city pairs using air waybills. This service is referred to as road feeder service. Currently, more than 1,000 city pairs in the U.S. and Canada are served by road feeder service.

Many foreign flag air carriers use road feeder service as a means to expand their operational capability in the U.S. This allows the air carrier to actually fly to a limited number of gateways but provide service to many other cities using a combination of scheduled air and truck service. The air carriers publish schedules showing the arrival and departure times of both airplanes and road feeder truck service for the cities they serve. At the present time, the fastest growing segment of air cargo within the U.S. is the trucking of air shipments between airports.

4.3.2 North American West Coast and Regional Air Cargo Activity

Washington State, the Pacific Northwest, and the North American West Coast air cargo markets are well served by a combination of passenger carriers offering both lower deck and full freighter capacity, by the integrated/express and traditional all-cargo carriers providing both door-to-door service and line haul airport-to-airport service, and by an extensive network of freight forwarders, consolidators, customs brokers, and air trucking firms.

Air cargo volumes at most major West Coast gateway airports have declined over the past 14 years, decreasing from approximately 5.7 million tons in 2000 to 4.1 million tons in 2014. This is a decline in growth rate of 1.4 percent per year, much worse than the world average of 9.5 percent GDP growth over the same period. The decline in air cargo volumes in the U.S. is primarily related to modal shift from domestic air to truck. Most of the air cargo growth in recent years is in international shipments at large international gateway airports.

Historical air cargo activity at select West Coast airports is shown below in Table 4-17.

Table 4-17: Select West Coast Historical Air Cargo Activity (metric tons)

Airport	2000	2005	2010	2014	2014 Market share
Los Angeles (LAX)	2,038,784	1,928,894	1,747,629	1,816,629	44.2%
Oakland (OAK)	685,425	675,227	510,947	503,568	12.2%
Ontario (ONT)	464,164	521,853	355,932	430,319	10.5%
San Francisco (SFO)	869,839	584,926	426,725	400,614	9.7%
Seattle (SEA)	455,997	338,663	283,291	327,239	8.0%
Vancouver (YVR)	251,771	223,608	228,387	256,935	6.2%
Portland (PDX)	282,019	263,599	190,117	207,785	5.1%
Seattle (BFI)	145,000	112,758	107,370	109,653	2.7%
Spokane (GEG)	61,009	52,263	43,390	59,567	1.4%
TOTAL	*5,254,008*	*4,701,791*	*3,893,788*	*4,112,309*	*100.0%*

Source: Source: LAX, OAK,SFO, ONT, PDX, YVR: ACI-NA; BFI year 2000 is estimated, years 2005 and 2010 from the KBFI Strategic Plan- BFI, year 2014 from DOT T-100 form; SEA from Port of Seattle records; Spokane from airport records.

As can be seen in Table 4-17, the dominant air cargo airport on the West Coast is Los Angeles International Airport (LAX) with a 44 percent market share. Oakland International (OAK) is a distant second followed closely by Ontario (ONT), San Francisco, and SEA. LAX ranks as the 14th largest air cargo airport in the world and the third largest in the U.S. behind Memphis International Airport (the primary hub for FedEx), Louisville International (the primary hub for UPS), and Miami International.

LAX dominates the West Coast in air cargo due to a number of factors. The most significant reasons include the size of the local Southern California market, number of wide-body aircraft, both passenger and freighter, in service, the variety of destinations served, the frequency of departures and arrivals, the large investment in infrastructure and facilities, and the network of air freight forwarders that has developed in the immediate vicinity of the airport. Secondary reasons why the Southern California air cargo market dominates the West Coast include the large presence of warehouse and logistics company operators located in the Inland Empire of San Bernardino and Riverside Counties.

The air cargo markets at ONT, OAK, BFI, and GEG are dominated by the integrator/express airlines. ONT is the West Coast hub for UPS and OAK is the West Coast hub for FedEx. BFI is the UPS and DHL gateway airport for Western Washington and GEG is a transload hub for the Pacific Northwest for both UPS and FedEx. SEA is the Western Washington gateway for FedEx.

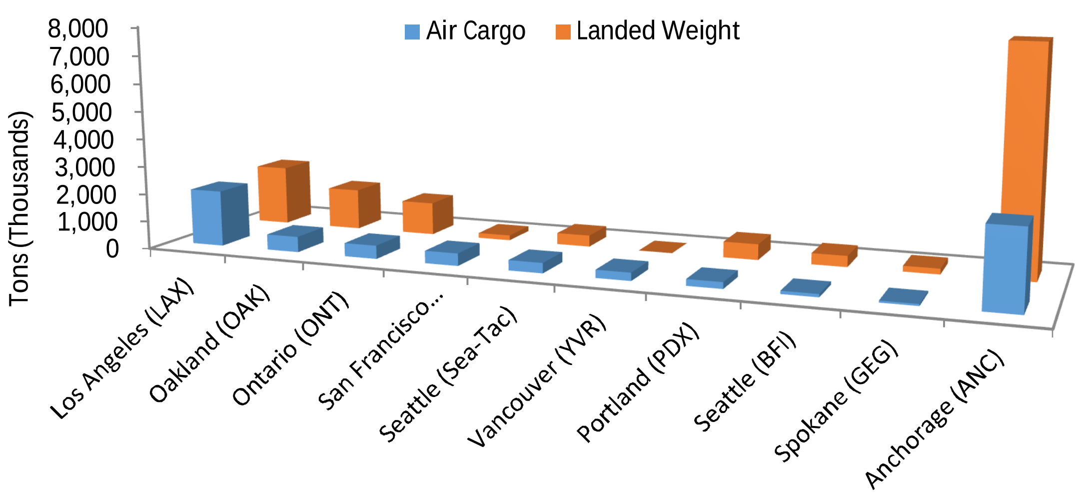
Ted Stevens Anchorage International Airport (not included in Table 4-17), ranks third in air cargo in the U.S. according to Airports Council International. It is unique in that it has a very small local market but serves as a technical stop and transfer hub for air cargo carriers serving the trans-Pacific market and represents an important market of air cargo from Washington State.

West Coast Air Cargo Freighter Market

There is a significant variation in the role various North American West Coast airports have in their use by the air cargo airlines. As with passenger traffic, some airports function as international cargo gateways, others as hubs to large hub and spoke networks, and others as origin and destination points.

To provide a more complete picture of the U.S. West Coast air cargo airport network, a review of the all-cargo-freighter landed weight at each major West Coast airport was performed. Air-cargo landed weight is a statistic collected by the FAA to determine air cargo airports of significance in the U.S. and to allocate air cargo Airport Improvement Program (AIP) funds. Air-cargo landed weight is the certified maximum gross landed weight of an all-cargo aircraft that lands at airport regardless of its payload. As such, the cargo aircraft landed weight for a particular airport represents the theoretical freighter capacity of that airport. Air cargo freighter landed weights compared with metric tons of enplaned and deplaned air cargo for select airports for calendar year 2014 is shown on Figure 4-24.

Figure 4-24: Freighter Aircraft Landed Weight and Cargo Tonnages (2014)



Source: ACI-NA North American Traffic Report; FAA AIP Records; compiled by Keiser Phillips Associates

As can be seen on Figure 4-24, Ted Stevens Anchorage International Airport, in its role as a tech stop for transpacific freighters and a hub for FedEx, UPS, and Polar Air Cargo airlines, has a significant amount of all-cargo freighter traffic compared to other West Coast airports. Both OAK, the west coast hub for FedEx, and ONT, the west coast hub for UPS, also have a significant amount of freighter traffic compared to actual enplaned and deplaned cargo. This gives these airport an advantage in receiving AIP funding.

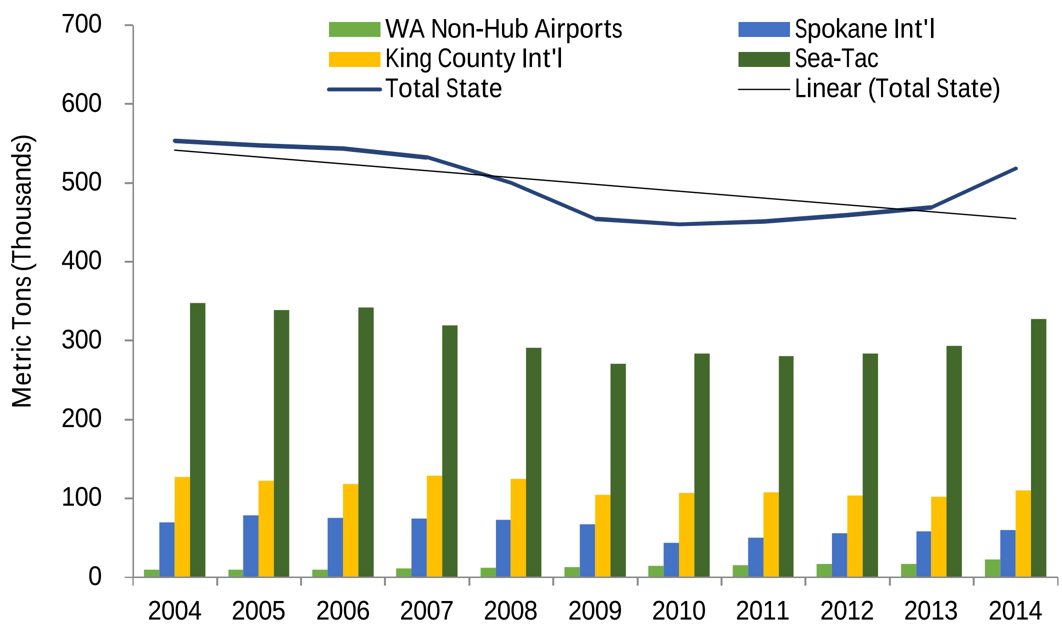
FedEx is also the largest air cargo carrier by tons at LAX. No landed weight data is available for Vancouver International Airport. SEA landed weight increased 15 percent in 2014 over 2013, while Portland International Airport's decreased 1 percent. BFI saw a 7-percent increase in 2014 over 2013 and GEG saw an 11-percent decrease over the previous year. Snohomish County Airport, the only other airport in the state with recorded air cargo aircraft landed weight, saw a phenomenal one-year 57-percent increase in 2014.

4.3.3 Washington State Air Cargo

Air cargo in Washington State is primarily generated by activity at SEA, BFI, and GEG. Non-hub and small commercial passenger airports within the state account for only 4 percent of the total air cargo volumes moved in 2014.

The trend of air cargo activity for Washington State is shown on Figure 4-25. Reflecting trends in general economy, as well as systemic changes in the air cargo industry, air cargo volumes in Washington State have fluctuated over the past 10 years from a high of 553,415 metric tons in 2004 to a low of 454,419 tons during the economic crisis of 2008/2009. The trend lines in the following charts reflect a 10-year downward trend, however, the financial recovery following the Great Recession indicate steady, slow growth.

Figure 4-25: Washington State Air Cargo Trends (2004–2014)

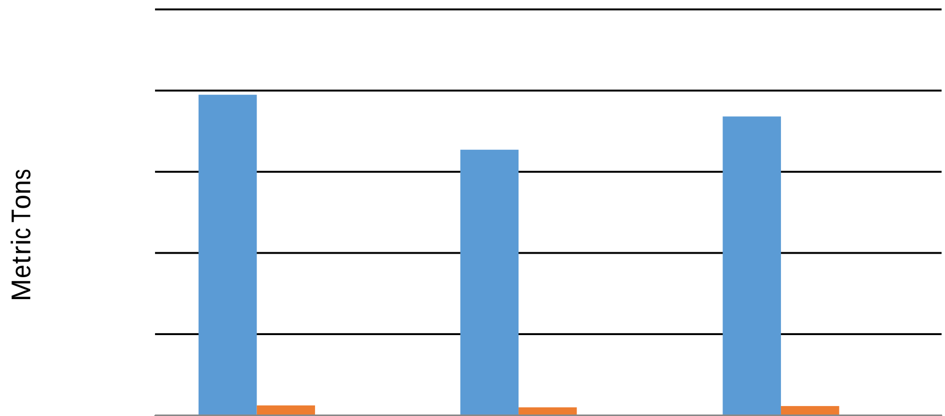


Source: Individual airport records; inventory data; compiled by Keiser Phillips Associates

Growing slowly, but faster than the general economy, air cargo volumes in the state slowly increased 3.8 percent per year from 2009 to 524,782 tons in 2014. Most of the growth in air cargo within the state is driven by the increase in international wide-body aircraft air service at SEA.

Figure 4-26 compares Washington State air cargo trends with U.S. trends. As can be seen in this figure, Washington has maintained a fairly consistent market share of 2.8 percent of the national air cargo market.

Figure 4-26: U.S. and Washington State Air Cargo Tonnage Trends



	2004	2009	2014
Total US Air Cargo	19,723,924	16,345,595	18,363,604
WA Air Cargo	553,381	454,419	518,688
% WA State	2.81%	2.78%	2.82%

Source: Individual airport records; inventory data; compiled by Keiser Phillips Associates

Airports in Washington State that handled one metric ton or more of air cargo in 2014 are presented in Table 4-18. Of the top 20 airports in the state for air cargo, Snohomish County Paine Field experienced the most increase in air cargo, while Walla Walla Regional experienced the greatest decrease. Reflecting an important trend in U.S. air cargo activity, international air cargo at SEA increased 7.7 percent per year over the past five years.

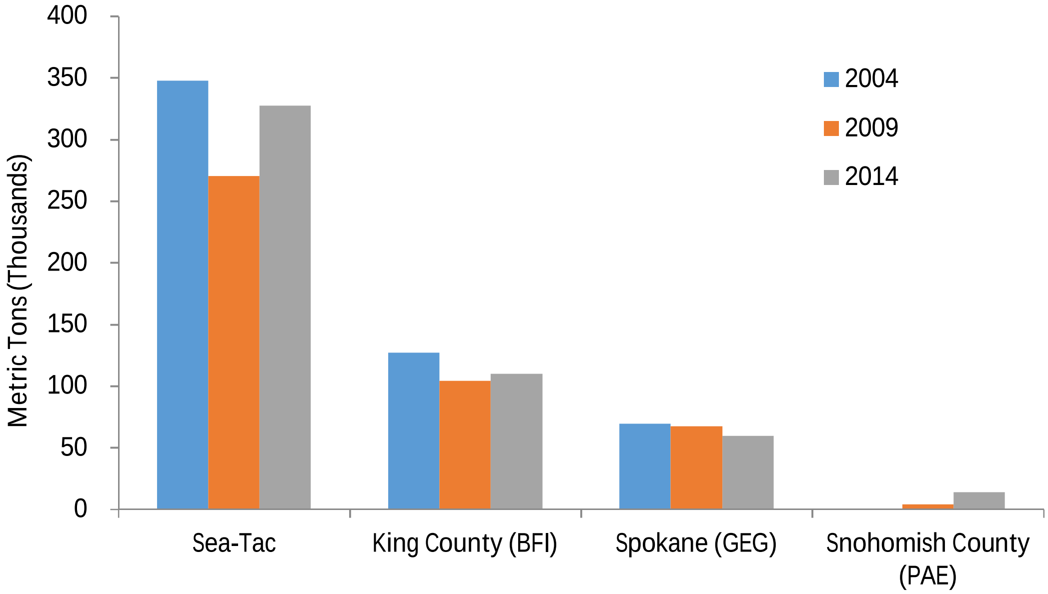
Table 4-18: Washington State Air Cargo Airports (metric tons)

Airport	2004	2014	2004-2014 Average Annual Growth	2009-2014 Average Annual Growth	2014 Market Share
Seattle-Tacoma International	347,574	327,239	-0.6%	3.9%	63.1%
King County International	126,984	109,653	-1.5%	1.0%	21.1%
Spokane International	69,363	59,567	-1.5%	-2.4%	11.5%
Snohomish County	53	13,639	74.2%	28.4%	2.6%
Tri Cities	2,962	2,855	-0.4%	-3.2%	0.6%
Yakima Air Terminal	2,251	1,917	2.4%	1.1%	0.4%
Bellingham International	1,205	1,095	-1.0%	1.9%	0.2%
Pangborn Memorial	672	711	0.6%	2.2%	0.1%
William R. Fairchild International	522	627	1.9%	3.3%	0.1%
Orcas Island Airport	236	444	6.5%	12.8%	0.1%
Grant County International	524	365	-3.6%	-2.1%	0.1%
Skagit Regional	0	363	100.0%	8.0%	0.1%
Friday Harbor Airport	88	196	8.3%	12.5%	0.0%
Pullman Moscow Regional	17	7	-8.5%	-2.6%	0.0%
Ephrata Municipal	5	3	-5.0%	100.0%	0.0%
Sequim Valley	0	2	100.0%	100.0%	0.0%
Walla Walla Regional	9	2	-14.0%	-22.2%	0.0%
Friday Harbor Seaplane Base	0	1	100.0%	100.0%	0.0%
Roche Harbor Airport	0	1	100.0%	0.0%	0.0%
Kenmore Air Harbor	0	1	100.0%	0.0%	0.0%
Oak Harbor	560	0	-100.0%	-100.0%	0.0%
Omak Airport	350	0	-100.0%	-100.0%	0.0%

Source: Seattle-Tacoma International Airport data from Port of Seattle, Spokane International Airport data years 2010-2014 from Spokane International Airport –year 2009 from DOT T-100 All Carrier Market data; all other cargo activity from the DOT T-100 All Carrier Market data

As shown on Figure 4-27, the Seattle air cargo market is by far the largest in the State. SEA and BFI combined have an 84-percent share of the total Washington State market. GEG, the third largest cargo airport in the state, represents an 11.5-percent share of the Washington market.

Figure 4-27: Primary Washington State Air Cargo Markets



Source: Individual airport records; inventory data; compiled by Keiser Phillips Associates

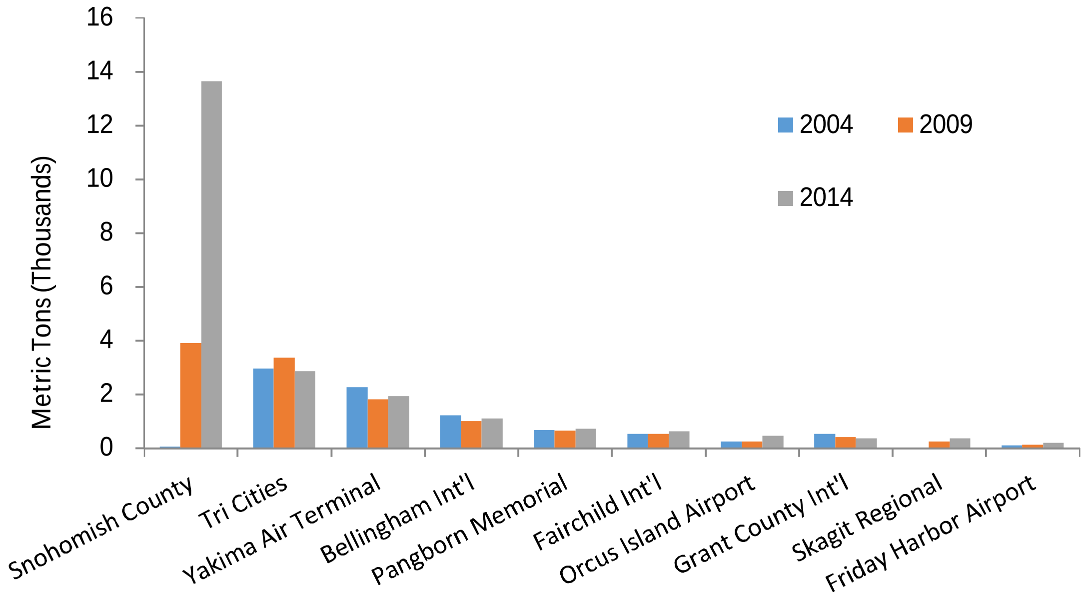
SEA dominates the local Seattle air cargo market with a mix of domestic and international lower-deck cargo (belly cargo), domestic and international freighter cargo, as well as integrator/express cargo generated by FedEx. Air cargo at BFI is generated almost exclusively by the integrator all-cargo carriers. The dominant air cargo carrier at BFI is UPS with an 80-percent market share.

GEG is utilized as an integrator/express cargo hub for the Pacific Northwest. It is dominated by FedEx and UPS with a combined market share of 91 percent. Passenger airlines account for less than 9 percent of the air cargo at GEG.

The air cargo at Snohomish County Paine Field in 2014 was generated by special modified widebody freighters as a part of the Boeing Company's 787 airplane manufacturing and assembly program. Origin and destination cities for cargo generated at Paine Field included Anchorage (a trans-Pacific transload point), Charleston, Nagoya, and Wichita. The general cargo demand in Snohomish County is served through SEA and BFI.

Air cargo activity at other airports in Washington State, shown on Figure 4-28, is generated almost exclusively by FedEx and UPS with very small quantities of enplaned and deplaned by Alaska/Horizon Airlines. Belly cargo capacity at smaller airports in the state is limited due to the regional aircraft utilized to serve these markets.

Figure 4-28: Secondary Washington State Air Cargo Markets



Source: Individual airport records; inventory data; compiled by Keiser Phillips Associates

Due to the lack of wide-body air service, smaller population centers, and the general operational economics of the air cargo business explained previously, Washington State businesses located outside the metropolitan Seattle market are served by air/truck road feeder service from SEA and BFI or directly to/from other major Midwest and West Coast airports, such as Los Angeles, San Francisco, Chicago, or Dallas.

4.3.4 Washington State Air Cargo Hub Airports

This section focuses on the three main air cargo airports within Washington State.

Seattle/Tacoma International Airport

SEA is owned and operated by the Port of Seattle. The Port of Seattle is a special-purpose government established to foster regional economic activity, provide transportation facilities for cargo and passengers by air, water, and land, and to provide a home for the North Pacific fishing industry.

Because there are often competing interests in airport resource utilization between passenger and cargo facilities, it may be informative to review some of the policies that the Port of Seattle has publicly identified as factors that should be considered in understanding the future direction of SEA's growth as related to air cargo.

The Port of Seattle's Mission Statement according to the Port's website is

> *The Port of Seattle is a public agency that creates jobs by advancing trade and commerce, promoting industrial growth, and stimulating economic development."*

The Port of Seattle's Vision is

> *Over the next 25 years we will add 100,000 jobs through economic growth led by the Port of Seattle, for a total of 300,000 port-related jobs in the region, while reducing our environmental footprint.*

The Port has identified four Strategic Objectives as a part of its "Century Agenda":

- Position the Puget Sound region as a premier international logistics hub
- Advance this region as a leading tourism destination and business gateway
- Use our influence as an institution to promote small business growth and workforce development
- Be the greenest and most energy efficient port in North America

Relevant to this study is that as part of the Port's strategy to "Position the Puget Sound region as a premier international logistics hub," its objective is to "Triple air cargo volume to 750,000 metric tons." To achieve this objective, SEA must double its existing air cargo tonnage and significantly increase the air cargo capacity of the airport.

A preliminary review of the recent *Seattle/Tacoma International Airport Master Plan* indicates that the Master Plan air cargo forecast seems to fall short of the goals identified in the Port's Century Agenda.

Seattle/Tacoma International Airport Air Cargo Activity

In 2014, enplaned and deplaned freight and mail at SEA totaled 327,239 metric tons. Airport historical air cargo activity trends are shown in Table 4-19.

Table 4-19: Historical Air Cargo Trends at Seattle/Tacoma International Airport (metric tons)

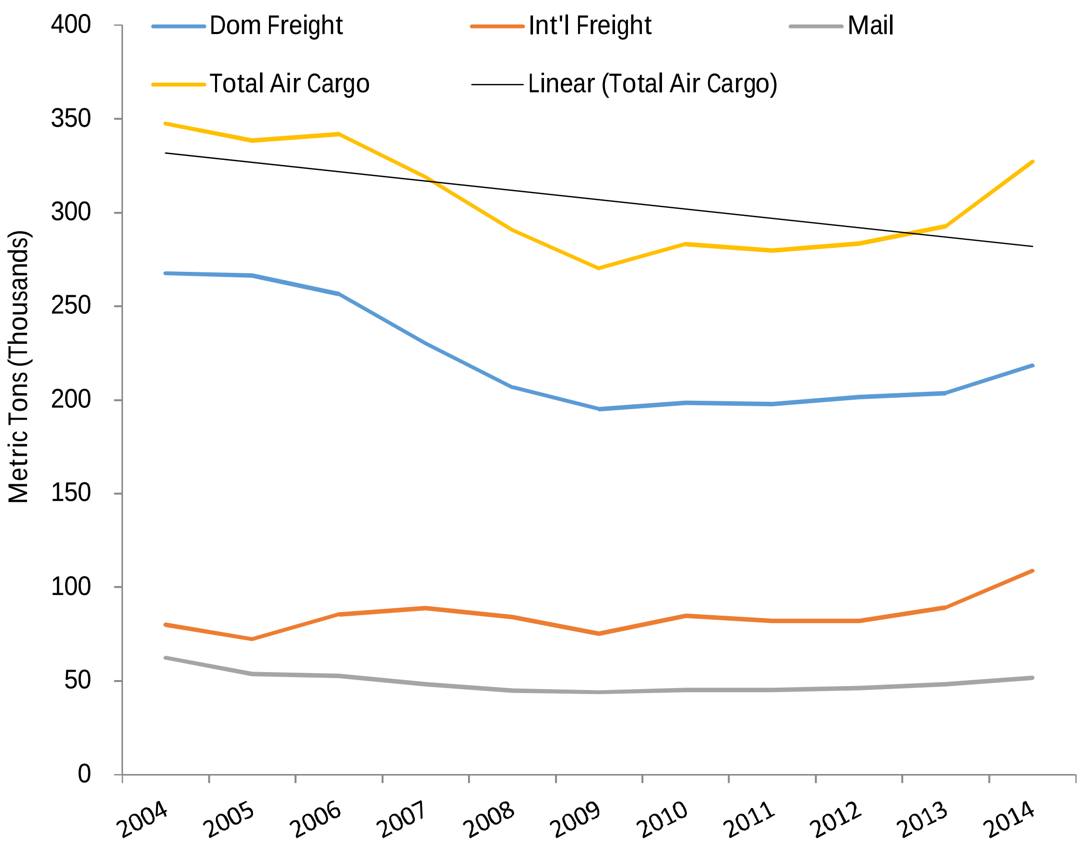
Year	Inbound	Outbound	Total Cargo	% Change
1990	139,650	173,810	313,460	n/a
1991	159,831	187,835	347,666	10.9%
1992	169,751	191,857	361,608	4.0%
1993	181,520	200,022	381,542	5.5%
1994	198,196	211,940	410,136	7.5%
1995	195,120	213,078	408,198	-0.5%
1996	181,502	206,716	388,218	-4.9%
1997	184,263	209,523	393,786	1.4%
1998	207,249	221,078	428,327	8.8%
1999	220,936	223,288	444,224	3.7%
2000	230,530	226,390	456,920	2.9%
2001	199,337	202,198	401,535	-12.1%
2002	185,463	189,290	374,753	-6.7%
2003	175,871	175,547	351,418	-6.2%
2004	173,649	173,868	347,517	-1.1%
2005	175,193	163,469	338,662	-2.6%
2006	173,136	168,904	342,040	1.0%
2007	161,566	157,527	319,093	-6.7%
2008	142,501	148,346	290,847	-8.9%
2009	131,952	138,263	270,215	-7.1%
2010	140,715	142,576	283,291	4.8%
2011	138,337	141,556	279,893	-1.2%
2012	142,235	141,374	283,609	1.3%
2013	152,234	140,475	292,709	3.2%
2014	169,816	157,424	327,240	11.8%

Source: Individual airport records; compiled by Keiser Phillips Associates

As can be seen in Table 4-19, air cargo at SEA steadily has fluctuated significantly from year to year. Since 1990, air cargo at the airport has averaged 0.18 percent per year. Over the past five years, the average annual growth rate has been 3.9 percent.

With the exception of the past few years, inbound and outbound cargo volumes are fairly even indicating a balanced market. Figure 4-29 shows the trends among domestic and international freight and mail. The past three years has seen a marked increase in inbound cargo.

Figure 4-29: Historical Air Cargo Trends at Seattle/Tacoma International Airport



Source: Individual airport records; compiled by Keiser Phillips Associates

The increase of air cargo at SEA over the past few years can be attributed primarily to the increase in international passenger traffic and the increase in seasonal international freighter cherry charters. SEA also received a large boost in air cargo in 2014 due to an eight-month protracted waterfront labor dispute that closed or slowed down most U.S. West Coast seaports. In the month of November 2014, the airport handled four to five additional freighters each week in an effort to move freight for the Christmas holiday buying season. In 2015, air cargo returned to a more sustainable 1.7-percent annual average growth rate reaching 332,636 metric tons.

Seattle/Tacoma International Airport Air Cargo by Type

SEA has both domestic and international passenger air service. The domestic passenger carriers servicing SEA include Alaska Airlines, American Airlines, Delta Air Lines, Frontier, Hawaiian, JetBlue Airways, Southwest Airlines, Sun Country, United Airlines, and U.S. Airways. International combination carriers include Air Canada, All Nippon Airways, Asiana Airline, British Airways, Condor, Emirates, EVA Airlines, Hainan Airlines, Korean Air, and Lufthansa Airlines.

The passenger aircraft fleet mix at SEA is a combination of regional turbo-props, regional jets, and both small narrow-body and wide-body transport jets. The largest passenger planes used are Boeing 747-400s. Air carriers that also utilize freighter aircraft are sometimes referred to as mixed-use carriers. The two largest air cargo carriers among the passenger airlines are Alaska Airlines and Delta Air Lines.

Similar to passenger service, air cargo freighter service at SEA is provided by both domestic and international airlines utilizing a variety of aircraft. The largest all-cargo airlines operating at SEA are FedEx, Cargolux, China Airlines, and Korean Air.

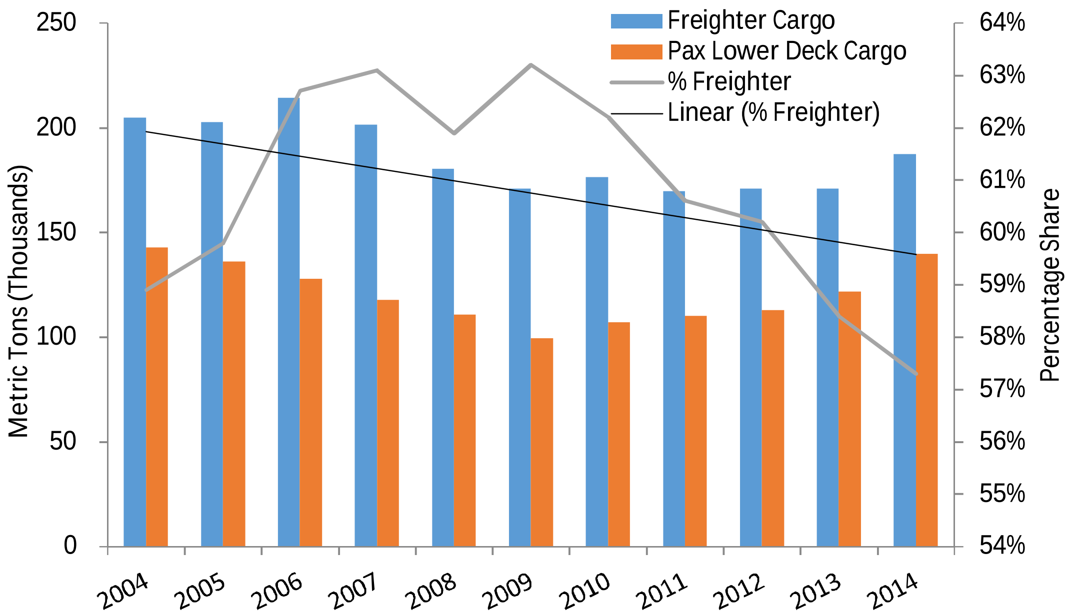
Some airlines, such as Alaska Airlines, Asiana, EVA Air, and Korean Air, operate freighter aircraft in addition to passenger aircraft. Historical lower deck passenger air cargo and freighter air cargo at SEA is presented in Table 4-20 and shown graphically on Figure 4-30.

Table 4-20: Historical Freighter and Belly Cargo at Seattle/Tacoma International Airport (metric tons)

Year	Freighter Cargo	Pax Lower Deck Cargo	% Freighter
2004	204,864	142,710	58.9%
2005	202,548	136,115	59.8%
2006	214,360	127,682	62.7%
2007	201,458	117,637	63.1%
2008	180,157	110,690	61.9%
2009	170,900	99,316	63.2%
2010	176,291	107,000	62.2%
2011	169,732	110,161	60.6%
2012	170,699	112,912	60.2%
2013	170,977	121,732	58.4%
2014	187,475	139,764	57.3%

Source: Individual airport records; compiled by Keiser Phillips

Figure 4-30: Historical Belly and Freighter Cargo at Seattle/Tacoma International Airport



Source: Individual airport records; compiled by Keiser Phillips Associates

As can be determined from Figure 4-30, the passenger belly cargo as a percent of total cargo at SEA has increased significantly since 2009. This is primarily due to increase in wide-body passenger service at SEA over the past five years.

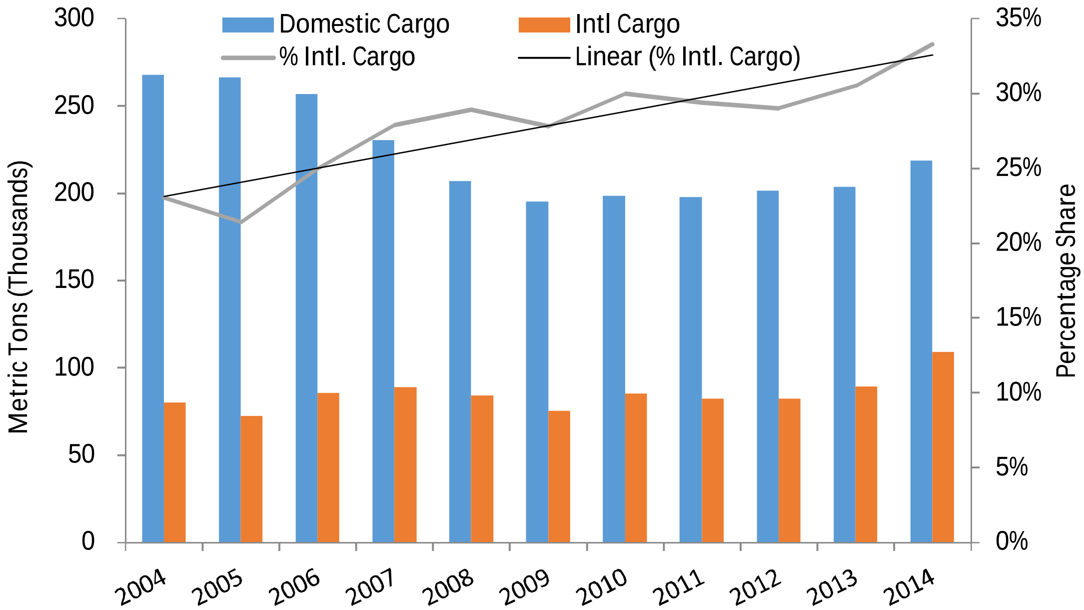
A breakout of domestic and international air cargo is presented in Table 4-21 and shown graphically on Figure 4-31.

Table 4-21: Domestic and International Air Cargo Trends at Seattle/Tacoma International Airport (metric tons)

Year	Domestic Cargo	Intl Cargo	Total Air Cargo	% International Cargo
2004	267,570	80,004	347,574	23.0%
2005	266,281	72,382	338,663	21.4%
2006	256,545	85,497	342,042	25.0%
2007	230,152	88,943	319,095	27.9%
2008	206,694	84,153	290,847	28.9%
2009	195,111	75,105	270,216	27.8%
2010	198,342	84,949	283,291	30.0%
2011	197,687	82,206	279,893	29.4%
2012	201,483	82,128	283,611	29.0%
2013	203,536	89,173	292,709	30.5%
2014	218,410	108,829	327,239	33.3%

Source: Individual airport records; compiled by Keiser Phillips Associates

Figure 4-31: Domestic and International Air Cargo Trends at Seattle/Tacoma International Airport



Source: Individual airport records; compiled by Keiser Phillips Associates

As with the growth in belly cargo at the airport, the growth of international cargo has increased significantly over the past five years corresponding with the increase in international wide-body passenger service.

From 2004 to 2014, international air cargo averaged a 3.12-percent annual growth. Following the economic recession and the growth of wide-body aircraft passenger service at SEA, international air cargo growth has averaged 7.7 percent per year.

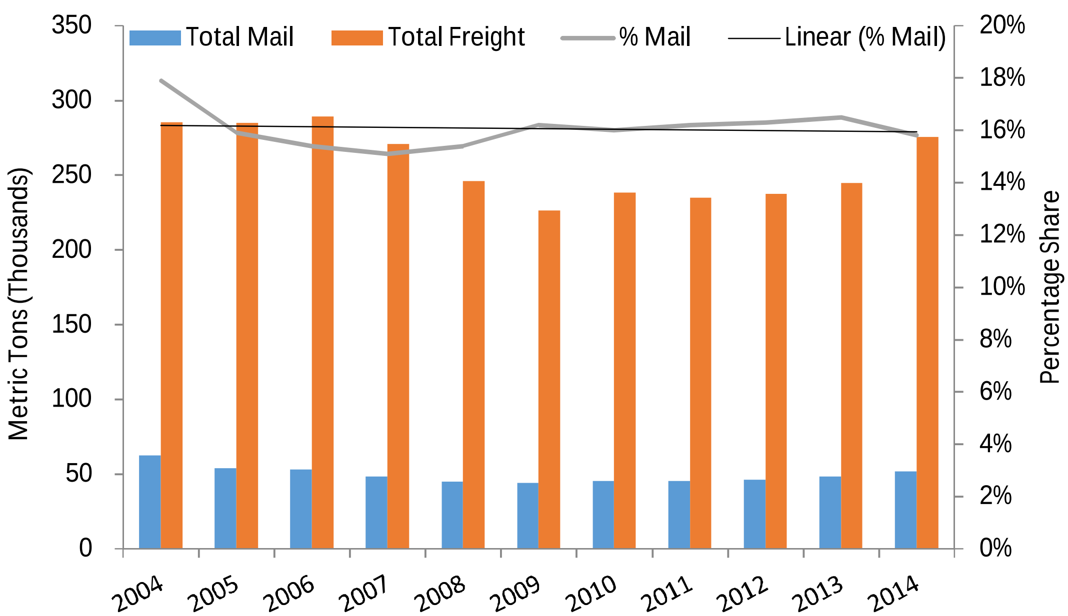
Mail tonnages as a percent of total cargo is fairly steady and is dominated by domestic mail. Air mail totals are presented in Table 4-22 and shown graphically on Figure 4-32.

Table 4-22: Air Mail Trends at Seattle/Tacoma International Airport (metric tons)

Year	Domestic Mail	International Mail	Total Mail	Total Freight	% Mail
2004	62,201	167	62,368	285,206	17.9%
2005	53,734	100	53,834	284,829	15.9%
2006	52,725	120	52,845	289,197	15.4%
2007	48,112	175	48,287	270,808	15.1%
2008	44,811	54	44,865	245,982	15.4%
2009	43,791	74	43,865	226,351	16.2%
2010	45,198	31	45,229	238,062	16.0%
2011	45,164	144	45,308	234,585	16.2%
2012	46,262	38	46,300	237,311	16.3%
2013	47,668	593	48,261	244,448	16.5%
2014	50,681	1,077	51,758	275,481	15.8%

Source: Individual airport records; compiled by Keiser Phillips Associates

Figure 4-32: Air Mail Trends at Seattle/Tacoma International Airport



Source: Individual Airport Records; compiled by Keiser Phillips Associates

The mail is delivered to the airport by the U.S. Postal Service and tendered to the designated terminal handling supplier. The terminal handling supplier scans and containerizes the mail and then delivers the containers of bags to the airlines. The reverse is true for inbound mail. Most of the air mail at SEA is handled by FedEx as domestic shipments.

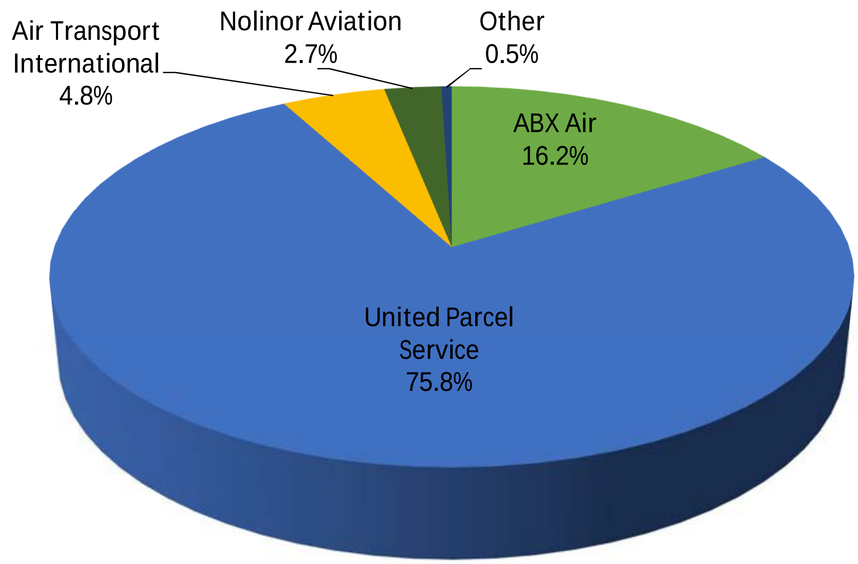
King County International Airport

BFI, locally referred to as "Boeing Field," is a mixed-use general aviation, commercial service, and industrial airport located just south of the SODO (South of Downtown) District in the city of Seattle. The highly constrained airport is bounded on the east by U.S. Interstate 5, to the west by East Marginal Way and the Duwamish Waterway, to the north by the community of Georgetown, and to the south by a cluster of private warehouses and truck terminals.

Due to its inner city location and access to I-5, the airport is attractive to domestic air cargo operators. As mentioned previously, air cargo at BFI is generated almost exclusively by the integrator all-cargo carriers. The dominant air cargo carrier is UPS with an 80-percent market share.

In 2014, enplaned and deplaned air cargo at BFI totaled 109,653 metric tons. The primary air cargo carrier was UPS and the top import and export markets were the carrier's primary hub at Louisville, Kentucky. Other top import markets in 2014 included Ontario, California, Spokane, and Vancouver, British Columbia. The second top export market was Vancouver, followed by Ontario and Spokane. The air cargo market share by air carrier is shown on Figure 4-33.

Figure 4-33: Air Cargo Market Share at King County International Airport for 2014



Source: U.S. DOT T-100 Market Data; compiled by Keiser Phillips Associates

Besides UPS, other all-cargo airlines operating at BFI during 2014 included ABX Air Inc. (operating for DHL), Air Transport International, Ameristar Air Cargo, Atlas Air Inc., Gulf & Caribbean Cargo, Kalitta Charters, Kenmore Air Harbor, Lynden Air Cargo Airlines, Nolinor Aviation, Northern Air Cargo Inc., Everts Air Alaska and Everts Air Cargo, and U.S.A Jet Airlines Inc.

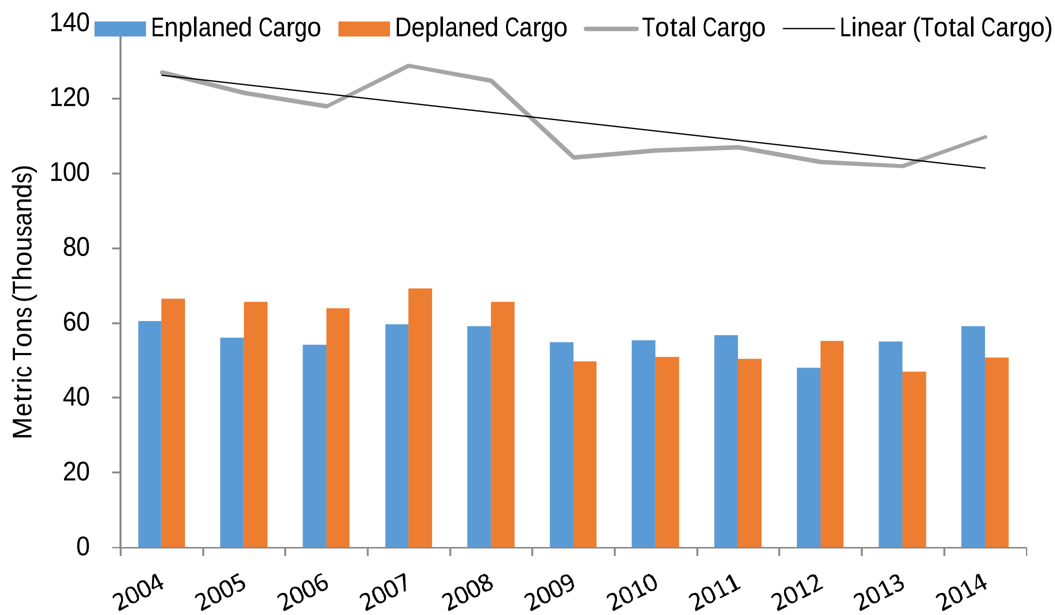
Historical trend of air cargo activity at BFI is presented in Table 4-23 and shown graphically on Figure 4-34.

Table 4-23: Air Cargo Trends at King County International Airport (metric tons)

Year	Enplaned Cargo	Deplaned Cargo	Total Air Cargo	% Change
2004	60,501	66,483	126,984	
2005	56,014	65,563	121,577	-4.3%
2006	54,123	63,775	117,898	-3.0%
2007	59,664	69,113	128,777	9.2%
2008	59,145	65,616	124,761	-3.1%
2009	54,727	49,575	104,302	-16.4%
2010	55,269	50,905	106,174	1.8%
2011	56,619	50,313	106,932	0.7%
2012	47,867	55,147	103,014	-3.7%
2013	54,933	46,951	101,884	-1.1%
2014	59,047	50,606	109,653	7.6%

Source: U.S. DOT T-100 Market Data; compiled by Keiser Phillips Associates

Figure 4-34: Air Cargo Trends at King County International Airport (metric tons)



Source: U.S. DOT T-100 Market Data; compiled by Keiser Phillips Associates

Freighter aircraft types used on a regular basis at BFI include the A300-600, B767-200/300ER, MD11, MD DC-10, and B757-200.

Spokane International Airport

Air cargo service at GEG is provided by the combination passenger/cargo belly carriers, the integrator/express carriers, and small air taxi all-cargo operators. In 2014, the combination carriers accounted for approximately 9 percent of the total enplaned and deplaned cargo tonnages at the airport with the all-cargo carriers handling the remaining 91 percent.

The combination passenger/cargo carriers include Alaska Airlines, Allegiant Air, Delta, Frontier, Horizon, Republic, Shuttle America/UAL, Southwest, Sun Country, United, and U.S. Airways. The largest regularly scheduled passenger planes used are A320s and Boeing 737-8/900s. The largest freighter aircraft used on a regular basis include the A300-600, B767-300, MD 11, and MD DC-10.

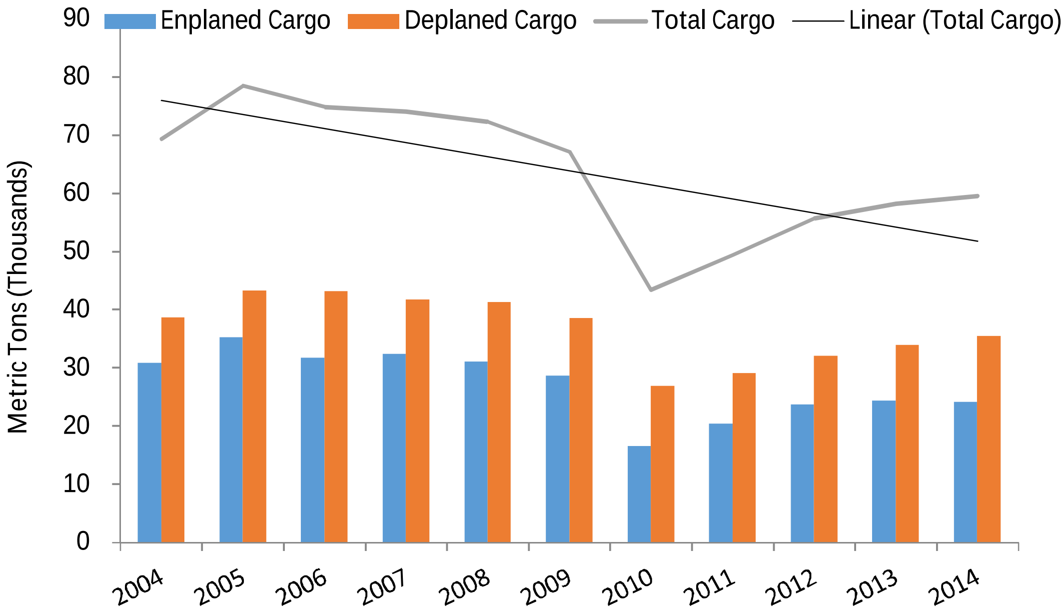
Alaska and Delta had the highest air cargo tonnages in 2014 among the combination carriers. The all-cargo airlines at GEG include FedEx, UPS, Empire, and Airpac. The two dominant cargo carriers are FedEx and UPS. Both FedEx and UPS service the local air cargo market and also utilize GEG as a regional transload hub for aircraft originating and departing to other destinations. FedEx accounted for 58 percent of all air cargo handled by the all-cargo carriers and UPS accounted for 33 percent. A significant portion of the cargo carried by FedEx is U.S. mail. Historical air cargo at GEG is presented in Table 4-24 and shown graphically on Figure 4-35.

Table 4-24: Air Cargo Trends at Spokane International Airport (metric tons)

Year	Enplaned Cargo	Deplaned Cargo	Total Air Cargo	% Change
2004	30,787	38,576	69,363	
2005	35,185	43,275	78,460	13.1%
2006	31,719	43,127	74,846	-4.6%
2007	32,318	41,697	74,015	-1.1%
2008	31,069	41,223	72,292	-2.3%
2009	28,624	38,505	67,129	-7.1%
2010	16,551	26,839	43,390	-35.4%
2011	20,352	29,067	49,419	13.9%
2012	23,711	31,995	55,706	12.7%
2013	24,368	33,850	58,218	4.5%
2014	24,149	35,418	59,567	2.3%

Source: U.S. DOT T-100 Market Data; compiled by Keiser Phillips Associates

Figure 4-35: Air Cargo Trends at Spokane International Airport (metric tons)



Source: Individual Airport Records (2004-2009); U.S. DOT T100 Market Data (2010-2014); compiled by Keiser Phillips Associates

A significant portion of the freighter volume since 1992–93 at GEG has been generated by transload, or sometimes called crossload, operations. A transload typically occurs when a carrier has scheduled one aircraft arriving in Spokane from City A with a final destination to City C; and a second aircraft scheduled to arrive in Spokane from City B with a final destination to City D. At Spokane, the carrier will transload cargo from the aircraft arriving from City A with cargo destined to City D to the aircraft scheduled to City D; while cargo on the aircraft from City B, destined for City C, will be transferred to the aircraft scheduled for City C.

In a typical transload operation, the cargo is physically deplaned from one aircraft and enplaned onto a second aircraft. The transload may take place over a few hours or over the course of a few days. Depending upon a particular carrier's type of operation, if a transload of two or more aircraft is performed simultaneously, then sufficient apron space must be available in close proximity to facilitate the transload operation. If the transload takes place over a few days, then sufficient warehouse space must be available for storage and sorting.

At present, FedEx is currently performing transload operations at Spokane with aircraft, trucks and cargo ultimately to and from Memphis, Oakland, Seattle, Vancouver BC, Reno, and Great Falls. UPS is transloading freight between planes coming to and from Seattle, Portland, Des Moines, and Dallas.

Only a very small portion of the total volume generated in these transload operations originates, or is destined, for the Spokane regional market. Spokane's unique geographical location in Eastern Washington lends itself to this type of hubbing operation taking place at the airport. Both FedEx and UPS have major operations in the Seattle region but are constrained in their ability to expand in that city due to the overcrowded facilities at BFI and SEA. By utilizing GEG, the integrator carriers can maximize the utilization of their aircraft serving the Pacific Northwest and beyond.

Key destinations being served by freighter aircraft to and from GEG include Dallas, Portland, Seattle, Vancouver BC, Memphis, Louisville, Des Moines, Billings, Pendleton, Wenatchee, Sacramento, Missoula, Moses Lake, Lewiston, Yakima, Ontario (California), and Pasco.

Bellingham International Airport

Bellingham International Airport (BLI) is a non-hub commercial service airport located in Whatcom County, approximately 3 miles northwest of the city limits of Bellingham, Washington. The airport is situated approximately 90 miles north of Seattle and 20 miles south of the U.S./Canada Peace Arch Border crossing located in Blaine, Washington.

BLI is typical of Washington State non-hub commercial service airports. Passenger service is provided by airlines using narrow-body 130- to 200-seat aircraft and by small regional air taxis. Air cargo handled at the airport is typically less than 150 pounds.

Aircraft belly cargo service at the airport is provided by Alaska Airlines. Belly cargo is processed through the passenger terminal.

FedEx provides small package express service using air taxi aircraft. Charter service is also provided by local air taxi operators. Approximately 90 percent of the air cargo moving by aircraft through BLI is by FedEx. The FedEx operation provides door-to-door air freight service in the Bellingham market through the use of a fleet of small service vans and to the San Juan Islands by air. Freight is delivered to the FedEx facility in the morning by both over-the-road tractor trailer rigs and by aircraft, typically a Cessna Caravan operated by Empire Airlines. Inbound freight for the Bellingham region is then sorted on site and put on delivery trucks for distribution. Freight destined for the San Juan Islands is placed back on the aircraft to be flown to Friday Harbor.

In the afternoon, the reverse occurs. Outbound freight picked up in the Bellingham region is brought back to the airport by delivery truck, where it is sorted and East Coast priority packages are put on a Cessna 208 Caravan to meet an early evening flight from SEA to Memphis. Most of the West Coast priority packages and deferred delivery packages are loaded onto trucks for over-the-road delivery to the Seattle FedEx station later in the evening.

Other small commercial service airports in Washington, such as Tri Cities, Yakima Air Terminal, Pangborn Memorial, Walla Walla Regional Airport, have similar air cargo profiles as BLI. That is, most air cargo are small packages under 150 pounds in weight and are moved in the belly of narrow-body passenger aircraft by FedEx or UPS feeder aircraft or by air taxi charter service. Cargo ground handling is done on the passenger ramp, in small specialized facilities operated by FedEx or UPS, or on the general aviation ramp.

Other Washington State Cargo Airports

As mentioned previously, air cargo activity at small commercial service airports in Washington State is generated almost exclusively by FedEx and UPS with very small quantities of enplaned and deplaned belly cargo by Alaska/Horizon Airlines. Belly cargo capacity at smaller airports in the state is limited due to the regional aircraft utilized to serve these markets.

Beyond space for FedEx and UPS airport operations, the need for airport air cargo facilities at most non-hub commercial service airports in Washington State is limited. Air cargo tendered at these airports is typically same day express cargo under 150 pounds in weight. Most of these small packages have limited dwell time.

An exception to this profile is Snohomish County Paine Field. The surge in air cargo at Paine Field in 2014 was generated by special modified wide-body freighters as a part of the Boeing Company's 787 airplane manufacturing and assembly program. Origin and destination cities for cargo generated at Paine Field included Anchorage (a trans-Pacific transload point), Charleston, Nagoya, and Wichita. The general cargo demand in Snohomish County is served through SEA and BFI.

Summary

Air cargo in Washington State is primarily generated by activity at SEA, BFI, and GEG. Non-hub and small commercial passenger airports within the state account for only 4 percent of the total air cargo volumes moved in 2014.

Reflecting trends in general economy, as well as systemic changes in the air cargo industry, air cargo volumes in Washington State have fluctuated over the past 10 years from a high of 553,415 metric tons in 2004 to a low of 454,419 metric tons during the economic crisis of 2008/2009.

Growing slowly, but faster than the general economy, air cargo volumes in the state increased 3.8 percent per year from 2009 to 524,782 tons in 2014. Most of the growth in air cargo within the state is driven by the increase in international wide-body aircraft air service at SEA.

Most small airports in the state have experienced a decline in air cargo volumes corresponding to a reduction of passenger service at smaller airports, the downsizing of aircraft serving the smaller markets, and a shift of air cargo to truck.

4.3.5 Washington State Air Cargo Forecast

The forecast of aviation demand is a key element in both the short- and long-term development of air cargo facilities in Washington State. Forecasts provide a basis for determining the type, size, and timing of airside and landside facilities development and consequently influence many phases of the airport planning process.

The focus of this effort is to provide an estimate of air cargo volumes and freighter operations over the long-term, 20-year planning horizon. The base year for this forecast is 2014 and the forecast includes 2019, 2024, and 2034.

It should be noted that data collection, both at the industry level and locally, is problematic. Historical air cargo data is limited and activity by carrier and cargo type is unavailable. A summary of the air cargo forecast is presented in Table 4-25.

Table 4-25: Summary of Air Cargo Forecast for Washington State (metric tons)

Year	Seattle-Tacoma International	King County International	Spokane International	Other Washington Airports	Total Air Cargo
Historical					
2004	347,574	126,984	69,363	9,494	553,415
2009	270,216	104,302	67,129	12,772	454,419
2014	327,239	109,653	59,567	22,229	518,688
Forecast					
2019	370,397	124,063	67,395	23,363	585,218
2024	419,755	140,365	76,251	24,555	660,926
2034	541,093	179,680	97,607	27,124	845,504
Average Annual Growth (2014–2034)	*2.5%*	*2.5%*	*2.5%*	*1.0%*	*2.5%*

Note: Many of the factors influencing future aviation demand cannot necessarily nor readily be quantified. As a result, the forecast process should not be viewed as precise, particularly given the major structural changes that have occurred in the air cargo industry, the uncertain global economy and the security regulations imposed by on-going terrorist threats. Actual future traffic levels addressed here may differ materially from the projections presented herein because of unforeseen or unrealized events.

Recent Air Cargo Market Trends

This section presents an overview of the factors that can influence the development of air cargo demand forecasts.

Global Economic Trends

Globalization of world markets has expanded trade activity. Global economies are interdependent, and global integration is at a stage that is unprecedented since the late 19th century and early 20th century. In 2015, over $16 billion of goods traveled by air each day, 1/3 of all world trade by value.

U.S. international trade in goods and services grew from more than $288,430 million in January 2009 to more than $398,589 million in January 2016, an average annual growth rate of 4.7 percent.

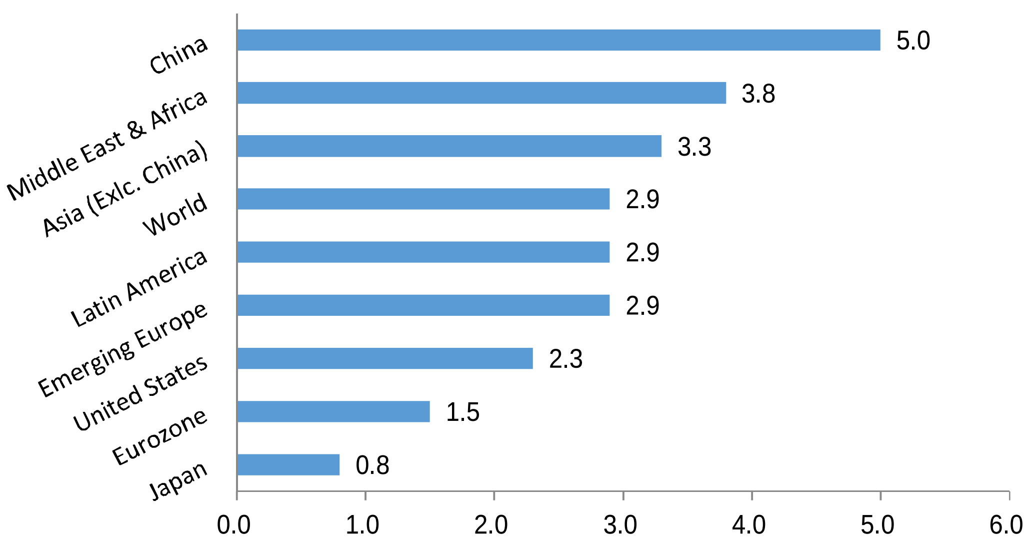
Free trade agreements are playing a significant role in opening up foreign markets to U.S. exporters. Today the U.S. holds free trade agreements with 20 countries. In 2007, trade with countries that the U.S. has free trade agreements with was significantly greater than their relative share of the global economy: although comprising 7.5 percent of global GDP (not including the U.S.), those countries accounted for over 42 percent of U.S. exports.

In 2015, global economic activity remained subdued. Growth in emerging market and developing economies—while still accounting for over 70 percent of global growth—declined for the fifth consecutive year, while a modest recovery continued in advanced economies. Three key transitions continue to influence the global outlook: (1) the gradual slowdown and rebalancing of economic activity in China away from investment and manufacturing toward consumption and services, (2) lower prices for energy and other commodities, and (3) a gradual tightening in monetary policy in the U.S. in the context of a resilient U.S. recovery as several other major advanced economy central banks continue to ease monetary policy.

According to the International Monetary Fund, growth in emerging market and developing economies is projected to increase from 4 percent in 2015—the lowest since the 2008–09 financial crisis—to 4.3 and 4.7 percent in 2016 and 2017, respectively. Price Waterhouse Coppers projects the world economy to grow at an average of just over 3 percent per annum in the period 2014–50, doubling in size by 2037 and nearly tripling by 2050.

IHS Global Insight projects that world economic growth will remain sub-par, below 3 percent a year for the next two years. They forecast world real GDP to grow at 2.9 percent a year between 2016 and 2036. Emerging markets are forecast to grow above the global average but at lower rates than in the early 2000s. Asia (excluding Japan), led by India and China, is projected to have the fastest growth followed by the Middle East and Africa, Latin America, and Eastern Europe. Growth in the more mature economies will be lower than the global trend with the fastest rates in the U.S. followed by Europe. Growth in Japan is projected to be very slow with rates below 1 percent a year reflecting deep structural issues associated with a shrinking and aging population. Figure 4-36 presents the growth rates for the GDP forecast by world region.

Figure 4-36: World GDP Forecast Growth by Region



Source: HIS Global Insight, December 2015 World Forecast; compiled by Keiser Phillips Associates

Historically, air cargo activity has moved in synch with GDP, influenced by fuel price volatility, movement of real yields, and globalization. Over the past five years, however, significant structural changes have occurred in the air cargo industry. Among these changes are air cargo security regulations issued by the U.S. and EU regulators; market maturation of the domestic express market; domestic U.S. modal shift from air to other modes (especially truck); a significant decrease in the cost of oil; growth in international trade from open skies agreements; increased use of mail substitutes; and the emergence of the cross-border e-commerce market.

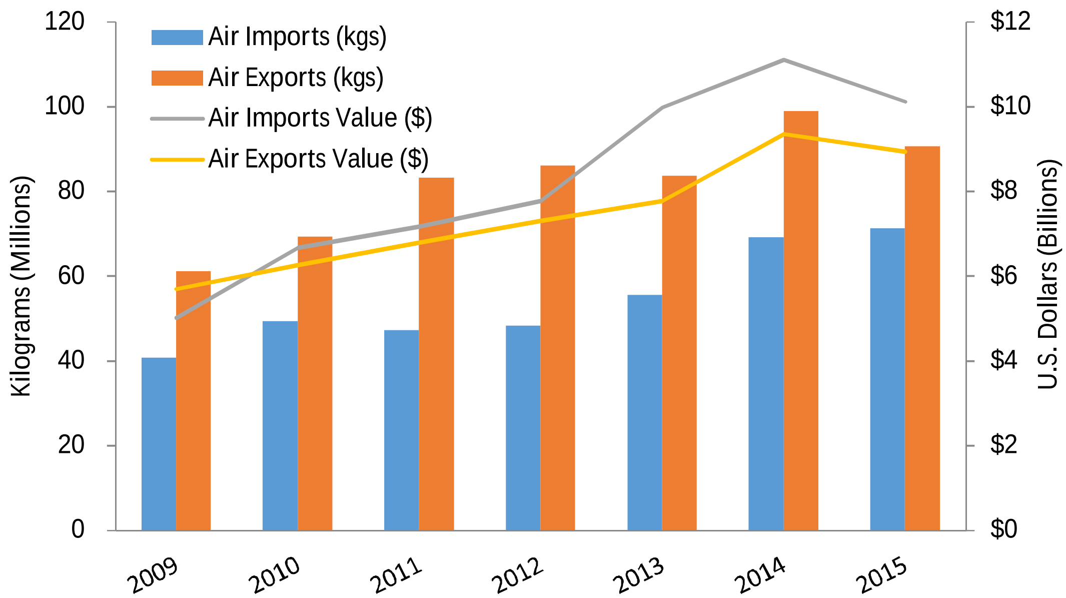
Washington State Economic Trends

According to the February 2016 Washington State Economic and Revenue Forecast, the Washington economy is expanding at a solid pace, although annual Washington exports declined for the first time since 2009. However, according to U.S. Department of Commerce data, state air exports rose dramatically between the same period growing from $5.7 billion in 1997 to $8.9 billion in 2015, a growth rate of 8 percent each year.

The Washington forecast for GDP growth is 2.1 percent and 2.4 percent for 2016 and 2017 and forecasted growth rates for 2018 and 2019 are 2.4 percent and 2.2 percent, respectively.

As shown on Figure 4-37, air exports from Washington State accounted for $8.9 billion in 2015 and air imports to Washington were $10.1 billion with air imports and exports totaling 162,000 metric tons.

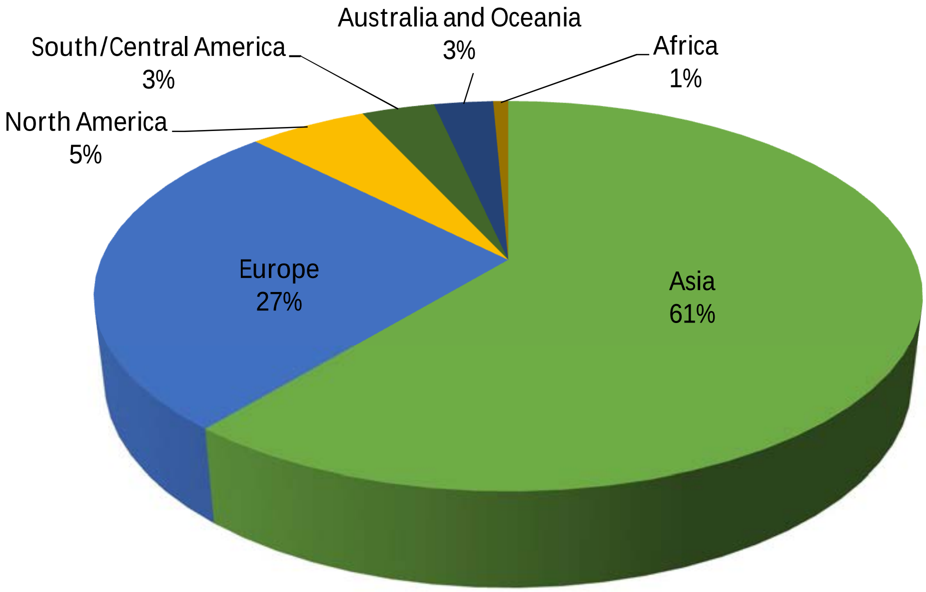
Figure 4-37: Washington State Air Imports and Exports



Source: Compiled by Keiser Phillips Associates

As presented on Figure 4-38, the largest markets for air exports from the state of Washington as measured by weight were Asia, followed by Europe and Canada and Mexico, South America and Australia, and Oceania and Africa.

Figure 4-38: Washington State Air Exports and Import Share by Region (based on weight)



Source: Compiled by Keiser Phillips Associates

World Air Cargo Trends

World air cargo traffic has averaged a 5.2-percent growth per year between 1983 and 2013. The growth rate actually exceeded 6 percent in several years throughout the 1980s, 1990s, and early 2000s. Growth slowed as fuel prices began to rise in 2005 and some shippers began to divert freight to less expensive modes of transport.

The global economic downturn of 2008–2009, the worst economic contraction since the Great Depression, dragged down all modes of freight transport. World air cargo traffic dropped 13 percent over the two years ending in 2009. Traffic jumped 19.4 percent in 2010 and gained a further 0.8 percent in 2011 as global businesses replenished their inventories. The net result of these developments is a world air cargo traffic growth rate of only 2.6 percent for the span of years between 2003 and 2013.

Regional air cargo market shares have changed significantly during the past two decades. Airlines based in Asia, Europe, and North America have accounted for more than 80 percent of the world's air cargo traffic for that entire span of years.

Airlines based in North America led all other world regions with a 35-percent share of the world's air cargo traffic in 1992. This changed during the 1990s and early 2000s as the share flown by airlines based in Asia, including those based in China, grew from 28 percent in 1992 to 39 percent in 2010, reflecting the rapid expansion of Asian export markets. Since 2000, however, carriers based in the Middle East have leveraged their geographic position at the crossroads between Africa, Asia, and Europe. Middle East carriers have quickly expanded their wide-body passenger and freighter fleets, allowing them to increase their share of world air cargo traffic from 4 percent in 2003 to 11 percent in 2013.

In 2015 most major regions experienced weakness in air freight demand. This includes Asia Pacific, where growth was just 2.3 percent in 2015 compared to 2014. For North American carriers, there was a small expansion of 0.1 percent in 2015 overall. These small gains in volumes over the year are explained by the surge in activity in the first quarter of 2015 due to switching towards air cargo because of the U.S. West Coast seaport backlog and recalls in the U.S. for Japanese auto-parts.

The Middle East continued to see strong growth in 2015, with expansion of 11.3 percent.

Over the next five years, it is expected that air cargo demand will continue to come under strain but a stronger recovery in the Eurozone—a key market—can be a source of optimism. The global economy is facing increased uncertainty with three key factors weighing on global outlook: (1) U.S. Federal Reserve looking to normalize monetary policy while other major currencies are likely to ease further, paving the way for further tightening in U.S. bank credit conditions, (2) China's economy embarking on a multi-year rebalancing, and (3) the decade-long commodity super cycle appears to be coming to an end.

According to the *FAA Aerospace Forecasts, FY 2016-FY 2035*, U.S. air carriers flew 35.9 billion revenue ton miles (RTM) in 2015, up 2.2 percent from 2014 with domestic cargo RTMs increasing 3.3 percent to 13.1 billion while international RTMs increased by 1.6 percent to 22.9 billion. Air cargo RTMs flown by all-cargo carriers comprised 78.1 percent of total RTMs in 2015, with passenger carriers flying the remainder. Total RTMs flown by the all-cargo carriers increased 1.8 percent in 2015 while total RTMs flown by passenger carriers grew by 3.6 percent.

Industry Forecasts of Air Cargo Activity

According to most industry analysts, worldwide air cargo is expected to rise between 3 percent and 5.5 percent per year over the next 20 years. This growth relates to an improving world economy and accelerating rates of international trade.

Detailed market analysis in the *2014 Boeing World Air Cargo Forecast* projects annual world air cargo growth of 4.0 percent to 5.5 percent over the next 20 years, approximately double the forecasted economic growth. According to Boeing, Asia will continue to lead the world air cargo industry. The more mature North America and Europe markets will reflect slower and thus lower-than-average traffic growth rates. World airmail is forecast to grow at a consistent 1.0 percent per year.

Regionally, North America air traffic is projected by Boeing to average 2.2 percent growth over the next 10 years and then at 2.1 percent to the 2043 forecast period. Baseline growth in North America-to-Europe air trade is predicted by Boeing to average 2.9 percent per year and Europe-to-North America baseline growth will average 3.3 percent per year. The combined total market baseline growth for the next 20 years is projected to be 3.1 percent, compared with 2.8-percent average growth during the past 20 years.

Asia to North America air cargo traffic flowing in both directions across the Pacific is forecast by Boeing to grow an average of 5.4 percent per year over the next 20 years. The flow from Asia to North America is forecast to grow at an average rate of 5.5 percent per year. The flow from North America to Asia is forecast to grow 5.4 percent per year over the next 20 years.

The total Latin America-to-North America market for air cargo services is forecast by Boeing to grow 5.2 percent per year between 2013 and 2033. North America-to-Africa flows are expected by Boeing to grow 5.2 percent per year through 2033, driven by continued U.S. and Canadian investment in African extractive industries. Africa-to-North America air trade is expected to grow at the nearly identical rate of 5.1 percent per year, as African light manufacturing develops export markets in North America.

Airbus forecasts air cargo to grow 4.4 percent per year over the next 20 years. According to Airbus, Asia Pacific (including India and the People's Republic of China) today represents 36 percent of the world freight traffic and will grow to 42 percent by 2032. Europe/Commonwealth of Independent States and North America combined accounted for 51 percent of the total traffic in 2012; by 2032 its share will be 45 percent. China is the largest driver of air cargo growth; today it represents 15 percent and by 2032 it will be 22 percent of the global market. Due in part to the expanding middle class in emerging countries, traffic from mature to emerging is the second fastest growing segment of the industry. Airbus predicts that the North American domestic market will grow at 2.1 percent per year, while the U.S.-to-China market will grow at 6.4 percent per year. The North America-to-Europe market is projected by Airbus to grow at 4.3 percent per year.

In the *FAA Aerospace Forecasts, FY 2016-FY 2035*, domestic cargo is predicted to increase at an average annual rate of 1.9 percent in 2016 as the U.S. economic recovery continues after posting a 3.3-percent increase in 2015. Between 2016 and 2036, domestic cargo RTMs are forecast by the FAA to increase at an average annual rate of 0.4 percent. International cargo is projected by the FAA to grow at 6 percent for 2016 and for the forecast period (2016–36), international cargo RTMs are forecast to increase an average of 4.7 percent a year based on projected growth in world GDP with the Pacific region having the fastest growth, followed by the Other International, Atlantic, and Latin regions, respectively.

The freight/express segment of domestic air cargo is highly correlated with capital spending; thus, this segment's growth will be tied to growth in the economy. The share of international cargo RTMs flown by all-cargo carriers increased from 49.3 percent in 2000 to 71.8 percent in 2015. Continuing the trend experienced over the past decade, the all-cargo share of international RTMs flown is forecast by the FAA to increase modestly to 78.1 percent by 2036.

Forecast of Air Cargo for Washington

This section presents the cargo forecasts for Washington by individual cargo hub airport, as well as a summary of cargo activity for the state.

Seattle/Tacoma International Airport

A stated goal for the Port of Seattle in its Century Agenda is to more than double the amount of air cargo it handled at SEA by 2036. Recently the Port of Seattle says it has invested $23 million in two major projects to expand SEA's capacity to handle a growing amount of air freight.

As stated previously, air cargo in Washington State is primarily generated by activity at SEA. Over the past 10 years (2004–2014), air cargo at the airport fluctuated up and down, decreasing at an average rate of 0.6 percent annually. Over the past five years (2009–2014) SEA has averaged a 3.9-percent growth rate in total air cargo tonnage. During 2014, the amount of air cargo handled at the airport increased by 11.8 percent.

Reflecting a national trend, most of the recent growth at SEA has been in international air cargo. From 2004 to 2014, international air cargo averaged a 3.12-percent yearly growth rate and, since 2009, international air cargo has averaged a 7.7-percent growth per year.

Considering the emerging role of SEA's role as a trans-Pacific passenger and cargo hub for Delta Air Lines and surge in new international wide-body passenger and cargo service at the airport, it can be expected that international air cargo tonnages will continue to increase at a rapid rate.

The forecast utilized for SEA was taken from the *Draft Final Technical Memorandum, Forecasts of Aviation Activity, Seattle-Tacoma International Airport*, Prepared for Port of Seattle, dated September 2015 and approved by the FAA, as a part of the SAMP. The forecast is presented in Table 4-26.

Table 4-26: Air Cargo Forecast for Seattle-Tacoma International Airport (metric tons)

Year	Domestic	International	Total
Historical			
2004	267,570	80,004	347,574
2009	195,111	75,105	270,216
2014	210,810	108,680	319,490
Forecast			
2019	219,290	132,250	351,540
2024	230,470	152,540	383,010
2034	254,590	187,280	441,870
Average Annual Growth (2014–2034)	*0.8%*	*2.8%*	*2.5%*

Source: Leigh Fisher Associates, SAMP; compiled by Keiser Phillips Associates

The resulting SAMP air cargo forecast projects air cargo at SEA to grow to 441,870 metric tons by the year 2034. This forecast represents a combined average annual growth rate of 1.5 percent from 2014 to 2034. It should be noted that the SAMP air cargo forecast must be considered extremely conservative considering the growth of international wide-body passenger service at the airport and the Port of Seattle's policy to "Triple air cargo volume to 750,000 metric tons" as a part of its Century Agenda.

King County International Airport

The forecast of demand for BFI is presented in Table 4-27. Air cargo growth at is projected to grow at 2.5 percent per year over the next 20 years. The two key factors that were considered in the projection of air cargo at BFI were the significant presence of the integrator express traffic at the airport and the expectations of above-average domestic air cargo volumes due to the growth of the e-commerce market serviced by the integrator/express airlines.

Table 4-27: Air Cargo Forecast for King County International Airport (metric tons)

Year	Domestic	International	Total
Historical			
2004	60,501	66,483	126,984
2009	54,727	49,575	104,302
2014	59,047	50,606	109,653
Forecast			
2019	66,994	57,069	124,063
2024	75,797	64,568	140,365
2034	97,027	82,653	179,680
Average Annual Growth (2014–2034)	*2.5%*	*2.5%*	*2.5%*

Source: Keiser Phillips Associates

Spokane International Airport

The forecast of demand for GEG is presented in Table 4-28. Air cargo growth is projected to grow at 2.5 percent per year over the next 20 years. Similar to BFI, the two key factors that were considered in the projection of air cargo at GEG were the significant presence of the integrator express traffic at the airport and the expectations of above-average domestic air cargo volumes due to the growth of the e-commerce market serviced by the integrator/express airlines.

Table 4-28: Air Cargo Forecast for Spokane International Airport (metric tons)

Year	Domestic	International	Total
Historical			
2004	30,787	38,576	69,363
2009	28,624	38,505	67,129
2014	24,149	35,418	59,567
Forecast			
2019	27,632	39,763	67,395
2024	31,263	44,988	76,251
2034	40,019	57,588	97,607
Average Annual Growth (2014–2034)	*2.6%*	*2.5%*	*2.5%*

Source: Keiser Phillips Associates

Washington State Non-hub Airports

Air cargo at the state's non-hub airports is projected to grow at an average annual rate of 1 percent per year. The forecast for Washington State's non-hub airports is presented in Table 4-29.

Table 4-29: Air Cargo Forecast for Washington Non-hub Airports (metric tons)

Year	Snohomish County	Tri Cites	Yakima	Bellingham	Pangborn	Walla Walla	Others	Total
Historical								
2014	13,639	2,855	1,917	1,096	711	2	2,009	22,229
Forecast								
2019	14,335	3,000	2,014	1,152	748	2	2,112	23,363
2024	15,067	3,153	2,117	1,211	786	2	2,220	24,555
2034	16,643	3,483	2,338	1,337	868	3	2,452	27,124
Average Annual Growth (2014–2034)	*1.0%*	*1.0%*	*1.0%*	*1.0%*	*1.0%*	*2.0%*	*1.0%*	*1.0%*

Source: Keiser Phillips Associates

Cargo Forecast Summary

The forecast of air cargo for Washington State is presented above in Table 4-25. Air cargo in Washington is projected to grow at an average annual growth rate of 2.5 percent from 2014 to 2034. Most of this growth will be driven by air cargo activity at SEA. Air cargo activity at smaller non-hub airports is projected to increase at 1 percent per year over the planning period.