

## B Forecasts of Aviation Activity

**INTRODUCTION.** This chapter identifies the 20-year aviation activity forecasts for the King County International Airport/Boeing Field (BFI or Airport). The MP Update forecasts provide an expectation of activity levels used to guide the analysis and evaluation of future airport facility needs, alternatives, and development strategies.

The aviation demand projections are documented in the following sections:

- **Historical and Exiting Aviation Activity**
- **Previous Forecasts**
- **Factors Affecting Aviation Forecasts**
- **Forecast Methodologies**
- **Forecast of Aviation Demand Activity**
  - Commercial Passenger Enplanement & Operations Forecast
  - Air Cargo Weight & Operations Forecast
  - General Aviation Operations Forecast
  - Military Aircraft Operations Forecast
  - Aircraft Operations Forecast (Mix, Peaking, Critical Planning Aircraft)
  - General Aviation Based Aircraft Forecast
- **Runway Design Code (RDC)/Critical Aircraft Analysis**
- **FAA TAF Comparison and Forecast Conclusion**

Aviation forecasts are time-based projections offering a reasonable expectation of future airport activity. The forecast of activity projections influences nearly every aspect of the MP Update process. The relationship between current activity and forecast demand is an indicator as to the type and timing of future airport infrastructure, equipment and service needs, as well as funding resource allocation.

The forecasts are prepared annually for a 20-year planning period, from 2015 through 2035, identified in five-year increments, and segmented into three planning phases:

- 'Near-term' (2015-2020)
- 'Mid-term' (2021-2025)
- 'Long-term' (2025-2035)

The forecasts are developed consistent with FAA forecasting guidance, reflecting the current baseline of airport activity levels, user trends, and industry-wide activity patterns. The forecasts are considered "unconstrained", in that they assume the Airport is sufficiently able to accommodate the demand either through existing facilities or future improvements.

It should also be understood there are typically year-to-year fluctuations to forecast activity due to various unanticipated factors and unforeseen demand circumstances (e.g., changes in emerging airport markets and national aviation trends, including economic factors, both nationally and regionally). Although activity levels during individual years might vary above or below the forecast projections, the Airport's future development should correlate to the tracking of actual activity.

### Historical and Exiting Aviation Activity

BFI is a complex facility that serves a wide variety of aviation users. These include a commercial commuter passenger airline<sup>1</sup> and air carrier passenger charter operators, large and small air cargo carriers, commercial general aviation Fixed Base Operators (FBOs), corporate general aviation flight departments, private aircraft owners, helicopters, and military aircraft that all require a high standard for both aviation facilities and services. The Airport also serves an important regional economic role by accommodating the aviation industrial/maintenance operations and activities related to The Boeing Company's various civilian and military aircraft Flight Test and Delivery Center operations that directly support over 5,200 jobs in the local economy.

Historical activity for the Airport provides the context from which future activity can be projected, and **Table B1** provides a snapshot of the aviation activity that has occurred at BFI over the past 15 years. While historical trends are not always indicative of future activity, historical data does provide insight into how local, regional, and national demographic and aviation-related trends may relate to, or influence future airport activity.

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<sup>1</sup> After FAA's approval of the MP Update forecasts, a second commercial commuter passenger airline (JSX) began operations at BFI. No attempt has been made to alter the approved commercial service enplanements and aircraft operations forecasts based on the entrance of the second commuter airline.

Table B1 HISTORICAL AIRPORT ACTIVITY, 2000-2015

Year	Itinerant					Local		
	Air Carrier	Air Taxi	General Aviation	Military	Total Itinerant	Civil	Military	Total Local
2000 <sup>1</sup>	11,526	46,811	179,682	1,764	239,783	119,552	291	119,843
2001 <sup>1</sup>	10,148	46,057	166,684	1,577	224,466	92,422	453	92,875
2002 <sup>2</sup>	9,279	49,494	145,862	2,406	207,041	78,909	294	79,203
2003 <sup>2</sup>	9,091	53,344	151,043	2,145	215,623	94,766	462	95,228
2004 <sup>2</sup>	10,404	58,994	135,865	1,417	206,680	92,116	263	92,379
2005 <sup>2</sup>	9,967	63,092	136,652	1,379	211,090	89,014	374	89,388
2006 <sup>2</sup>	9,790	62,060	134,117	1,669	207,636	91,278	879	92,157
2007 <sup>2</sup>	10,662	64,237	126,522	1,732	203,153	96,342	689	97,031
2008 <sup>2</sup>	9,543	64,305	127,003	2,141	202,992	91,934	821	92,755
2009 <sup>2</sup>	10,663	66,145	113,568	2,096	192,472	73,068	576	73,644
2010 <sup>2</sup>	10,458	67,164	107,263	1,669	186,554	72,080	762	72,842
2011 <sup>2</sup>	11,720	59,225	101,724	1,497	174,166	54,010	551	54,561
2012 <sup>2</sup>	9,014	39,306	96,563	900	145,783	46,955	422	47,377
2013 <sup>2</sup>	9,200	33,058	91,819	568	134,645	46,998	298	47,296
2014 <sup>2</sup>	10,094	32,816	90,233	935	134,078	45,017	299	43,316
2015 <sup>2</sup>	10,896	28,809	84,280	1,056	125,041	39,770	760	40,530

Year	Total Ops	Based Aircraft	Passenger Enplan. <sup>3</sup>	Cargo (Landed Wt. in lbs.) <sup>3</sup>
2000 <sup>1</sup>	359,626	478	10,582	856,064,310
2001 <sup>1</sup>	317,341	427	10,555	725,072,970
2002 <sup>2</sup>	286,244	443 <sup>1</sup>	10,069	781,775,040
2003 <sup>2</sup>	310,851	443 <sup>1</sup>	16,220	763,813,680
2004 <sup>2</sup>	299,059	472 <sup>1</sup>	28,458	892,135,450
2005 <sup>2</sup>	300,478	472 <sup>1</sup>	23,016	866,798,960
2006 <sup>2</sup>	299,793	491 <sup>1</sup>	31,418	784,084,940
2007 <sup>2</sup>	300,184	490 <sup>1</sup>	34,580	805,503,706
2008 <sup>2</sup>	295,747	438 <sup>1</sup>	34,597	835,114,481
2009 <sup>2</sup>	266,116	463 <sup>1</sup>	35,863	894,664,512
2010 <sup>2</sup>	259,396	470 <sup>4</sup>	33,656	906,716,494
2011 <sup>2</sup>	228,727	427 <sup>4</sup>	34,434	909,809,432
2012 <sup>2</sup>	193,160	427 <sup>4</sup>	23,078	791,928,576
2013 <sup>2</sup>	181,941	418 <sup>4</sup>	13,008	759,444,826
2014 <sup>2</sup>	177,394	396 <sup>4</sup>	20,418	815,258,980
2015 <sup>2</sup>	165,571	380 <sup>4</sup>	18,945	833,475,382

SOURCE: BFI Airport Records, FAA OPSNET, ACAIS, & TAF databases.

<sup>1</sup> FAA Terminal Area Forecast (TAF) data - Fiscal Year (FY).

<sup>2</sup> FAA Operational Network (OPSNET) data - Calendar Year (CY).

<sup>3</sup> FAA Air Carrier Activity Information System (ACAIS) data - CY.

<sup>4</sup> BFI Airport Records - CY.

Over the past 15 years the Airport has recorded a downward trend in total operations and based aircraft. The majority of the operational decline has occurred within the recreational and training sectors of the General Aviation category. This segment of the aviation industry was severely impacted by the 2008 financial crisis, which has resulted in an aging GA fleet, fewer pilots and pilots in training, and increased operational costs. The national shortage of pilots seems to have stabilized this decline as more individuals enter the profession. However, at the same time the Airport has realized some growth in corporate and business-related general aviation activity, as well as stability in the commercial service, air cargo, and aviation industrial-related activity. These trends for each forecast category are examined in the following sections of this chapter.

### **Commercial Service**

Commercial service activity at BFI is currently conducted by scheduled 'commuter' and non-scheduled 'air carrier' service providers. The scheduled commercial service consists of an independent regional commuter airline (Kenmore Air), which is not affiliated with a major air carrier. Kenmore Air operates two to 12 passenger, single engine piston or turboprop-powered floatplane and fixed-gear aircraft to leisure-type destinations. Most BFI scheduled passengers are transported using nine-seat turboprop-powered aircraft. The non-scheduled service consists of a mix of air carrier charter operators, Justice Prisoner and Alien Transportation System (JPATS) flights, and occasional diverted flights from SEA.

As presented in **Table B2** and illustrated in **Figure B1**, total BFI passenger levels have increased since 2002, representing a 5.0 percent Compound Annual Growth Rate (CAGR). Between 2004 and 2012, total passenger enplanements remained relatively stable, ranging between 20,000 and 35,000 passengers. Non-scheduled commercial service enplanements have increased by approximately 84.3 percent, representing a CAGR of 1.5 percent. Scheduled commercial service has accounted for an average of 68 percent of passenger enplanements during the historical time period, whereas the non-scheduled service has accounted for an average of 32 percent of the passenger enplanements.

Total commercial aircraft operations have increased through the time period by an 8.0 percent CAGR, with historic highs mirroring passenger enplanements. Scheduled service has provided an approximate average of 88 percent of commercial service aircraft operations, with non-scheduled service providing an approximate average of 12 percent of commercial service activity.

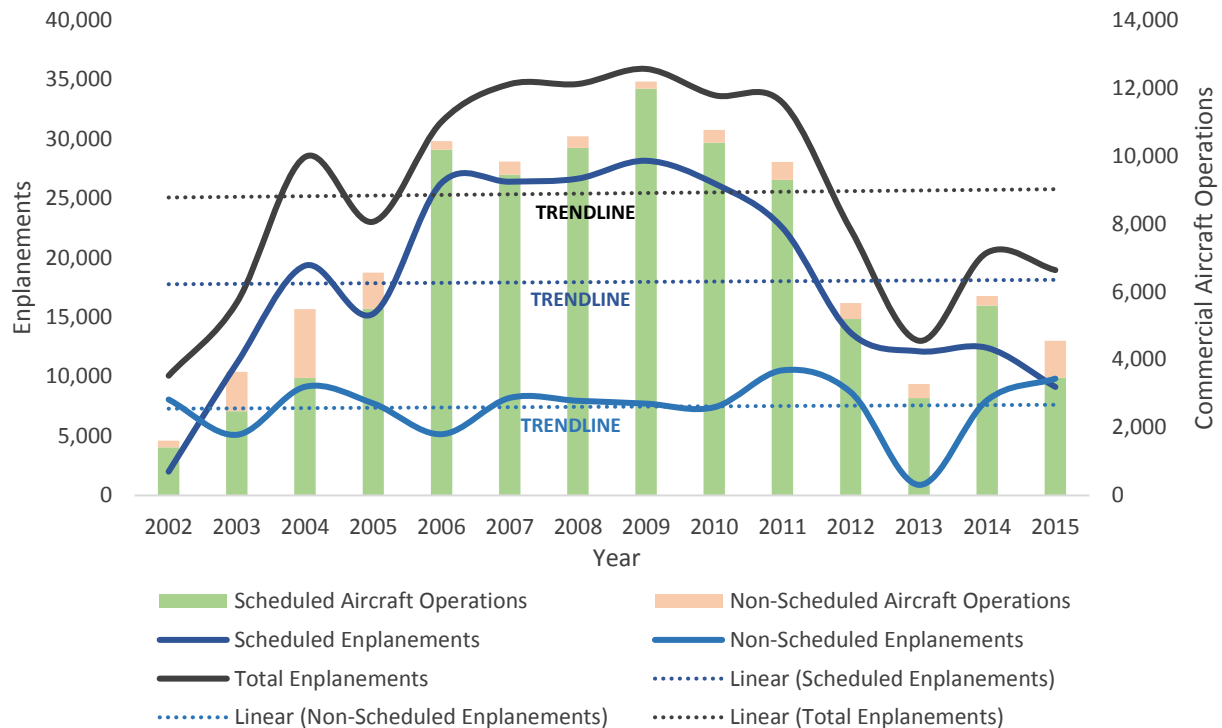
Table B2 HISTORICAL AND EXISTING COMMERCIAL SERVICE ACTIVITY

Year <sup>1</sup>	Passenger Enplanements			Passenger Aircraft Operations		
	Scheduled	Non-Scheduled	Total	Scheduled	Non-Scheduled	Total
2002	2,003	8,066	10,069	1,414	199	1,673
2003	11,121	5,099	16,220	2,476	1,159	3,635
2004	19,321	9,137	28,458	3,455	2,030	5,485
2005	15,277	7,739	23,016	5,497	1,062	6,559
2006	26,271	5,147	31,418	10,172	255	10,427
2007	26,380	8,200	34,580	9,440	384	9,824
2008	26,638	7,959	34,597	10,234	334	10,568
2009	28,141	7,722	35,863	11,975	206	12,181
2010	26,238	7,418	33,656	10,383	371	10,754
2011	22,501	11,933	34,434	9,286	534	9,820
2012	13,679	9,399	23,078	5,196	470	5,666
2013	12,119	889	13,008	2,864	416	3,280
2014	12,410	8,008	20,418	5,584	290	5,874
2015	9,123	9,822	18,945	3,468	1,080	4,548
<b>CAGR</b>	<b>12.4%</b>	<b>1.5%</b>	<b>5.0%</b>	<b>7.1%</b>	<b>13.9%</b>	<b>8.0%</b>

SOURCE: FAA T-100, USDOT BTS Website (March 2016).

<sup>1</sup> Calendar Year (CY) data.

Figure B1 HISTORICAL AND EXISTING BFI COMMERCIAL SERVICE ACTIVITY



SOURCE: Historical: FAA T-100, USDOT BTS Website (March 2016).

## **Air Cargo**

Air cargo at BFI represents a large sector and high-valued market of aviation activity. In 2015, BFI ranked as the 29th busiest cargo airport in the country, recording a landed weight of 416,737 tons, an increase of 2.2 percent from 2014 data. BFI's proximity to the Seattle Central Business District makes it a desirable location for the integrated express air cargo operations that predominate, and efforts by the Airport management to work with these cargo operators/tenants to meet their needs, despite tight physical constraints, have been beneficial to both the tenant and the Airport. The BFI international air cargo carriers are most commonly routed through west coast hubs or Anchorage.

The USDOT T-100 and FAA's Air Carrier Activity Information System (ACAIS) are the resource basis for the historical BFI and regional air cargo (freight and mail) activity. This activity is subdivided into enplaned, deplaned cargo, cargo operator, operations, and aircraft flight frequency (see **Table B3** and **Figure B2** below). BFI air cargo activity for both domestic and international destinations has generally continued to increase since 2005, as quantified in terms of enplaned/deplaned pounds, aircraft landing weights, and revenue ton miles. In the past 10 years, BFI has accommodated 2.3 to 3.4 million pounds of air cargo annually. On average, freight constitutes 97 percent of the total BFI cargo volume weight, compared to mail at 3.0 percent. Nearly 73 percent of the air cargo transport operations are conducted by wide-body aircraft, predominately the B-767-200 & 300 series aircraft, but also the MD-11 and the B-747 in previous years.

**Table B3** provides a summary of the 2015 BFI 'scheduled' air cargo carriers, subdivided by type of aircraft for percent of cargo flights/operations and total annual landing weights. For 2015, UPS and ABX (formerly Airborne Express) were the largest cargo operators, representing over 85 percent of the total cargo landing weight (volume).

Table B3 BFI SCHEDULED AIR CARGO OPERATORS AND ACTIVITY (2015)

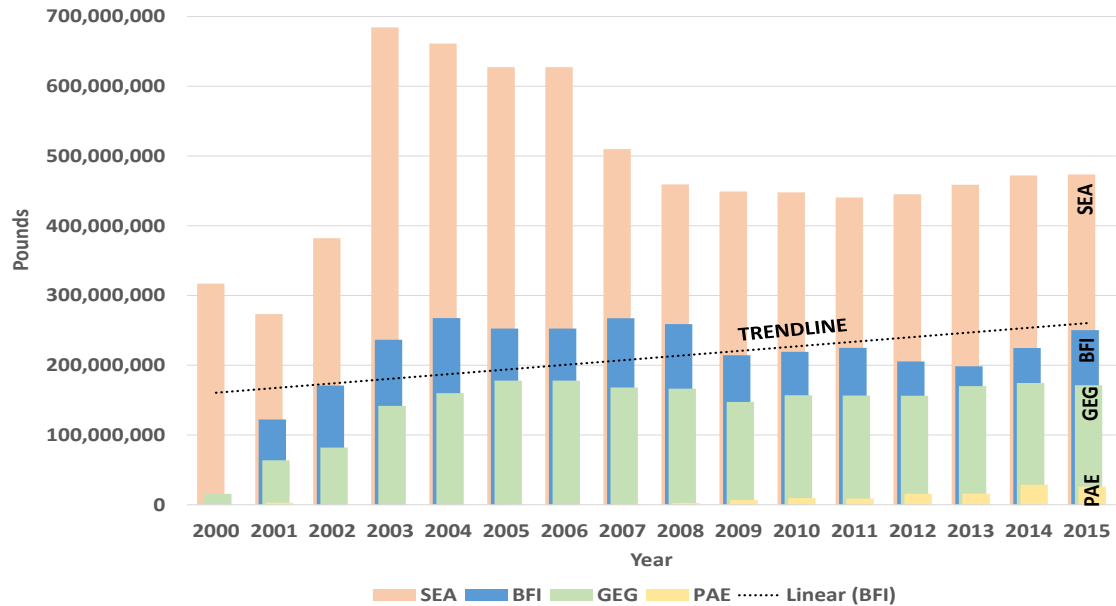
Cargo Carrier	Aircraft Weight	Total Landings	Percent Landings	Total Landing Weight	Percent Landing Weight
<b>ABX</b>	--	<b>789</b>	<b>12.8%</b>	<b>214,841,000</b>	<b>26.4%</b>
B-767	277,000	44	--	12,188,000	--
B-767-200	272,000	744	--	202,368,000	--
B-767-200ER	285,000	1	--	285,000	--
<b>AIRPAC Airlines</b>	--	<b>1,005</b>	<b>16.3%</b>	<b>6,168,000</b>	<b>0.8%</b>
Piper PA-31-350	7,250	588	--	4,263,000	--
Piper PA-31-34	3,470	417	--	1,905,000	--
<b>Ameriflight</b>	--	<b>1,985</b>	<b>32.2%</b>	<b>30,301,300</b>	<b>3.7%</b>
Beech B-99	10,400	198	--	2,059,200	--
Beech C-99	1,300	623	--	7,039,900	--
Beech 1900	16,100	482	--	7,760,200	--
EMB-120	25,794	335	--	8,640,000	--
F-227	14,000	339	--	4,746,000	--
Piper Navajo PA-31-350	7,000	8	--	56,000	--
<b>BAX Global</b>	--	<b>227</b>	<b>3.7%</b>	<b>44,946,000</b>	<b>5.5%</b>
B-767-200	198,000	227	--	44,946,000	--
<b>Martinaire</b>	--	<b>252</b>	<b>4.1%</b>	<b>2,142,000</b>	<b>0.3%</b>
Cessna 208	8,500	252	--	2,142,000	--
<b>Nolinor Aviation</b>	--	<b>171</b>	<b>2.8%</b>	<b>18,297,000</b>	<b>2.2%</b>
B-737-200	107,000	171	--	18,297,000	--
<b>Northern Air Cargo</b>	--	<b>31</b>	<b>0.5%</b>	<b>3,450,000</b>	<b>0.4%</b>
B-737-200	107,000	12	--	1,284,000	--
B-737-300	114,000	19	--	2,166,000	--
<b>UPS</b>	--	<b>1,708</b>	<b>27.7%</b>	<b>495,112,000</b>	<b>60.7%</b>
Airbus A300-600	315,000	16	--	5,040,000	--
B-757-200PF	210,000	576	--	120,960,000	--
B-767-300F	326,000	1,084	--	353,384,000	--
MD-11	491,500	32	--	15,728,000	--
<b>Total/Average</b>	<b>139,816</b>	<b>6,168</b>	<b>100.0%</b>	<b>815,257,300</b>	<b>100.0%</b>

SOURCE: FAA T-100 Cargo Data; USDOT BTS Website (Obtained March 2016).

Note: BAX Global relocated cargo operations from BFI to SEA during 2016.

Figure B2 also provides a comparison of BFI's historic cargo volumes over the past 15 years with the other Seattle regional airports (i.e., SEA, GEG, & PAE).

Figure B2 TOTAL ENPLANED & DEPLANED FREIGHT AND MAIL – SEATTLE REGION AIRPORTS



SOURCE: FAA T-100 Cargo Data; USDOT BTS Website (Obtained March 2016).

As shown in the figure, SEA handles the majority of the region's cargo with 785,005 tons being recorded at the Airport in 2015. However, the distribution of cargo between the four airports has remained constant over the past 10 years.

### General Aviation

General aviation aircraft operations are defined as all civil aviation aircraft activity excluding air carriers and commercial aircraft. Between the years 2000 and 2015, total general aviation aircraft operations have declined at BFI by a CAGR of 5.7 percent. Itinerant GA operations have decreased by a CAGR 4.9 percent; local GA operations have declined by a CAGR of 7.1 percent. This general aviation trend is not unique to BFI and is reflective of the decline across much of the nation due to the continued economic weakness during the recession that began in 2007, high fuel prices, less flight training, and elevated insurance costs associated with owning and operating general aviation aircraft.

In addition, an analysis of BFI general aviation operations-per-based-aircraft (OPBA), the ratio between annual general aviation operations and based aircraft, indicates that BFI based aircraft, on average, are being operated less, and that activity by based aircraft has fallen, relative to the drop in BFI airport operations and in total based aircraft. During the past 10 years, the OPBA has declined from over 600 to less than 400. However, the occupancy rate for BFI hangar space for this same period has remained at nearly 100 percent.

**Table B4** presents the historical and existing general aviation aircraft operations at BFI. **Figure B3** graphically presents this data.



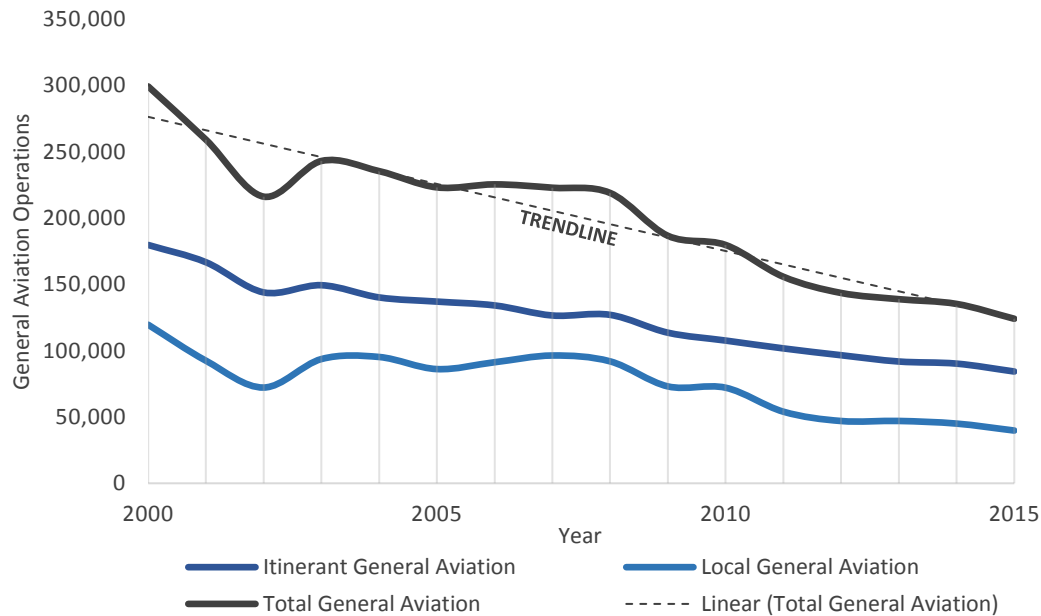
Table B4 HISTORICAL AND EXISTING GENERAL AVIATION AIRCRAFT OPERATIONS

Year	Total General Aviation	General Aviation – Itinerant	General Aviation – Local	General Aviation – Based Aircraft/ OPBA <sup>1</sup>
2000	299,234	179,682	119,552	478/626
2001	259,106	166,684	92,422	427/607
2002	216,139	143,950	72,189	443/488
2003	243,032	149,359	93,673	443/549
2004	235,368	140,131	95,237	472/499
2005	223,122	137,009	86,113	472/473
2006	225,395	134,117	91,278	473/477
2007	222,864	126,522	96,342	472/472
2008	218,937	127,003	91,934	420/521
2009	186,636	113,568	73,068	439/425
2010	179,703	107,623	72,080	447/402
2011	155,734	101,724	54,010	424/367
2012	143,518	96,563	46,955	424/338
2013	138,817	91,819	46,998	417/333
2014	135,250	90,233	45,017	396/342
2015	129,292	86,816	42,476	380/340
<b>CAGR</b>	<b>-5.7%</b>	<b>-4.9%</b>	<b>-7.1%</b>	<b>-1.5%/-4.0%</b>

SOURCE: FAA Terminal Area Forecast (TAF) – BFI Airport, Obtained January 2016.

<sup>1</sup> OPBA: Operations Per Based Aircraft.

Figure B3 HISTORICAL AND EXISTING BFI GENERAL AVIATION ACTIVITY



SOURCE: FAA Terminal Area Forecast (TAF) – BFI Airport, Obtained January 2016.

## Based Aircraft

Based aircraft are those aircraft permanently stored at an airport. As presented in **Table B5**, there has been a precipitous decline in total number of based aircraft since 2006, dropping from around 500 to 380, with an average loss of three based aircraft per year, with higher rates of 10 to 15 aircraft per year experienced recently. The most significant change is the proportional increase of based jets and the continued decline of single engine/civilian owned aircraft.

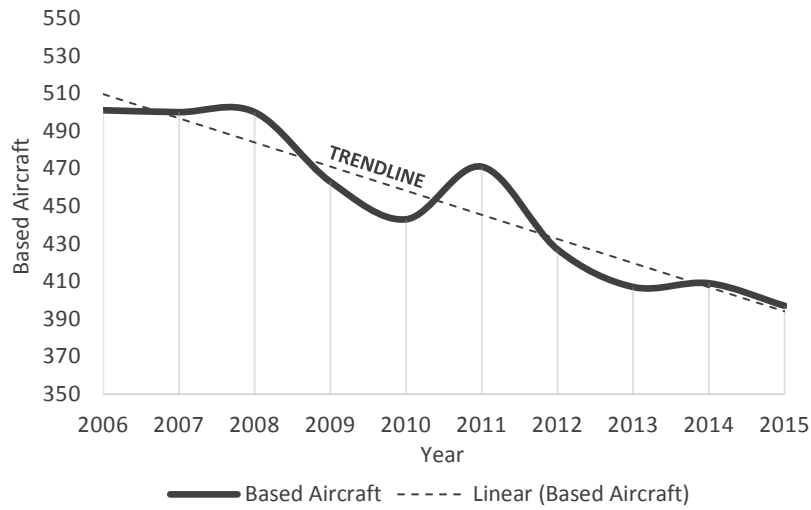
Since the airport's 76 hangars, ranging in size from small T-hangars to large executive hangars, have maintained an occupancy rate of over 95 percent between 2008 to 2015, it is recognized that the majority of the base aircraft losses were recorded from the aircraft tiedown apron areas. The BFI Airport staff foresees stability in hangar demand for all types of aircraft, with increasing demand for larger turbine aircraft. The property availability and economic returns for hangar space constraints will be an on-going challenge. **Figure B4** graphically presents the historical and existing BFI based aircraft.

Table B5 BFI HISTORICAL AND EXISTING BASED AIRCRAFT BREAKDOWN - TYPE AND PERCENT (2006-2015)

Year	Single Engine	Multi Engine	Jet	Rotorcraft	Military	Total Civilian	Grand Total
2006	269	72	90	42	18	473	491
2007	264	84	82	42	18	472	490
2008	189	107	82	42	18	420	438
2009	257	86	65	31	24	439	463
2010	254	105	59	33	19	447	470
2011	238	79	76	32	2	424	427
2012	238	79	76	32	2	424	427
2013	233	75	77	32	1	417	418
2014	217	63	82	34	0	396	396
2015	203	60	86	31	0	380	380
CAGR	-3.1%	-2.0%	-0.5%	-3.3%	-100%	-2.4%	-2.8%

SOURCE: BFI Airport Records & FAA TAF database.

Figure B4 HISTORICAL AND EXISTING BFI BASED AIRCRAFT



SOURCE: BFI Airport Records.

### Previous Forecasts

Aviation activity forecasting not only utilizes historical and existing data as an initial baseline, it is also supplemented with a comparison to previous forecasts. Previous aviation activity forecasts used for comparison purposes in this MP Update include the 1996 BFI Airport Master Plan (1996 AMP), the 2008 BFI Aviation Activity Forecast Update, the 2009 Washington (WSDOT) Long-Term Air Transportation Study (LATS), and the 2004 Puget Sound Regional Council Planning and Transportation Study (2004 PSRC Study).

### Previous Enplanements Forecasts

Table B6 presents a comparison of the enplanements forecasts projected in the 1996 AMP and the 2008 Aviation Activity Forecast Update with the actual enplanements occurring between 2005 and 2015. A comparison of the enplanements forecast with actual enplanements indicates that the 1996 AMP and the WSDOT LATS were overly optimistic in their estimates. The 1996 AMP overestimated enplanements by an average margin of error of 163.6 percent; the LATS overestimated by an average margin of error of 119.4 percent. The 2008 Aviation Activity Forecast Update was much closer in estimating actual enplanements, in which it underestimated by an average margin of error of 12.9 percent.

Table B6 BFI ACTUAL ENPLANEMENTS COMPARISON TO FORECASTS ENPLANEMENTS

Year	Actual	1996 AMP	Variation from Actual	2008 Aviation Activity Forecast Update	Variation from Actual	WSDOT LATS	Variation from Actual
2005	23,016	38,200	9,724 (34.1%)				
2008	34,597			27,754	-6,826 (-19.7%)		
2009	35,563			28,725	-5,872 (-17.0%)		
2010	33,656	77,000	41,137 (114.7%)	29,817	-6,046 (16.6%)	53,600	17,737 (49.5%)
2011	33,434			30,950	-2,706 (-8.0%)		
2012	23,078			32,126	-897 (-2.7%)		
2015	18,945	89,300	69,086 (341.8%)			58,500	38,286 (189.4%)

**SOURCE:** 1996 BFI Airport Master Plan, 2008 BFI Aviation Activity Forecast Update, 2009 Washington (WSDOT) Long-Term Air Transportation Study (LATS) and the 2004 Puget Sound Regional Council Planning and Transportation Study (2004 PSRC Study).

### Previous Aircraft Activity Forecasts

**Table B7** presents a comparison of the aircraft activity forecasts with actual activity occurring between 2000 and 2015. A comparison of the forecasted aircraft activity with actual operations indicates that only the forecasted commercial service operations were below actual levels, having a negative 26.7 percent average margin of error for the 20-year time period. General aviation aircraft operations were the highest overestimated category of activity levels, with a 20-year average margin of error of 90.1 percent. Air taxi operations were next highest, with an average margin of error of 72.1 percent, followed by air cargo aircraft operations (69.3 percent average margin of error) and military operations (51.6 percent average margin of error). Total aircraft operations were overestimated by an average margin of error of 78.2 percent for the 20-year period. The 1996 AMP was prepared over two decades ago during historic highs of airport activity and is thus overly optimistic and considered irrelevant for forecasting efforts today.

Table B7 BFI ACTUAL OPERATIONAL ACTIVITY COMPARISON TO FORECAST OPERATIONAL ACTIVITY

Aircraft Operations	2000	2005	2010	2015
<b>1996 AMP Forecast Commercial Service</b>	<b>5,000</b>	<b>7,200</b>	<b>9,000</b>	<b>10,200</b>
Actual Commercial Service	35	6,559	10,754	4,548
Variation from Actual	4,965 (14,185.7%)	641 (9.8%)	1,754 (-16.3%)	5,652 (124.3%)
<b>1996 AMP Forecast Air Cargo</b>	<b>25,658</b>	<b>29,387</b>	<b>33,904</b>	<b>38,184</b>
Actual Air Cargo	24,646	25,390	16,920	12,336
Variation from Actual	1,012 (3.9%)	3,997 (13.6%)	16,984 (50.1%)	25,848 (209.5%)
<b>1996 AMP Forecast General Aviation</b>	<b>323,274</b>	<b>339,608</b>	<b>356,600</b>	<b>374,275</b>
Actual General Aviation	299,234	223,122	179,703	129,292
Variation from Actual	24,040 (8.0%)	115,486 (52.2%)	176,897 (98.4%)	244,983 (189.5%)
<b>1996 AMP Forecast Military</b>	<b>3,000</b>	<b>3,000</b>	<b>3,000</b>	<b>3,000</b>
Actual Military	2,055	1,748	2,431	1,816
Variation from Actual	945 (46.0%)	1,252 (71.6%)	569 (23.4%)	1,184 (65.2%)
<b>1996 AMP Forecast Air Taxi</b>	<b>31,848</b>	<b>36,498</b>	<b>42,314</b>	<b>49,051</b>
Actual Air Taxi	20,955	31,143	10,754	11,925
Variation from Actual	13,829 (66.0%)	9,255 (29.7%)	36,157 (336.2%)	42,626 (357.5%)
<b>1996 AMP Forecast Total</b>	<b>391,716</b>	<b>419,593</b>	<b>449,415</b>	<b>480,210</b>
Actual Total	359,626	298,257	259,913	165,571
Variation from Actual	32,090 (8.9%)	121,336 (40.7%)	189,502 (72.9%)	314,639 (190.0%)

SOURCE: 1996 BFI Airport Master Plan.

### Previous Air Cargo Activity Forecasts

Table B8 presents a comparison of the air cargo activity forecasts contained in the 2006 PSRC REGIONAL AIR CARGO STRATEGY (2006 PSRC Study) with actual activity occurring in 2010 and 2015. As with most of the previous forecasting studies, the comparison indicates that the forecasted air cargo activity levels were overly optimistic, having overestimated air cargo tonnage by an average margin of error of 48.4 percent and air cargo operations by an average margin of error of 100.6 percent. The 2006 PSRC Study was conducted prior to the economic recession of 2007, which had a negative impact on air cargo activity not only at BFI, but nationwide.

Table B8 BFI ACTUAL AIR CARGO COMPARISON TO AIR CARGO FORECASTS

Year	Actual Air Cargo Tonnage (metric tons)	2004 PSRC Study (metric tons)	Variation from Actual (metric tons)	Actual Air Cargo Aircraft Operations	2004 PSRC Study	Variation from Actual
2010	106,576	156,900	50,324 (47.2%)	16,920	27,300	10,380 (61.3%)
2015	121,899	182,300	60,401 (49.6%)	12,336	29,600	17,264 (139.9%)

SOURCE: 2006 PSRC Regional Air Cargo Strategy.

## Factors Affecting Aviation Forecasts

The amount and kind of aviation activity expected at any airport is dependent upon many factors, but is reflective of general economic conditions prevalent within the airport's market area, the services available to aircraft operators, and the businesses located on the airport or within the community. Additionally, the expected aviation regulatory climate, national aviation trends and forecasts, and local issues also factor into the projections of airport activity.

### Airport Service/Market Area Overview

**Airport Service Area and Roles.** The BFI aeronautical service area extends throughout the Seattle Metropolitan Area, conjoining and overlapping with multiple commercial service and general aviation public use airports in the surrounding vicinity (i.e., SEA, RNT, PAE, S50, PWT). It is estimated the BFI aeronautical service area, which is a function of drive distance/times in relation to surrounding airports and available services, is primarily concentrated within King County, serving a population of nearly 2.1 million residents. Existing planning standards for driving distance/travel times are generally defined by a minimum 20-mile driving distance between NPIAS airports, 30-minute travel times that are often cited in pilot surveys as the maximum travel time from home or work to based aircraft locations, and the time taken to transport cargo between an airport and the Central Business District (CBD) that is often defined in 30 minute travel time increments. The primary aviation-related user categories that are contained within the service area boundary are commercial passenger service, air cargo, and general aviation based aircraft.

A brief description of these categories is provided in the text below:

- **Commercial Passenger Service.** As noted on **Figure B5**, there are two commercial service airports that operate within the BFI aeronautical service area. SEA is the primary commercial service airport in the Pacific Northwest, which is located approximately four miles south of BFI. SEA recorded over 20 million enplanements in 2015 (ranks 13th in the United States) and is served by 23 airlines providing daily non-stop domestic and international flights. Scheduled commercial passenger service at BFI is provided by Kenmore Air that operates a nine-seat turboprop-powered aircraft as an independent regional commuter airline. Kenmore Air, which primarily serves a niche market of San Juan Island destinations and resort areas of British Columbia, recorded 9,123 scheduled enplanements in 2015.
- **Air Cargo.** Similar to the commercial passenger service category presented above, SEA and BFI are the two primary air cargo airports within the defined service area. SEA ranked 18th in the nation for cargo landed weight in 2015 with approximately 785,006 tons and is currently served by six dedicated freighter airlines and 19 air carrier passenger airlines that accommodate belly cargo. FedEx has operated at SEA since 1997 and maintains a leading 36.64 percent market share of total freight by airline. For comparison, BFI ranked 29th in the nation for landed weight with approximately 416,738 tons in 2015. UPS has operated at BFI since 1996 and continues to benefit from BFI's locational proximity to downtown Seattle, recording a leading 60.7 percent market share of total landed weight by airline in 2015.

- **Airport Based Aircraft Owner Locations.** The identification of based aircraft owner locations is one means to discern the Airport's geographical boundary of influence and concentration of based aircraft. **Figure B5** depicts BFI registered aircraft owners plotted by zip code density. Of the 309 listed aircraft owner addresses, 72 percent reside within a 20-mile radius of BFI, which generally corresponds to the 30-minute travel time planning standard, and east of Puget Sound, as largely amassed within the Seattle MSA, and mostly contained by the north and south King County boundary. The greatest owner concentrations are north and northeast, including north Seattle, Bellevue, Kirkland, Mercer Island, and Redmond. This service area analysis suggests, other than the Renton Municipal Airport (RNT), there is little based aircraft ownership overlap with the surrounding public use airport system. RNT currently has 267 based aircraft that includes 244 single engine aircraft and two jets, which compares to SEA that has two based aircraft (both jets).

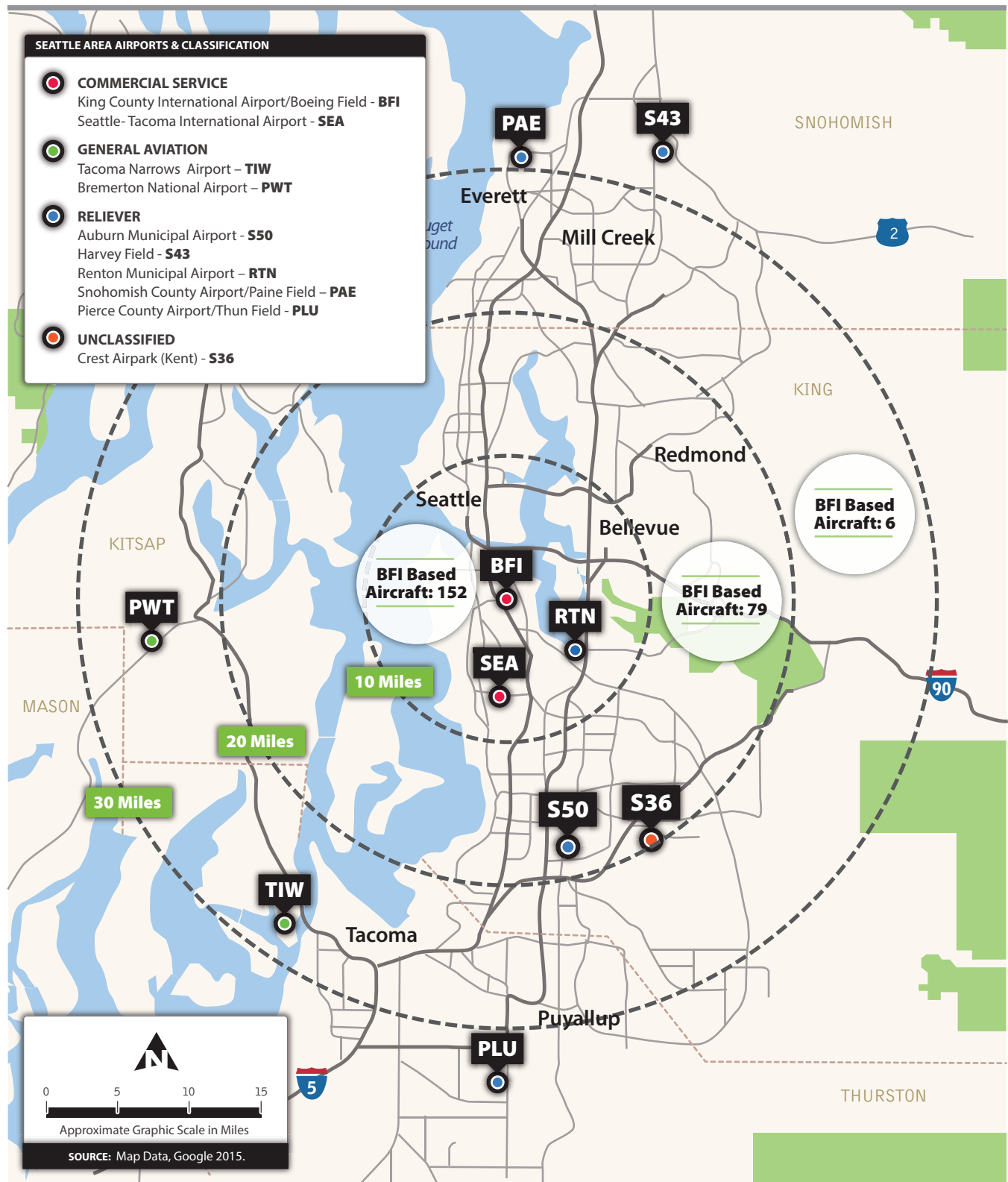


FIGURE B5 **Airport Service Area/  
Based Aircraft Owner Locations**



## Regional Demographics

Historically, aviation activity at the macro and micro scale have been influenced by national, regional, and local trends in population, income, and employment (socioeconomic conditions). Population is an indicator of the general number of persons served by an airport and, therefore, reflects the potential customer base. Employment levels are a gauge of economic activity and vitality of a region. Income levels indicate the degree to which the airport's customer base has sufficient disposable income to spend on aviation activities (e.g., airline travel, owning aircraft, and chartering or renting aircraft). Other, broader metrics presented include such characteristics as household income, net earnings, retail sales, and economic wealth index.

This section presents the historical and forecast socioeconomic characteristics for the BFI market area, roughly defined as the Seattle Metropolitan Statistical Area (MSA). Subsequent sections, providing individual aviation activity forecasts, will evaluate the degree to which these socioeconomic conditions have or will influence BFI's activity levels.

**Table B9** provides a summary, by major socioeconomic category, of the historic and projected socioeconomic trends for the Seattle MSA. **Tables B10** and **B11** provide the same summaries for the State of Washington and the United States, respectively, to compare how the MSA compares in relation to state and national trends. The majority of economic indicators point to continued economic growth in the Seattle MSA over the 20-year BFI forecast horizon. As substantiated by the 2013 Puget Sound Regional Council (PSRC) long-range regional economic forecast, a favorable long-term economic outlook for the Seattle MSA is supported by its growing population, well-educated work force, high per capita income, diverse local economy, and popularity as a domestic and international tourist destination.

According to a 2013 Brookings Study, of the 100 largest nationwide MSA's, Seattle ranked sixth for exports and twelfth for output in 2012. Factors expected to contribute to Seattle's economic growth include:

- Diversity in the economic base, which lessens its vulnerability to weaknesses in certain industry sectors.
- Growth in the existing and emerging Seattle industry sectors described earlier.
- An educated labor force able to support the development of knowledge-based and service industries.
- Continued reinvestment to support the development of tourism, conventions, and other businesses.

Table B9 SUMMARY SOCIOECONOMIC TRENDS AND PROJECTIONS

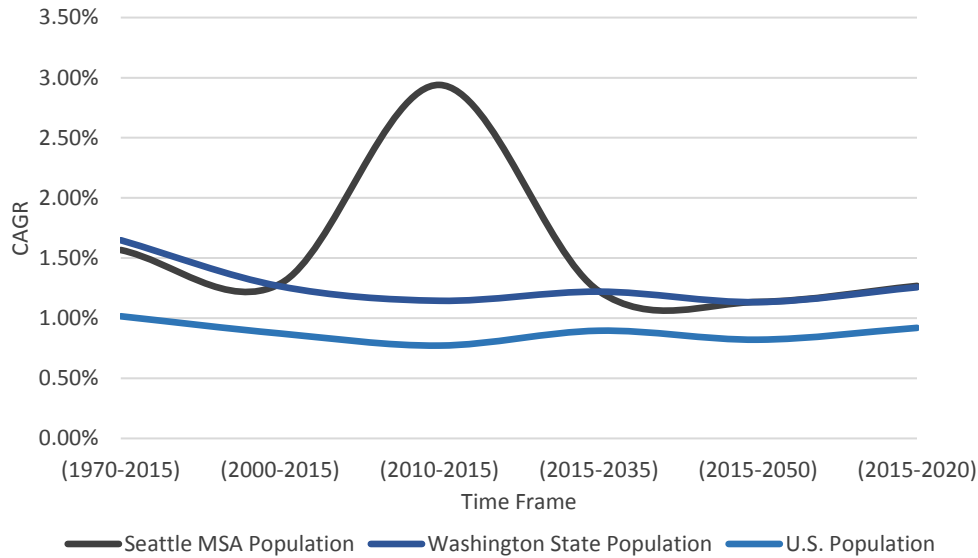
Economic Segment	CAGR - Historical Periods			CAGR - Forecast Periods		
	(1970-2015)	(2000-2015)	(2010-2015)	(2015-2035)	(2015-2050)	(2015-2020)
<b>Seattle MSA</b>						
Total Population	1.57%	1.29%	2.94%	1.23%	1.14%	1.27%
Total Employment	2.39%	1.03%	2.63%	1.44%	1.32%	1.61%
Total Earnings (2009 \$)	3.60%	1.66%	4.45%	2.19%	2.08%	2.34%
Total Personal Income (2009 \$)	3.64%	2.11%	5.05%	2.31%	2.13%	2.47%
Net Earnings (2009 \$)	3.42%	1.69%	4.52%	2.15%	2.06%	2.22%
Economic Wealth Index	0.23%	-0.13%	-0.12%	-0.20%	-0.16%	-0.24%
Mean Household Income	5.28%	2.59%	5.79%	4.27%	4.49%	3.19%
Total Retail Sales	3.33%	2.62%	4.30%	1.80%	1.75%	2.05%
<b>Composite Average</b>	<b>2.93%</b>	<b>1.61%</b>	<b>3.69%</b>	<b>1.90%</b>	<b>1.85%</b>	<b>1.86%</b>
<b>Washington State</b>						
Total Population	1.65%	1.27%	1.14%	1.22%	1.13%	1.26%
Total Employment	2.29%	1.05%	1.84%	1.41%	1.29%	1.59%
Total Earnings (2009 \$)	3.33%	1.74%	2.70%	2.17%	2.06%	2.33%
Total Personal Income (2009 \$)	3.58%	2.24%	2.92%	2.37%	2.16%	2.56%
Net Earnings (2009 \$)	3.23%	1.71%	2.66%	2.18%	2.09%	2.27%
Economic Wealth Index	0.07%	-0.02%	0.13%	-0.14%	-0.12%	-0.15%
Mean Household Income	5.12%	2.62%	2.76%	4.30%	4.50%	3.26%
Total Retail Sales	3.11%	2.31%	3.45%	1.79%	1.74%	2.03%
<b>Composite Average</b>	<b>2.29%</b>	<b>1.05%</b>	<b>1.84%</b>	<b>1.41%</b>	<b>1.29%</b>	<b>1.59%</b>
<b>National</b>						
Total Population	1.02%	0.87%	0.77%	0.90%	0.82%	0.92%
Total Employment	1.62%	0.86%	1.68%	1.26%	1.13%	1.44%
Total Earnings (2009 \$)	2.61%	1.48%	2.33%	2.05%	1.93%	2.21%
Total Personal Income (2009 \$)	2.89%	1.93%	2.51%	2.21%	2.00%	2.41%
Net Earnings (2009 \$)	2.50%	1.45%	2.29%	2.07%	1.97%	2.16%
Economic Wealth Index	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Mean Household Income	5.04%	2.71%	2.76%	4.50%	4.68%	3.47%
Total Retail Sales	2.24%	1.43%	3.08%	1.47%	1.44%	1.70%
<b>Composite Average</b>	<b>2.24%</b>	<b>1.34%</b>	<b>1.93%</b>	<b>1.81%</b>	<b>1.75%</b>	<b>1.79%</b>

SOURCE: Woods & Poole Data.

Note: Existing data is through CY 2015.

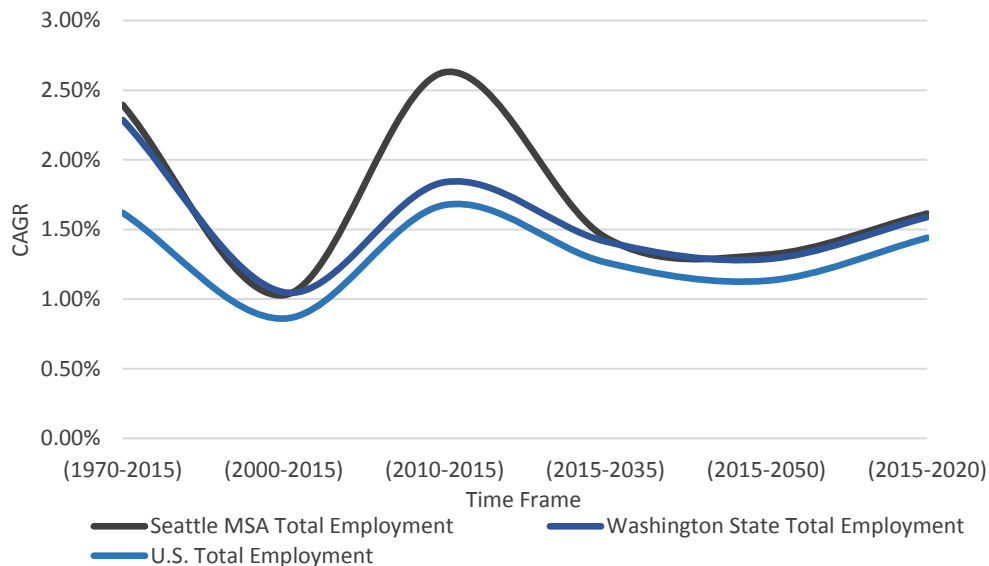
Figures B6, B7, and B8 provide a graphic comparison of the population, employment, and personal income growth rates, respectively, during the time frames provided in the previous tables.

Figure B6 HISTORICAL AND FORECAST POPULATION GROWTH RATES COMPARISON



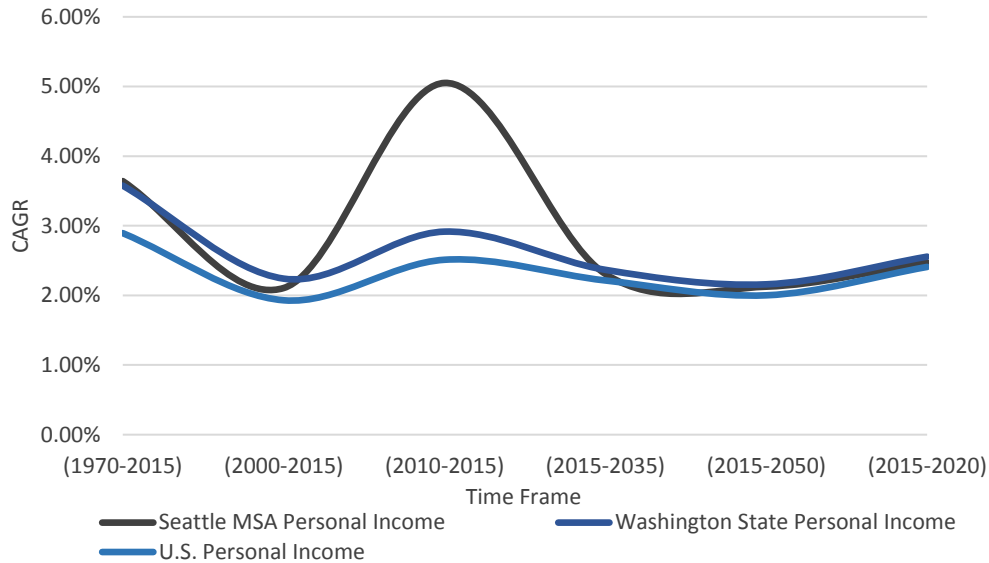
SOURCE: Woods & Poole Data.

Figure B7 HISTORICAL AND FORECAST EMPLOYMENT GROWTH RATES COMPARISON



SOURCE: Woods & Poole Data.

Figure B8 HISTORICAL AND FORECAST INCOME GROWTH RATES COMPARISON



SOURCE: Woods & Poole Data.

As can be noted, the key indicators of population, employment, and personal income in the Seattle MSA have historically increased faster than nationwide rates, and closely mirrored the State's growth rates. Also substantiated by PSRC population growth projected, the Seattle MSA population is projected to increase an average of 1.0 percent per year between 2013 and 2034, compared with 1.3 percent for the State, and 1.0 percent nationwide. As noted by economic category in **Table B9**, when compiled as a composite socioeconomic average, the overall Seattle MSA market area is expected to grow socioeconomically at 1.8 to 1.9 percent annually, a similar rate as experienced since 2000 (1.6 percent), but lower than since 2010 (3.7 percent). Overall, these indicators suggest that BFI would be expected to grow at or above nationwide industry projections for aviation-related activity.

### **Aviation Industry Trends with Potential to Influence Airport Growth**

To provide a broader perspective to the BFI forecasts, the following is an industry overview of the major aviation sector trends and patterns occurring on a local and national basis. National trends can provide insight into future aviation activity that often have a trickle-down effect on the regional and local levels.

**Airline Service Industry Trends.** As stated previously, the scheduled BFI airline service is provided by an independent regional commuter airline (Kenmore Air) operating two to 12 passenger aircraft not affiliated with a mainline air carrier, with most passengers transported using nine-seat turboprop aircraft. Regional airlines are generally defined as those providing service primarily via aircraft with 89 or less seats and whose routes serve mainly as feeders to the mainline carriers. Mainline carriers are generally defined as those providing service primarily via aircraft with 90 or more seats.

At BFI, the scheduled air carrier airline provides a niche service in terms of providing service to and from leisure-type destinations in the San Juan Islands and Canada; it does not provide feeder service for mainline carriers. Because Kenmore Air operates with nine-seat and smaller aircraft, they are not subject to the same Transportation Security Agency (TSA) security and screening requirements that larger airlines are subject. In this regard, they are more like an on-demand, air taxi service. This level/type of service is expected to continue throughout the forecast planning period, as Kenmore Air has successfully survived many competitors over the years and has demonstrated an ability to maintain a relatively stable market and passenger levels. Despite some interest from larger mainline air carriers in the past, further proliferation of mainline scheduled passenger service is not anticipated at BFI, due primarily to airfield constraints (i.e., no readily available or sufficient space to provide adequate aircraft parking apron and passenger terminal building) and landside constraints (i.e., limited capacity of the surrounding surface transportation infrastructure and auto parking positions to accommodate substantial increases in demand of passenger-related vehicles).

**Air Cargo Industry Trends.** Significant structural changes have occurred in the air cargo industry, with a maturation of the domestic express market, resulting in total national air cargo volumes declining over the last 10 years. The most notable changes have involved the global economy, increased jet fuel costs, more stringent FAA and TSA air cargo security regulations, a shift from air to truck modes and greater reliance on all-cargo air carriers for the transport of U.S. Postal Service mail, combined with the decline in mail due to electronic substitutes.

Additional factors affecting air cargo growth are fuel price volatility, movement of real yields, and globalization. It is for these reasons that the U.S. air cargo industry is not expected to sustain the high growth rates experienced in previous decades. However, for forecast purposes, air cargo is derived from demand resulting from economic activity, historically, tracking with gross domestic product. The air cargo market at BFI continues to show moderate and stable growth, a trend expected to continue into the forecast planning period. As the Airport builds increased ties to the integrated express carriers (e.g., UPS) that will benefit from the continued expansion of e-commerce, this trend may accelerate.

**Aircraft Manufacturing Industry Trends.** The Boeing Company conducts approximately 4,200 operations at BFI per year in support of their civilian and military aircraft manufacturing, testing, and customer delivery operations, with nearly 90 percent attributed to the B-737 Series aircraft, eight percent by the 787 Series, and two percent combined by the B-767 and B-777 Series. Each Boeing aircraft conducts an average of three to five test/readiness flights at BFI, prior to the final customer delivery. According to the Boeing *Current Market Outlook 2016-2035*, the Boeing Company plans to deliver 28,140 single-aisle airplanes during the next 20 years. For the past two years (2015 and 2016) Boeing produced approximately 41 B-737 aircraft per month at the Renton facility, totaling between 490 and 495 aircraft per year.

The majority of these B-737 aircraft conduct operations at BFI in support of the final testing, certification, and final delivery activities noted above. In addition, Boeing recently invested nearly \$10 million in a new B-737 aircraft delivery center that is located in the northwest quadrant of the Airport. For forecast purposes, with strong demand and order backlogs with the B-737, B-767, and B-787 Series, the Boeing Company operations at BFI are expected to increase proportional to the production rates of these aircraft, nearly five to 10 percent, and potentially greater as other aircraft models or variants are developed in the future.

**General Aviation (Business/Corporate) Industry Trends.** The use of general aviation for executive business/corporate travel has continued to experience growth, as measured by turbine, business jet, and helicopter aircraft deliveries and utilization trends. This general aviation segment has moderately recovered year-to-year since the 2008-2009 economic recession and financial credit crises. This positive activity increase is largely attributable to a bolstered economy, and continued awareness and value in using private aircraft to conduct efficient company travel. All segments of the small, medium, and large cabin business jet fleet are undergoing recent manufacturing delivery gains. This overall upward business-class activity trend is apparent at BFI in recent years, as indicative of the net increase of based turbine aircraft, the proportional upgrade to larger-cabin business jets, and prospective tenant interest for basing business operations at BFI.

**General Aviation (Recreational/Training) Industry Trends.** The use of general aviation for recreational/training purposes has continued to experience an overall decline, as measured by aircraft production rates, pilot certifications, and operating utilization trends. Single and twin piston aircraft account for nearly 80 percent of the nationwide aircraft fleet. The 2008-2009 economic recession resulted in a sharp reduction of light general aviation activity nationwide, which has impeded sustained growth for this general aviation sector. This trend of decreased activity over the past ten years is largely attributable to escalating aircraft operating costs (e.g.; purchase, equipment, maintenance, insurance and fuel), more burdensome airman and aircraft regulatory requirements, safety liability, air carrier hiring challenges, and competing interests for personal income and leisure time. This downward trend in nationwide general aviation activity has occurred at BFI since 2008-2009, as confirmed through a decline of general aviation piston operations, flight training activities, number of piston based aircraft, based piston aircraft utilization, and Avgas fuel sales.

### FAA Forecasts

Described below, the FAA provides a basis of forecasts for BFI in terms of reference for overall aviation industry trends and as a BFI forecast baseline. The FAA forecast data is developed from a high-level analysis of industry trends and projections, providing a top-down operational forecast for BFI generally using more aggregate forecast factors as compared with those identified as part of the MP Update.

**FAA Aerospace Forecasts (FY 2016-2036).** The FAA Aerospace Forecasts are aeronautical activity projections, by major industry sector, used to understand future demands on the national airport and airspace system. Each published forecast revisits previous aerospace forecasts and updates them after examining the previous year's trends in aviation and economic activity. Many factors are considered in the FAA's development of the forecasts. Some of the most important include U.S. and international economic forecasts and anticipated trends in fuel costs. The FAA Aerospace Forecasts are used for the BFI forecasts to assimilate nationwide industry patterns, comprehend the basis for the major forecast rationale and methodology, and to quantify growth patterns and rates of change relative to specific industry activity and utilization components. These FAA projections and rationale are important to BFI given the Airport's operational roles and diversity.

The projections found in the FAA Aerospace Forecast Fiscal Years 2016-2035 are summarized below:

- Between 2016 and 2036, worldwide real Gross Domestic Product (GDP) growth is assumed to grow at 2.9 percent annually, on average, while the U.S. real GDP is projected to grow at 2.4 percent annually. Real personal consumption expenditure per capita is also projected to grow at an annual rate of 1.7 percent over the same period.
- Over the long term, FAA sees a competitive and profitable overall airline aviation industry characterized by increasing demand for air travel and airfares growing more slowly than inflation, reflecting over the long term a growing U.S. economy.
- Growth in all-cargo revenue ton mile (RTM) is expected primarily from increased rates rather than increased tonnage.
- Domestic air cargo, quantified by revenue ton miles, is expected to increase approximately 0.5 to 1.0 percent annually over the next 20 years, with the strongest growth being international cargo movements, growing at 3.6 to 5.2 percent annually.
- The U.S. active general aviation aircraft fleet will grow from an estimated 203,880 aircraft in 2015 to 210,695 aircraft in 2036, equal to 0.2 percent annual growth.
- Active piston-powered fixed-wing aircraft are projected to decrease 0.7 percent annually. Active single-engine piston-powered aircraft are forecast to decline 0.7 percent annually, while active multi-engine piston-powered aircraft are projected to decline by 0.5 percent annually.
- Active turbine-powered fixed wing aircraft are expected to increase 2.0 percent annually. Turboprop aircraft are expected to increase 1.3 percent annually, while turbine aircraft are projected to increase 2.5 percent annually.
- Active rotorcraft are forecast to increase 2.2 percent annually, with piston-powered rotorcraft increasing 2.1 percent annually and turbine-powered rotorcraft increasing 2.5 percent.
- Active light sport aircraft (i.e., aircraft with weight, capacity, and performance restrictions) are projected to increase significantly by 4.5 percent annually.
- Anticipated general aviation aircraft operations will increase 0.3 percent annually through 2036. Hours flown by general aviation aircraft are expected to increase 1.2 percent annually.

**FAA Terminal Area Forecast (TAF).** The FAA Terminal Area Forecast (TAF) is the official forecast of aviation activity for airports in the National Plan of Integrated Airport Systems (NPIAS), which includes BFI. The TAF documents the year-by-year historical (1990 to 2015) and future (2016 to 2045) enplaned passenger, aircraft operational, and based aircraft activity levels, applying an unconstrained top-down forecast method prepared annually. The FAA TAF forecasts will be referenced and compared against the more analytical MP Update forecasts in the following individual forecast categories to demonstrate consistency with FAA forecast expectations. However, the following text summarizes a few highlights of the TAF projections for BFI:

- Passenger enplanements are forecast to increase 2.1 percent annually through 2035.
- Itinerant aircraft operations are expected to increase 0.7 percent annually.
- Local aircraft operations are projected to decrease 0.2 percent annually.
- Total aircraft operations are forecast to increase 0.5 percent annually.
- Total based aircraft are expected to increase 0.9 percent annually.

### **Local Factors Affecting Demand**

The following section includes local industry trends, socioeconomic conditions, community support and other factors that may have either upward or downward influences on the amount of aviation activity and utilization at BFI for the next 20 years. Discussions with Airport Staff and the Airport Working Group (AWG), as supported by activity records collected from BFI operators and tenants (FBO's, based aircraft owners, air traffic control), have been used to understand the Airport's general aviation preferences, aircraft utilization, and other factors that could reasonably influence the Airport's aviation activity projections.



The following data points support an understanding of the trends and conditions that impact the future growth or decline in each segment of the BFI aviation business activity:

**BFI Upward Activity Influences (+):**

- Commercial-class facility; runway dimension(s), pavement strength, lighting aids, approaches
- Central location within Seattle metropolitan area; close interstate access to Seattle downtown
- Serves growing metropolitan area: population, industry, and commerce
- On-Airport business growth; reflecting a net local economic expansion
- Diversity of aviation sectors and aircraft types (passenger service, cargo, corporate, charter, recreational/training, helicopter services)
- Full-service providers (FBO/SASO) for aircraft servicing and pilot/passenger amenities
- Aeronautical service provisions (air traffic control tower, customs)
- Community-based aeronautical services (medical, police, fire & rescue)
- Sustained and expected growing Boeing 737 production/delivery schedules
- Growth in alternative general aviation segments: sport and experimental aircraft
- Existing general aviation hangar wait list demand
- Reasonable rates and charges

**BFI Downward Activity Influences (-):**

- Limited expansion property/space for facilities and tenants
- Proximity and competition from surrounding public-use airports (SEA, RNT, PAE)
- Urban growth and environmental challenges
- Escalating operating costs and regulatory requirements
- Industry decline of the general aviation piston fleet and aircraft utilization

## Forecast Methodologies

A wide variety of forecasting techniques have been developed to address aviation activity and overall demand. A technique's effectiveness depends on the availability and accuracy of the data. The three most common methodologies are briefly described below.

**Regression Analysis.** In a regression analysis forecast, the value being estimated or forecast (called the dependent variable) is related to other variables (called the independent or explanatory variables, which help "explain" the estimated value). A correlation coefficient is calculated for each pairing of dependent to independent variables to quantify this link. One major advantage of regression analysis is that if the independent variables are more readily projected than the forecasts or dependent available, then deriving a forecast is relatively easy.

**Market Share Analysis.** A market share analysis is a relatively easy method to use and can be applied to any measure for which a reliable higher-level (i.e. larger aggregate) forecast is available. Historical shares are calculated and used as a basis for projecting future shares. This approach is a "top-down" method of forecasting, since forecasts of larger aggregates (e.g., national aviation forecasts) are used to derive forecasts for smaller areas (e.g., individual airport aviation forecasts).

**Trend Analysis.** Trend analysis relies on projecting historic trends into the future. In trend analysis, a regression equation is used, with time as the independent variable. It is one of the fundamental techniques used to analyze and forecast aviation activity. While it is frequently used as a back-up or expedient technique, it is highly valuable because it is simple to apply. Sometimes trend analysis can be used as a reasonable method of projecting variables that would be complicated to project by other means.

### Correlation Analysis

Correlation analysis, which is part of the regression analysis methodology, ignores units and orders of magnitude, and instead measure how closely different variables change in proportion to one another using percentages. Correlation can be negative, indicating that as one index grows, the other declines. Correlation is measured by the correlation coefficient, which ranges from -1 to +1. A score close to +/-1 suggest stronger positive/negative correlation, and a score closer to zero suggests that the two variables are not correlated.

While correlation shows potential interrelatedness between variables, it cannot be the sole factor to determine that growth of one variable is caused by the other. Often there are unrelated factors and additional variables that impact the growth in both variables. An example is a 10 percent growth in the sale of luxury goods correlating to the 10 percent growth in travel by private aircraft in a community. Purchasing luxury goods does not directly cause people to fly by private aircraft, nor vice versa – but a strong correlation suggests that a third factor may be causing both variables to grow (such as local growth in an industry with high paying jobs). Correlation analysis usually does not fully explain why variables behave the way they do, but does help suggest a connection, or lack thereof, between variables and may be subject to the same market forces. Correlation is augmented by professional judgement that helps explain the correlation. Factors evaluated in the correlation analysis and analysis results for BFI are shown in **Table B10**.

Table B10 BFI CORRELATION ANALYSIS

Year	BFI Activity					Seattle MSA						Price of Crude Oil (\$/Bbl)	Price of Jet Fuel (\$/gal)	FAA Aerospace Forecasts														General Aviation Airplane Shipments by Type Manufactured Worldwide (GAMA)									
	Enplanements	Commercial Service Operations	General Aviation Operations	Based Aircraft	Air Cargo (in Pounds)	Popula- tion (in Thous- ands)	Personal Income (in Thous- ands \$)	Earnings (in Thous- ands \$)	Retail Sales (in Thous- ands \$)	GRP (in Thous- ands \$)	Employ- ment (in Thous- ands)			Active General Aviation Fleet				Air Carrier Operations (in Thousands)	Air Taxi Operations (in Thousands)	GA Local Operations (in Thousands)	GA Itinerant Operations (in Thousands)	Total GA Operations (in Thousands)	Air Carrier Domestic Enplane- ments (in Thous- ands)	Regional Domestic Enplane- ments (in Thous- ands)	Total Enplane- ments (in Thous- ands)	Active Pilots											
														SEP	MEP	Jet	Total																				
2006	31,418	10,427	225,395	491	222,380,000	3,248	154,851	126,547	58,505	213,454	2,108	66.05	1.92							18,707	17,034	39,878				2,513	242	2,755	412	887	1,299	4,054					
2007	34,580	9,824	222,864	490	245,196,000	3,298	157,552	128,212	58,860	218,204	2,118	72.34	2.13	147,569	19,337	19,899	231,606	13,611	11,667,263	14,556	18,575	33,131	688,525	156,254	844,779	590,349	2,417	258	2,675	465	1,137	1,602	4,277				
2008	34,597	10,568	218,937	438	237,994,000	3,348	160,254	129,877	59,214	222,953	2,128	99.67	2.96	145,497	17,515	19,949	228,664	13,780	11,032,059	14,081	17,492	31,573	680,727	159,085	839,813	613,746	1,943	176	2,119	538	1,317	1,855	3,974				
2009	35,863	12,181	186,636	463	214,736,000	3,398	162,955	131,542	59,569	227,703	2,138	61.95	1.66	140,649	16,474	20,323	223,876	12,836	9,520,791	12,447	15,571	28,019	630,784	154,023	784,807	594,285	893	70	963	446	874	1,320	2,283				
2010	33,656	10,754	179,703	470	234,960,000	3,448	165,657	133,207	59,924	232,453	2,148	79.48	2.15	139,519	15,900	20,853	223,370	12,657	9,410,381	11,716	14,863	26,580	634,811	161,711	796,522	627,588	781	108	889	368	767	1,135	2,024				
2011	34,434	9,820	155,734	427	230,694,000	3,497	172,427	136,709	63,244	234,434	2,184	94.88	3.00	136,895	15,702	21,173	220,453	12,865	9,278,542	11,437	14,527	25,964	650,094	161,692	811,786	617,128	761	137	898	526	696	1,222	2,120				
2012	23,078	5,666	143,518	427	339,860,424	3,552	182,850	143,253	65,827	245,797	2,229	94.05	3.06	128,847	14,313	22,097	209,034	12,872	8,994,371	11,608	14,521	26,129	653,787	159,019	812,807	610,576	817	91	908	584	672	1,256	2,164				
2013	13,008	3,280	138,817	418	224,617,370	3,610	185,631	148,006	68,211	254,136	2,308	97.98	2.92	124,398	13,257	21,256	199,927	12,775	8,803,412	11,688	14,117	25,805	653,504	155,490	808,994	599,086	908	122	1,030	645	678	1,323	2,353				
2014	20,418	5,874	135,250	396	241,744,133	3,652	189,939	151,550	70,251	260,387	2,348	93.17	2.69	126,036	13,146	22,139	204,408	13,014	8,439,713	11,675	13,978	25,654	668,953	154,121	823,074	593,499	986	143	1,129	603	722	1,325	2,454				
2015	18,945	4,548	129,292	380	268,740,642	3,696	194,655	155,238	71,768	266,908	2,389	48.66	1.52	125,050	13,085	22,045	203,880	13,755	7,895,017	11,691	13,886	25,578	696,430	153,009	849,440	590,039	946	110	1,056	557	718	1,275	2,331				
Correlation																																					
Enplanements						(0.80)	(0.86)	(0.87)	(0.88)	(0.85)	(0.88)	(0.13)	(0.19)	0.92	0.85	(0.74)	0.96	0.08	0.69	0.37	0.65	0.45	(0.23)	0.49	(0.17)	0.38	0.38	0.29	0.37	(0.78)	0.58	0.27	0.38				
Commercial Service Operations						(0.82)	(0.89)	(0.89)	(0.90)	(0.85)	(0.88)	(0.17)	(0.27)	0.89	0.80	(0.76)	0.92	(0.01)	0.64	0.43	0.62	0.50	(0.34)	0.41	(0.30)	0.36	0.37	0.26	0.37	(0.82)	0.55	0.22	0.36				
General Aviation Operations						(0.97)	(0.96)	(0.93)	(0.91)	(0.94)	(0.88)	(0.14)	(0.22)	0.96	0.96	(0.94)	0.93	0.37	0.96	0.79	0.95	0.85	0.08	0.26	0.13	0.14	0.84	0.70	0.83	(0.67)	0.82	0.57	0.83				
Based Aircraft						(0.92)	(0.92)	(0.92)	(0.92)	(0.92)	(0.91)	(0.17)	(0.26)	0.84	0.86	(0.80)	0.83	(0.13)	0.79	0.66	0.76	0.72	(0.33)	0.37	(0.29)	0.24	0.62	0.53	0.61	(0.79)	0.47	0.15	0.55				
Air Cargo						0.35	0.43	0.37	0.36	0.35	0.29	0.12	0.28	(0.33)	(0.25)	0.54	(0.30)	0.08	(0.21)	(0.29)	(0.24)	(0.29)	0.21	0.09	0.23	0.06	(0.23)	(0.25)	(0.23)	0.35	(0.25)	(0.11)	(0.22)				
														Correlation Scale																							
														Strong Negative			Weak Negative			None			Weak Positive			Strong Positive											
														(1.0)			(0.5)			0.0			0.5			1.0											

Given these variables, it is evident that most of the aviation activity measures show strongest positive correlation with variables that are declining, and strongest negative correlation with variables that are growing. Positive correlation means that when one increases, the other does the same; negative correlation means that when one increases, the other decreases. The correlation analysis shows the following observations:

- BFI's enplanements, commercial service operations, general aviation operations, and based aircraft have the strongest positive correlations with the active general aviation aircraft fleet as reported in the FAA's Aerospace Forecasts. The strongest negative correlations are with the Seattle MSA socioeconomic indicators.
- BFI's general aviation operations are also strongly correlated with air taxi and general aviation itinerant operations as reported in the FAA's Aerospace Forecasts.
- BFI's air cargo activity does not have a strong correlation to any variable, but the strongest correlation is with the jet segment of the active general aviation aircraft fleet as reported by the FAA's Aerospace Forecasts.

The local conditions prevalent at BFI are reflective of the nationwide decline in overall general aviation activity, especially in the piston-powered segment of general aviation industry. Declining usage and ownership of piston-powered general aviation aircraft has been occurring for more than a decade. However, usage and ownership of turbine-powered aircraft, both locally and nationally, has been increasing and is expected to continue in the future.

## **Commercial Passenger Enplanement & Operations Forecast**

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### **Commercial Passenger Enplanement Forecast**

Forecasts of passenger enplanements serve as the foundation for other commercial service activity forecasts and provide a basis for determining future requirements for facilities integral to the accommodation of passengers. Typically in an airport master plan, forecasts can be produced from historical trends, which have traditionally correlated with socioeconomic data. However, as previously stated, BFI's historical passenger enplanements do not have a strong link with the Seattle MSA econometric data. Therefore, regression analysis linked directly to any econometric data is not a viable methodology due to low predictive reliability for BFI.

**Table B11** provides the historical (2000-2015) enplanements at BFI compared to those for the Puget Sound Region, the State of Washington, and the United States, and presents the respective market share of BFI compared to each region. The analysis indicates a fluctuation in BFI's market share, with no discernable trend that can be used for forecasting. Therefore, market share analysis is also not a viable methodology due to low predictive reliability.

Table B11 BFI MARKET SHARE OF PASSENGER ENPLANEMENTS COMPARISON (2000 TO 2015)

Year	BFI	Puget Sound Region	BFI Market Share	State of Washington	BFI Market Share	United States	BFI Market Share
2000	10,582	13,864,138	0.03%	15,996,284	0.027%	704,829,175	0.0006%
2001	10,555	13,988,927	0.06%	16,037,423	0.049%	693,147,977	0.0011%
2002	10,069	12,763,385	0.06%	14,600,550	0.050%	627,651,686	0.0012%
2003	16,220	12,991,451	0.11%	14,859,971	0.096%	643,224,641	0.0022%
2004	28,458	13,939,193	0.21%	15,898,945	0.185%	690,967,734	0.0043%
2005	23,016	14,277,318	0.15%	16,374,531	0.130%	733,403,888	0.0029%
2006	31,418	14,635,150	0.20%	16,778,067	0.176%	732,886,054	0.0040%
2007	34,580	15,152,852	0.18%	17,481,569	0.157%	756,525,464	0.0036%
2008	34,597	16,010,231	0.22%	18,497,508	0.188%	747,466,798	0.0047%
2009	35,863	15,273,875	0.21%	17,530,971	0.183%	695,488,533	0.0046%
2010	33,656	15,252,100	0.21%	17,658,548	0.179%	702,818,621	0.0045%
2011	34,434	15,902,517	0.21%	18,432,030	0.180%	722,926,202	0.0046%
2012	23,078	16,105,083	0.14%	18,664,260	0.120%	731,053,513	0.0031%
2013	13,008	16,555,367	0.09%	19,093,409	0.074%	734,336,521	0.0019%
2014	20,418	17,432,905	0.11%	19,953,576	0.095%	753,529,877	0.0025%
2015	18,945	19,657,736	0.13%	22,178,136	0.114%	786,389,033	0.0032%
Average Market Share			0.14%		0.125%		0.0031%

SOURCE: FAA TAF (2015 to 2035) and BFI Airport records.

Although BFI's average daily scheduled flights have decreased since 2004, the average scheduled daily enplanements-per-departure have remained consistent. Per the BFI Airport Strategic Plan 2014-2020 study, "while modest growth in passenger demand and operations can be expected at BFI, the passenger market is not expected to exceed the capacity of the existing terminal complex and will remain in the nine-seat commuter aircraft category". The existing scheduled airline (Kenmore Air) is expected to provide the similar level of niche service activities into the future, including destinations, aircraft equipment, flight frequencies, and passenger processing levels. Below is a summary of the key 2015 activity indicators for the commercial service passenger operations at BFI.

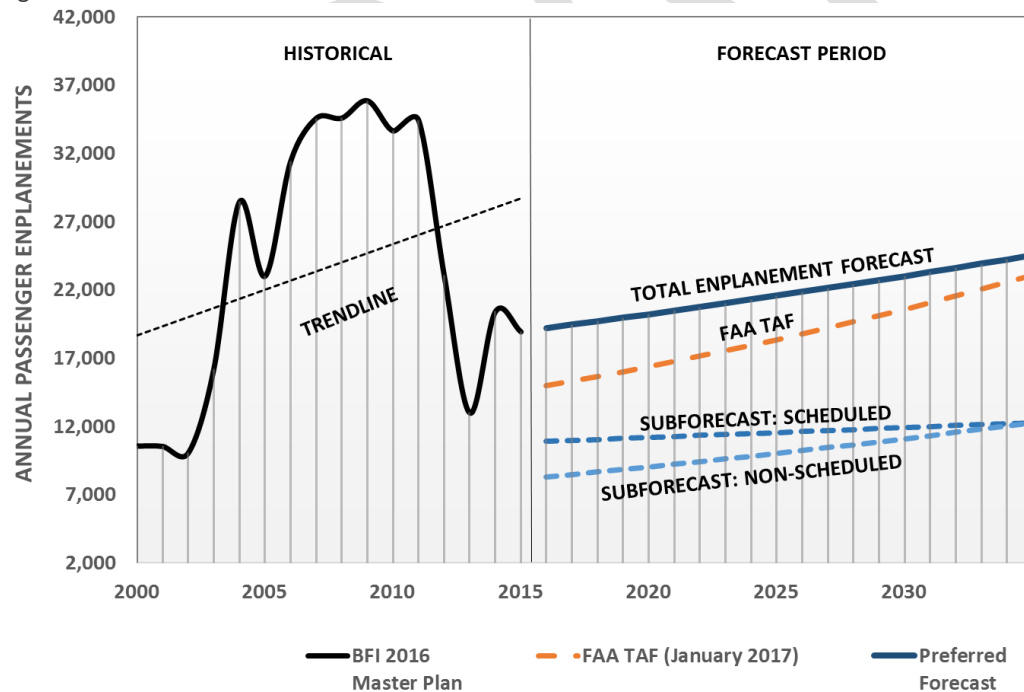
**Preferred Passenger Enplanement Forecast.** The preferred MP Update enplanement forecast was developed using percent trend analysis. This forecast technique extrapolates the total passengers, including those conducted by 'scheduled' and 'non-scheduled' operators, using the historical BFI annual enplaned passenger growth rate of 1.3 percent, as experienced from 2003 to 2015. During this trend period, total annual BFI enplanements increased nearly 2,725 passengers, from 16,220 to 18,945, averaging 227 additional passengers each year. The preferred MP Update forecast projects 24,541 enplanements by 2035, a total increase of 5,596, or an average of 280 additional passengers per year. The forecast of 'scheduled' (air carrier) and 'non-scheduled' (on-demand air taxi) passengers was projected using the 2015 proportion of 'scheduled' (53 percent) and 'non-scheduled' (47 percent) passengers. This ratio was graduated to a 50 percent and 50 percent proportion over the 20-year forecast period, indicative of the BFI shifting five-year trend towards 'non-scheduled' passengers, and more frequent 'non-scheduled' flights represented by a mix of air carrier charter operators, Justice Prisoner and Alien Transportation System (JPATS) flights, and occasional diverted flights from SEA.

The 'scheduled' air carrier service and activity levels are forecast to remain similar to past BFI trends experienced from 2005 to 2015, in terms of flight frequency and passenger load factor, which ranged between 40 percent and 65 percent, and averaged 55 percent.

**Figure B9** graphs total enplanements from 2000 to 2035, including the preferred MP Update forecast in comparison with the FAA TAF enplanement forecast. The MP Update forecast includes the sub-forecasts for 'scheduled' and 'non-scheduled' passengers, and the FAA TAF forecast includes the total of the reported 'air carrier' and 'commuter' passengers combined. The BFI forecast passenger growth is projected to track at a level and rate comparable to the FAA TAF, in which the MP Update forecasts increases nearly 5,584 passengers at 1.3 percent annually, and the FAA TAF increases 7,844 passengers at 2.1 percent annually. As depicted, the sub-forecast levels of 'scheduled' and 'non-scheduled' passengers are expected to continue growth consistent with BFI historical levels and percent of total BFI passengers.

**Table B12** summarizes the preferred MP Update and FAA TAF total enplanement forecasts, including 20-year forecast changes and compound annual growth rates (CAGR). The MP Update forecast results in enplaned passengers increasing from 18,945 in 2015 to 24,541 in 2035, while the FAA TAF forecasts increase from 15,236 in 2015 to 23,080 by 2035. In addition, both the 2035 MP Update forecast and the FAA TAF projections reach similar BFI passenger levels that are consistent with the historic average annual enplanement totals that have been recorded at the Airport between years 2000 and 2015.

Figure B9 BFI PASSENGER ENPLANEMENT ACTIVITY TRENDS AND FORECAST SCENARIO



**SOURCE:** Historical: FAA T-100, USDOT BTS Website (March 2016).

Forecast: FAA TAF (2015 to 2035) | Consultant Forecast (2015 to 2035) March 2016.

Table B12 BFI PASSENGER ENPLANEMENTS (2000 TO 2035)

Year <sup>1</sup>	FAA TAF	MP Update Forecast (Passenger Enplanements)		
		Scheduled	Non-Scheduled	Total
2000	4,343	--	--	10,582
2001	7,776	--	--	10,555
2002	7,273	2,003	8,066	10,069
2003	14,210	11,121	5,099	16,220
2004	29,447	19,321	9,137	28,458
2005	21,294	15,277	7,739	23,016
2006	29,439	26,271	5,147	31,418
2007	27,352	26,380	8,200	34,580
2008	34,838	26,638	7,959	34,597
2009	32,023	28,141	7,722	35,863
2010	31,571	26,238	7,418	33,656
2011	33,110	22,501	11,933	34,434
2012	22,357	13,679	9,399	23,078
2013	14,147	12,119	889	13,008
2014	18,851	12,410	8,008	20,418
2015	15,236 <sup>1</sup>	10,817	8,128	18,945 <sup>2</sup>
2020	16,373 <sup>1</sup>	11,181	9,030	20,211 <sup>2</sup>
2025	18,340 <sup>1</sup>	11,546	10,016	21,562 <sup>2</sup>
2030	20,565 <sup>1</sup>	11,910	11,094	23,004 <sup>2</sup>
2035	23,080 <sup>1</sup>	12,270	12,271	24,541 <sup>2</sup>
% CAGR	2.1%	---	---	1.3%

**SOURCE:** Historical: FAA TAF (2000 to 2015) – Fiscal Year (FY) data, Calendar Year (CY) data from FAA T-100, USDOT BTS Website & FAA ACAIS (2000 to 2015).

Forecast: <sup>1</sup> FAA TAF (2015 to 2035) – Fiscal Year (FY) data (April 2017).

<sup>2</sup> Consultant Forecast (2015 to 2035) April, 2017 - CY data with ACAIS totals for 2015.

### Commercial Passenger Aircraft Forecast

**Table B13** summarizes the forecast of BFI commercial passenger transport aircraft operations, as conducted by ‘scheduled’ and ‘non-scheduled’ air carrier operators. During the 20-year forecast period, total commercial activity is projected to increase from 3,646 operations in 2015 to 5,178 operations by 2035, a 1.8 percent annual growth. Consistent with commercial passenger forecast, the proportion of commercial aircraft activity is projected to shift from ‘scheduled’ (49.9 percent in 2015) more towards ‘non-scheduled’ (50.1 percent in 2015). The ‘scheduled’ aircraft operations are forecast to increase at 1.3 percent annually, reflective of the BFI forecast passenger demand levels. Scheduled air service is expected to expand in a similar manner and capacity as existing scheduled air carrier enplanements, in terms of flight destinations, route schedule, aircraft equipment, and passenger load factors. The ‘non-scheduled’ aircraft operations are forecast to increase at 2.2 percent annually, which reflects the BFI ‘non-scheduled’ passenger enplanement growth (2.1 percent), is consistent with the BFI FAA TAF forecast of commercial aircraft operations (1.8 percent), as well as consistent with the *FAA Aerospace Forecast* industry-wide aircraft turbine (turboprop and jet) fleet and utilization growth forecasts of the air-taxi sector (2.2 percent).



This growth rate is reasonable provided the commercial on-demand fixed wing and helicopter air service operators established at BFI, and the specialized commercial on-demand tourism and seasonal travel charters conducted at BFI (sports teams, low-cost carrier charters, special civic events).

Table B13 COMMERCIAL PASSENGER SERVICE OPERATIONS PROJECTIONS

Year	Scheduled Air Carrier Passenger Operations	Percent Scheduled (Commuter)	Non-Scheduled Air Carrier Passenger Operations	Percent Non-Scheduled (Air Carrier)	Total Air Passenger Aircraft Operations
2015 (Actual)	1,821	49.9%	1,825	50.1%	3,646
2020	1,882	47.3%	2,095	52.7%	3,977
2025	1,982	45.7%	2,359	54.3%	4,341
2030	2,010	42.4%	2,730	57.6%	4,740
2035	2,100	40.6%	3,078	59.4%	5,178
CAGR 2015-2035	0.7%	--	2.6%	--	1.8%

SOURCE: Base Year: Airport Records.

Forecast: Consultant Forecast (2016 to 2035), Conducted March 2016.

### Air Cargo Weight & Operations Forecast

Total air cargo volumes in the U.S. have declined over the last 10 years by a CAGR of 1.4 percent. This is a result of industry changes and consolidation related to increased jet fuel costs, declines coinciding with the global recession, increased security regulations, market saturation, and improved ground transport efficiency. The U.S. air cargo industry is not expected to return to the high growth rates experienced in previous decades and it is clear the market for air cargo has changed.

However, as noted previously, BFI's proximity to the Seattle Central Business District makes it a desirable location for the integrated express air cargo operations (e.g., provided by UPS) that dominate the air cargo activity at the Airport. This type of air cargo operation utilizes the hub-and-spoke transport model that is employed by passenger airlines, with regional carriers such as Ameriflight operating smaller turboprop aircraft that in turn feed the larger air carrier aircraft operated by UPS. Based upon this operational model, the BFI domestic air cargo activity has generally continued to increase since 2005, as quantified in terms of enplaned/deplaned pounds and aircraft landing weights, growing at CAGRs of 1.8 percent and -0.2 percent respectively.

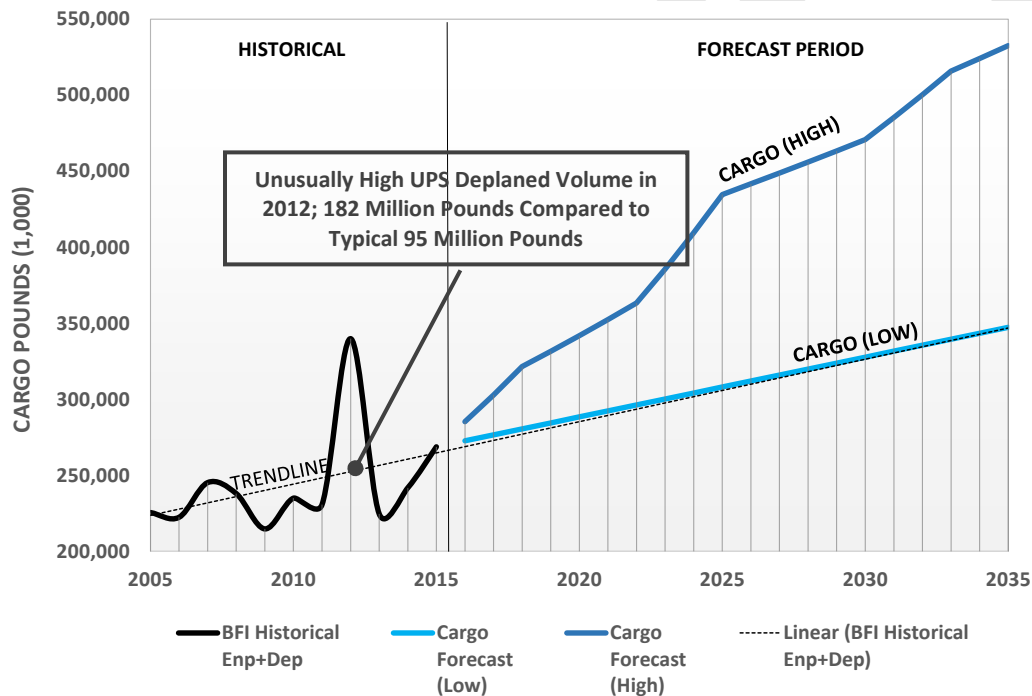
Therefore, two potential growth rate scenarios for the volume of air freight/mail at BFI have been projected for this analysis. The first includes a "Low" growth scenario with a CAGR of 1.3 percent that is calculated using the past 10 year net increase versus decrease of total enplaned plus deplaned volumes (essentially a trend analysis), generating an average annual increase of 3.9 million pounds. This growth rate reflects the maturity of the air cargo market, the steady/consistent historic cargo growth that has occurred at BFI, and the anticipated slower growth by the FAA in terms of revenue ton miles (estimated between 0.5 percent and 1.0 percent CAGR).



The second scenario reflects a “High” growth scenario with a CAGR of 3.5 percent that projects a more aggressive rate of growth that could be supported by the continued growth of e-commerce, and result in the potential introduction of a new, or expanded air cargo operation at the Airport (e.g., the start-up of Amazon Prime Air Cargo operations). Each of these scenarios are presented in **Table B14** and **Figure B10** reflect total air cargo at the Airport for the Low and High scenarios, ranging from 173,671 tons to 266,299 tons by 2035.

Given the existing conditions driving air cargo activity at BFI (e.g., existing carriers, type of operation, and potential site development expansion limitations), the Low growth rate scenario has been selected as the preferred forecast. However, opportunities to accommodate future expansion of cargo development at the Airport will be investigated in the alternatives chapter of this Study. In addition, this selected Low rate of growth is conservative compared to Airbus’ *Global Market Forecast for 2016-2035* and Boeing’s *World Air Cargo Forecast 2016-2017*, which predict U.S. air cargo to grow at a CAGR of 1.6 percent and 2.2 percent respectively through their 20 year forecasts.

Figure B10 BFI ENPLANED AND DEPLANED AIR CARGO TOTALS AND FORECAST SCENARIO(S)



SOURCE: FAA T-100 Cargo Data; USDOT BTS Website (Obtained March 2016).

Table B14 BFI CARGO FORECAST SUMMARY (2000 TO 2035)

Year	Historic Total Cargo Tons	Total Cargo Tons (Low)	Total Cargo Tons (High)
2000	N/A	---	---
2001	N/A	---	---
2002	N/A	---	---
2003	N/A	---	---
2004	N/A	---	---
2005	112,755	---	---
2006	111,190	---	---
2007	122,598	---	---
2008	118,997	---	---
2009	107,368	---	---
2010	117,480	---	---
2011	115,347	---	---
2012	169,930	---	---
2013	112,309	---	---
2014	120,872	---	---
2015	134,371	---	---
2020		144,196	170,888
2025		154,021	217,331
2030		163,846	235,366
2035		173,671	266,299
% CAGR	1.8%	1.3%	3.5%

**SOURCE:** Historical: FAA T-100 Cargo Data, USDOT BTS Website (March 2016).

Forecast: Consultant Forecast (2016 to 2035), Conducted March 2016.

**Table B15** displays that BFI aircraft cargo operations totaled 12,336 operations in 2015, as indicated by aircraft type. Traffic consists evenly of transport versus non-transport aircraft operations, in which nearly 75 percent of operations are conducted with widebody planes (B-767, MD-11, A-300), and 25 percent narrow body planes (e.g., B-737, B-757). The operations forecast is projected at an annual rate 1.0 percent that would support the other BFI air cargo activity components (enplaned/deplaned pounds, aircraft landing weights, revenue-ton-miles). Also, it is anticipated the BFI air cargo aircraft fleet and operations will remain fairly constant throughout the forecast period, including types of carriers, freight and mail delivery logistics, aircraft fleet composition, and domestic and international routes. During the 20-year forecast period, total air cargo aircraft operations are projected to increase from 12,336 to 15,052, reflecting a 1.0 percent annual growth.

Table B15 AIR CARGO CARRIER OPERATIONS PROJECTIONS

Year	Transport Aircraft	Narrowbody Transport Aircraft	Widebody Transport Aircraft	Non-Transport Aircraft	Total Air Cargo Aircraft Operations
2015 (Actual)	5,852	1,556	4,296	6,484	12,336
2015 (Actual %)	47.4%	26.6%	73.4%	52.6%	--
2020	6,150	1,635	4,515	6,815	12,965
2025	6,464	1,719	4,746	7,163	13,627
2030	6,794	1,807	4,988	7,528	14,322
2035	7,140	1,899	5,242	7,912	15,052
<b>CAGR 2015-2035</b>	<b>1.0%</b>	<b>--</b>	<b>--</b>	<b>1.0%</b>	<b>1.0%</b>

**SOURCE:** Base Year: Airport Records Forecast: Consultant Forecast (2016 to 2035), Conducted March 2016.

### General Aviation Operations Forecast

A comprehensive forecast requires an understanding of general aviation activity and involves an assessment of general aviation operations by major user component, which includes Air Taxi, Business/Corporate, and Recreational/Training. These general aviation components are individually characterized and influenced by differing user and industry operator factors. These operator factors are analyzed by segment in order to develop a more comprehensive projection of future general aviation activity levels for this diverse user segment at BFI. These factors are considered and incorporated into the development of the general aviation operation projections. The results of the forecasting effort for the general aviation categories are discussed below and are presented in **Table B16**.

- General Aviation – Air Taxi.** Air taxi operations are classified as any company or individual providing air passenger transportation service on a nonscheduled basis and over unspecified routes utilizing general aviation-type aircraft, such as the Piper Navajo. In response to the increasing Seattle passenger market volume and available air transportation services, this segment of general aviation activity is forecast to increase by 1.4 percent throughout the forecast period. The proximity of BFI to the Seattle business and entertainment districts, technical corridor, and the San Juan Islands reinforces the growth potential for air taxi services.
- General Aviation – Business/Corporate.** The business/corporate segment is commonly characterized by complex turbine-powered aircraft (i.e., larger turboprop and business jet aircraft), operated by individuals or corporations for executive purposes. On a national level, this segment is expected to grow as gauged by the aircraft production and hourly utilization. For example, the FAA Aerospace Forecasts indicates that active turbine-powered general aviation aircraft (both fixed wing and rotorcraft) is expected to increase 2.1 percent annually through 2036, and hours flown is expected to increase by 2.6 percent. The trends at BFI are expected to reflect national trends which is supported by higher facility and activity utilization, the increasing number of based business/corporate aircraft and facility assets, diversity of aircraft types, pilot operator services, and corporate flight departments located on the Airport.

Aircraft with the largest projected growth are turbine aircraft, including both fixed wing and helicopter operators. This growth is supported by the continued increase of corporate aircraft acquisition, higher aircraft utilization resulting from stronger national economic conditions, and the continued expansion of the fractional ownership program. The business/corporate segment of total operations should demonstrate an operations increase from 26,404 in 2015 to 46,418 in 2035, representing a 2.9 percent CAGR.

- General Aviation – Recreational/Training.** The recreational/training segment is typified by small single and multi-engine piston-powered aircraft and continues to undergo transition at both the local and national levels. At the national level, the piston-powered aircraft fleet is experiencing continued attrition and retirement of older aircraft, coupled with the declining production of new aircraft. The FAA Aerospace Forecasts project continued declines in the piston-powered active aircraft fleet (i.e., -0.6 percent CAGR through 2036), and hourly utilization rates (i.e., -0.3 percent CAGR). The General Aviation Manufacturers Association (GAMA) indicates the production of new piston-powered aircraft declined by 61.7 percent from 2006 to 2015, a CAGR of -10.1 percent. At the local level, recreational/training aircraft operations have been on the decline at BFI for over a decade, with contributing factors including decreased pilot training, aging aircraft, increased operating/storage costs, and limited/decreased storage options. By 2025, it is expected the BFI activity declines experienced during the past ten years would “bottom out” and start to stabilize and rebound, as the result of a more established pilot population, infusion of economical aircraft technologies, and industry-wide adaption to operating costs and evolving aircraft/airmen regulatory requirements. However, the rebound by 2035 of 68,755 operations is still well below the 2015 operations of 96,876, reflecting a CAGR of -1.7 percent.
- Total General Aviation.** As presented in **Table B18**, the total operations by general aviation aircraft is expected to decrease by 1,744 operations, representing a CAGR of -0.06 percent throughout the forecast period. This is reflective of the larger numerical decrease associated with recreational/training activity compared to the smaller increases numerically by air taxi and business/corporate activity.

Table B16 GENERAL AVIATION AIRCRAFT OPERATIONS PROJECTIONS

Year	Total General Aviation	General Aviation – Air Taxi	General Aviation – Business/Corporate	General Aviation – Recreational/Training
2015 (Actual)	143,783	20,503	26,404	96,876
2020	135,430	21,937	30,403	83,090
2025	127,151	23,470	35,009	68,672
2030	134,394	25,110	40,312	68,972
2035	142,039	26,866	46,418	68,755
CAGR	-0.1%	1.4%	2.9%	-1.7%

SOURCE: Forecast: Consultant Forecast (2015 to 2035), Conducted March 2016.

### Military Aircraft Operations Forecast

Military operations over the last 15 years have comprised an average of less than one percent of total aircraft operations at the Airport, with actual activity decreasing by approximately 23 percent. Typically, military operations levels are driven more by state and federal policy than by local decisions. It is likely that military operations will fluctuate in response to changing Department of Defense (DOD) funding, and operations related to Boeing's existing Military Flight Center and Test Facility at BFI, but no significant increase or decrease in flight operations are expected at the Airport throughout the forecast period. Current activity is related to testing and maintenance on the Boeing P-8 Poseidon, Boeing E-3 Sentry (AWACS), and the new Boeing KC-46 Pegasus (a widebody, multi-role tanker aircraft). **Table B17** presents the military aircraft operations forecast.

Table B17 MILITARY AIRCRAFT OPERATIONS PROJECTIONS

Year	Itinerant Military	Local Military	Total Military Operations
2015 (Actual)	965	643	1,608
2020	1,002	668	1,669
2025	1,040	693	1,733
2030	1,079	719	1,799
2035	1,120	747	1,867
<b>CAGR</b>	<b>0.8%</b>	<b>0.8%</b>	<b>0.8%</b>

**SOURCE:** Forecast: Consultant Forecast (2015 to 2035), Conducted March 2016.

### Aircraft Operations Forecast

Aircraft operations, defined as either a takeoff or a landing, is a forecast component to determine the year-by-year total number of annual operations, as broken down by user category, aircraft type, and other operational parameters. In 2015, a total of 165,571 operations occurred at the Airport. **Table B18** lists a summary of the key 2015 operational mix parameters.

Table B18 BFI OPERATIONAL MIX PARAMETERS – 2015

Operational Mix	Total	Percent Share
Air Carrier	3,646	(2.2%)
Air Taxi	37,037	(22.4%)
General Aviation	123,280	(74.5%)
Military	1,608	(0.9%)
Itinerant Traffic	129,648	(78.3%)
Local Traffic	35,923	(21.7%)
VFR Traffic	107,483	(65.0%)
IFR Traffic	58,088	(35.0%)
Business	85,302	(51.5%)
Recreational/Training	80,269	(48.5%)
<b>Total Operations:</b>	<b>165,571</b>	

### Forecast of Aircraft Operating Mix – Aircraft Types

The following lists the aircraft operational mix, by major user group, as estimated for in 2007 and 2015. For comparative purposes, 2007 was the last available year with a full assessment of the BFI operational fleet mix, as conducted for the 2008 *BFI Aviation Forecast Update Report*. Similarly, as done in 2007, the 2015 fleet mix was generated from the bottom-up, compiled from Airport/ATCT operational records and FAA published information. The 2015 aircraft mix is also reflective of recent-past BFI trends, including key user/tenant activities, based aircraft types, and fuel sale records. **Table B19** shows a breakdown of BFI aircraft types.

Table B19 BFI AIRCRAFT TYPES – 2007 VS. 2015

Aircraft Type	2007	2015
Piston	64%	62%
Turboprop	10%	14%
Business Jet	14%	10%
Transport Jet	4%	8%
Helicopter	8%	6%

**Table B20** is the forecast of total annual operations broken-down by major user category, including the percent annual growth rate over the 20-year forecast period.

Table B20 FORECAST OPERATIONS MIX – USER CATEGORY

Year	Airline	Air Cargo	Boeing	General Aviation (Air Taxi)	General Aviation (Bus/Rec)	Military	TOTAL
2015	3,646	12,336	4,198	20,503	123,280	1,608	165,571
2020	3,977	12,965	5,197	21,937	113,493	1,669	159,239
2025	4,341	13,627	6,297	23,470	103,681	1,733	153,148
2030	4,740	14,322	6,553	25,110	109,284	1,799	161,807
2035	5,178	15,052	6,819	26,866	115,173	1,867	170,956
% CAGR	1.8%	1.0%	2.5%	1.4%	-0.3%	0.8%	0.2%

**SOURCE:** Forecast: Consultant Forecast (2016 to 2035), Conducted March 2016.

**Note:** TAF projections of commercial operations include air cargo operations and some general aviation air taxi operations. The airport forecasts include only operations on commercial service airlines. For this MP Update, air cargo operations have been developed separately and air taxi operation have been included in general aviation operations projections.

**Table B21** is the forecast of total annual operations broken-down by major aircraft type, including the percent annual growth rate over the 20-year forecast period. In the future, a further increase of BFI transport aircraft utilization is expected, attributed mainly to air cargo operators, more frequent on-demand passenger service, and Boeing aircraft production/delivery schedules. Also, there is expected to be a further concentration of based corporate and specialized high-end general aviation service tenants.

Historical BFI piston and turboprop general aviation fleet mix trends are expected to continue, largely coincident with the nationwide piston/turboprop aircraft manufacturing and utilization rates. Otherwise, economic and regulatory factors are assumed to induce a cyclical pattern to this overall BFI activity pattern.

Table B21 FORECAST OPERATIONS MIX – AIRCRAFT TYPE

Year	Piston	Turboprop	Business Jet	Transport Jet	Helicopter	Total
2015	102,480	22,459	16,425	13,483	10,725	165,571
2020	88,177	24,412	19,570	14,668	12,412	159,239
2025	72,974	26,534	23,318	15,958	14,364	153,148
2030	71,198	28,842	27,783	17,361	16,623	161,807
2035	68,377	31,350	33,104	18,888	19,237	170,956
% CAGR	-2.0%	1.7%	3.6%	1.7%	3.0%	0.2%

SOURCE: Forecast: Consultant Forecast (2016 to 2035), Conducted March 2016.

Table B22 is the forecast of forecast of total operations conducted as itinerant and local, and actual instrument (IFR) and visual (VFR) conditions. Itinerant and VFR operations will continue to be the dominant aircraft activity at BFI. It is expected the Airport will maintain a similar operational profile throughout the planning period.

Table B22 FORECAST OPERATIONS MIX – OPERATION TYPE

Year	Total Itinerant Operations	Total Local Operations	Total IFR	Total VFR
2015	125,648 (78%)	35,923 (22%)	58,088 (35%)	107,483 (65%)
2020	124,206 (78%)	35,033 (22%)	55,866 (35%)	103,372 (65%)
2025	119,455 (78%)	33,693 (22%)	53,730 (35%)	99,419 (65%)
2030	126,209 (78%)	35,598 (22%)	56,768 (35%)	105,040 (65%)
2035	133,346 (78%)	37,610 (22%)	59,977 (35%)	110,978 (65%)
% CAGR	0.3%	0.2%	0.2%	0.2%

SOURCE: Forecast: Consultant Forecast (2016 to 2035), Conducted March 2016.

## Operational Peaking

Table B23 is the operational peaking forecast of total annual operations broken-down by month, day, and hour. Operational peaking is used to assess airfield user patterns, quantify capacity levels, and to analyze various facilities for level of service. The design-day and design-hour activity levels are reflective of the Airport's busy periods. This absolute peak period analysis is typically used in order to avoid constructing for capacity requirements that rarely occur. Peaking activity is derived from the aggregate annual Airport operations, calculated using FAA guidance, and substantiated by monthly Air Traffic Control activity records. Per FAA OPSNET data, the peak-month activity typically occurs from May to August, with the highest average peak-month of 11.4 percent experienced in July and/or August. The percent of peak-hour operations is estimated using FAA guidance contained in AC 150/5060-5 - AIRPORT CAPACITY AND DELAY to range between 12 to 18 percent.



Table B23 OPERATIONAL PEAKING (ANNUAL, MONTH, DAY AND HOUR)

Operational Peaking	Peaking Calculation	Activity Demand (Civilian Operations)				
		2015	2020	2025	2030	2035
<b>Total Annual Operations</b>	--	<b>165,571</b>	<b>159,239</b>	<b>153,148</b>	<b>161,807</b>	<b>170,956</b>
Peak Month Operations	11.4%	18,957	18,232	17,534	18,526	19,573
Average Day Peak Month	30.5 Days	622	598	575	607	642
Peak Hour	15.0%	93.2	89.7	86.2	91.1	96.3
Peak Hour - Itinerant	75.5%	35.2	33.9	32.6	34.4	36.3
Peak Hour - Local	24.5%	11.4	11.0	10.6	11.2	11.8
Peak Hour - IFR	35.1%	16.4	15.7	15.1	16.0	16.9
Peak Hour - VFR	64.9%	30.3	29.1	28.0	29.6	31.2

**SOURCE:** 2015 baseline data obtained from FAA OPSNET.

**Note:** Forecast: Consultant Forecast (2020 to 2035), conducted March 2016 using FAA guidance from AC 150/5060-5.

### General Aviation Based Aircraft Forecast

The number and type of based aircraft influences airfield operational system needs and influences the type and location of facilities, along with appropriate space allocation. Given the constrained terminal and landside property at BFI, based aircraft forecasts have a direct relationship to the function, utilization, and value of future Airport property assets. **Table B24** shows the BFI based aircraft count for 2015.

Table B24 BFI BASED AIRCRAFT – 2015

Category	Total	Percent Share
Single-engine piston	188	(49%)
Multi-engine piston	42	(11%)
Single-engine turboprop	15	(4%)
Multi-engine turboprop	18	(5%)
Small cabin business Jet	39	(10%)
Large cabin business Jet	47	(12%)
Helicopter	31	(5%)
<b>Total Based Aircraft:</b>	<b>390</b>	

The number and type of aircraft expected to base at an airport is dependent on many factors such as communications, available facilities, airport services, airport proximity and access, aircraft basing capacity available at nearby airports, airspace congestion, and other similar considerations. General aviation aircraft operators are particularly sensitive to the quality and location of their basing facility, with proximity of home and work often identified as the primary considerations in the selection of an aircraft basing location.

**Table B25** provides the historical based aircraft data for BFI compared to the based aircraft within the Puget Sound Region, the State of Washington, and the nation, as well as BFI's market share for each region. As with the enplanements analysis, this analysis indicates a fluctuation in BFI's market shares with no discernable trends that can be used for forecasting. Therefore, market share analysis is not a viable methodology for projecting based aircraft due to low predictive reliability.



Table B25 BFI MARKET SHARE OF BASED AIRCRAFT COMPARISON (2000-2015)

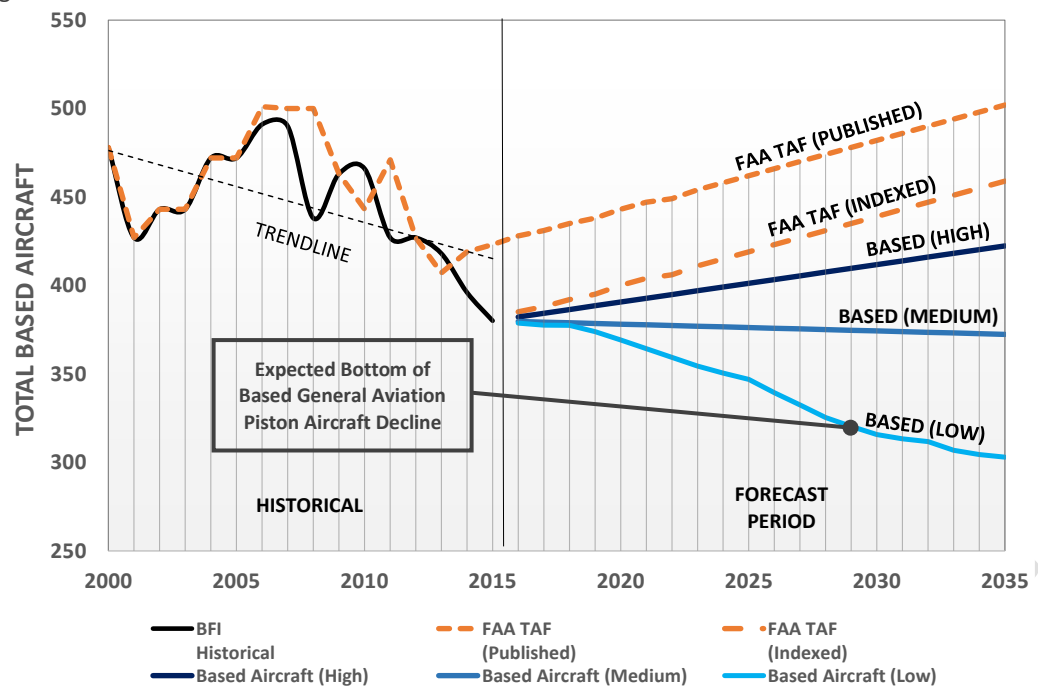
Year	BFI	Puget Sound Region	Market Share	State of Washington	Market Share	United States	Market Share
2000	478	2,360	20.25%	5,872	8.14%	179,719	0.27%
2001	427	2,375	17.98%	6,273	6.81%	186,731	0.23%
2002	443	2,455	18.05%	6,418	6.90%	188,757	0.23%
2003	443	2,485	17.83%	6,475	6.84%	190,101	0.23%
2004	472	2,485	18.99%	6,467	7.30%	193,041	0.24%
2005	472	2,549	18.52%	6,631	7.12%	197,214	0.24%
2006	491	2,623	18.72%	6,845	7.17%	197,301	0.25%
2007	490	2,661	18.41%	7,121	6.88%	199,608	0.25%
2008	438	2,335	18.76%	6,048	7.24%	175,579	0.25%
2009	463	2,426	19.09%	6,148	7.53%	177,432	0.26%
2010	470	2,387	19.69%	5,963	7.88%	165,472	0.28%
2011	418	2,234	18.71%	5,651	7.40%	166,953	0.25%
2012	396	2,149	18.43%	5,587	7.09%	170,375	0.23%
2013	380	2,275	16.70%	5,554	6.84%	163,994	0.23%
2014	478	2,360	20.25%	5,872	8.14%	179,719	0.27%
2015	491	2,623	18.72%	6,845	7.17%	197,301	0.25%
Average Market Share			18.74%		7.28%		0.25%

SOURCE: FAA TAF (2015 to 2035) and BFI Airport Records.

**Figure B11** graphs the based aircraft between 2000 and 2015. In addition, the graph provides the FAA TAF forecast (actual and indexed to 2015 based aircraft levels) along with the preliminary range of low, medium, and high MP Update forecasts. The FAA TAF based aircraft projection, which is projected using a top-down forecasts method, results in a high forecast level as a consequence of using a high based aircraft count starting in 2015 (423 versus the actual 380 based aircraft). For this reason, the FAA TAF has been indexed downward to reflect the actual 380 based aircraft. Based aircraft were projected using several BFI historic trend methods combined with FAA industry forecast growth rates by major aircraft type (see **Table B26**). The low forecast reflects a continued loss of piston based aircraft. The growth forecast scenarios reflect a slowing decline of piston based aircraft, coupled with a greater proportion of business-corporate general aviation utilization increases, including the potential influx of new high-end service operator tenants at BFI.

**Preferred Based Aircraft Forecast.** The preferred based aircraft forecast was derived from a bottom-up approach, by applying FAA Aerospace Forecasts general aviation forecast rates to each of the major aircraft types (single piston, twin piston, turboprop, business jet, helicopter) based at BFI in 2014 and 2015. In addition, general aviation aircraft production publications were referenced to provide a more detailed understanding of delivery trends for particular aircraft models, such as the small, medium, and large cabin business jets, and piston versus turbine helicopter production. The preferred forecast method generates a slight net decline in based aircraft, as evident of the past 10 years of piston aircraft trends, which is a reasonable expectation for BFI, at least in the near-term five to 10-year forecast horizon. The preferred forecast results in a total of 372 based aircraft by 2035, representing a net decline of eight aircraft. The piston fleet is projected to decline by 1.2 percent, the turboprop fleet increases 0.5 percent, and the business jet increases 2.0 percent annually.

Figure B11 BASED AIRCRAFT TRENDS AND FORECAST PROJECTION SCENARIOS



SOURCE: Trend – BFI Airport Records / Forecast – Consultant Forecast (April 2016).

Table B26 BFI BASED AIRCRAFT HISTORICAL AND FORECAST SCENARIOS (2000 TO 2035)

Year	FAA TAF (Published)	FAA TAF (Indexed)	Based Aircraft MP Update Forecasts		
			High	Medium	Low
2000	478	478	478	478	478
2001	427	427	427	427	427
2002	443	443	443	443	443
2003	443	443	443	443	443
2004	472	472	472	472	472
2005	472	472	472	472	472
2006	501	501	491	491	491
2007	500	500	490	490	490
2008	500	500	438	438	438
2009	463	463	463	463	463
2010	443	443	466	466	466
2011	471	471	427	427	427
2012	427	427	427	427	427
2013	407	407	418	418	418
2014	419	419	396	396	396
2015	423	423	380	380	380
2020	443	400	391	378	369
2025	462	419	401	376	347
2030	482	439	412	374	316
2035	502	459	422	372	303
% CAGR	0.9%	0.4%	0.5%	-0.1%	-1.1%

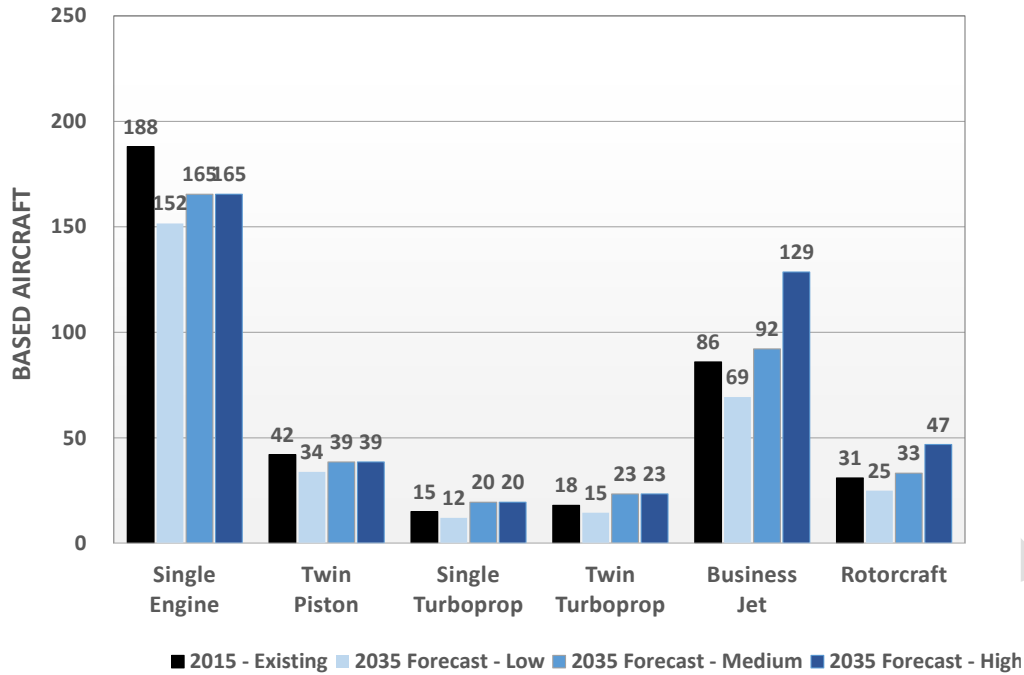
**SOURCE:** Historical: FAA and BFI Based Aircraft Records.

Forecast: Consultant Forecast (2015 to 2035), Conducted April 2016.

Note: Dark box indicates recommended forecast scenario.

**Figure B12** depicts the forecast of based aircraft by aircraft user group. The forecasts continue to show a decline in piston aircraft, a marginal increase in turboprop, and a moderate increase in business jet and helicopter. It is anticipated the based piston fleet will stabilize between 150 and 165 based aircraft. The based turbine aircraft segment is expected to increase due to a continued expanding demand and concentration of business-class aircraft at BFI.

Figure B12 BASED AIRCRAFT TYPES BY FORECAST PROJECTION SCENARIOS



SOURCE: Consultant Based Aircraft Forecast Scenarios (2016 to 2035), Conducted April 2016.

### Summary

It is anticipated that BFI will see some growth in most activity areas during the 20-year planning period. By 2035, approximately 37,000 enplanements and nearly 171,000 operations are projected to occur. Continued declines are anticipated in in both operations and based aircraft related to the recreational/training sector of general aviation, which are projected to be offset by steady and continued growth of the business/corporate general aviation sector (see **Table B27**).

Table B27 SUMMARY OF AVIATION ACTIVITY FORECASTS 2015-2035

Airport Activity	2015	2020	2025	2030	2035	CAGR 2015-2035
<b>Passenger Enplanements</b>	<b>18,945</b>	<b>20,211</b>	<b>21,562</b>	<b>23,004</b>	<b>24,541</b>	<b>1.30%</b>
Scheduled (Kenmore Air) <sup>1</sup>	10,817	11,181	11,546	11,910	12,270	0.63%
Non-Scheduled	8,128	9,030	10,016	11,094	12,271	2.08%
<b>Operations</b>						
<b>Commercial Service</b>	<b>7,844</b>	<b>9,174</b>	<b>10,638</b>	<b>11,293</b>	<b>11,297</b>	<b>2.15%</b>
Scheduled (Kenmore Air) <sup>1</sup>	1,821	1,882	1,982	2,010	2,100	0.7%
Non-Scheduled	1,825	2,095	2,359	2,730	3,078	2.6%
Boeing	4,198	5,197	6,297	6,553	6,819	2.46%
<b>Air Cargo</b>	<b>12,336</b>	<b>12,965</b>	<b>13,627</b>	<b>14,322</b>	<b>15,052</b>	<b>1.0%</b>
<b>General Aviation</b>	<b>143,783</b>	<b>135,430</b>	<b>127,151</b>	<b>134,394</b>	<b>142,039</b>	<b>-0.06%</b>
Air Taxi	20,503	21,937	23,470	25,110	26,866	1.36%
Corporate	26,404	30,403	35,099	40,312	46,418	2.86%
Recreational/Training	96,876	83,090	68,672	68,672	68,755	-1.7%
<b>Military</b>	<b>1,608</b>	<b>1,669</b>	<b>1,733</b>	<b>1,799</b>	<b>1,867</b>	<b>0.75%</b>
<b>Total Operations</b>	<b>165,571</b>	<b>159,239</b>	<b>153,148</b>	<b>161,807</b>	<b>170,956</b>	<b>0.2%</b>
<b>Based Aircraft</b>	<b>380</b>	<b>378</b>	<b>376</b>	<b>374</b>	<b>372</b>	<b>-0.1%</b>
<b>Air Cargo (Enplaned &amp; Deplaned in tons)</b>	<b>134,371</b>	<b>144,196</b>	<b>154,021</b>	<b>163,846</b>	<b>173,671</b>	<b>1.29%</b>

**SOURCE:** Forecast: Consultant Forecast (2015 to 2035), Conducted April 2016.

**Note:** <sup>1</sup> After FAA's approval of the MP Update forecasts, a second commercial commuter passenger airline (JSX) began operations at BFI. No attempt has been made to alter the approved commercial service enplanements and aircraft operations forecasts based on the entrance of the second commuter airline.

## Runway Design Code (RDC)/Critical Aircraft Analysis

The forecast of aircraft types using, and those that are expected to use BFI offers insight on the designation of the appropriate Runway Design Code (RDC) for each runway. FAA Advisory Circular 150/5300-13A, Change 1, *Airport Design*, provides guidance for this determination. The RDC is based on the "Design Aircraft" that is determined to be the most critical aircraft, or group of aircraft, using or projected to use a runway on a regular basis. Several FAA guidance documents define regular basis as 500 or more annual operations (landing and takeoffs are considered as separate operations). It is important to note that the 500 annual operations "substantial use" threshold is not a cap or limit on aircraft operations, but rather a planning metric for consideration of the potential need to upgrade airport facilities to a particular design standard. The identified design aircraft can either be one aircraft, or a composite of more than one aircraft, representing the highest Aircraft Approach Category (AAC) and Airplane Design Group (ADG).

The selected AAC and ADG are then combined to represent the Runway Design Code (RDC) of a particular runway, and the RDC determines the dimensional criteria standards that are applicable to that runway. The first component (i.e., the AAC) is depicted by a letter and relates to the aircraft approach speed. The second component (i.e., the ADG), is depicted by a roman numeral and relates to the aircraft wingspan and tail height. The third component relates to the visibility minimums for the runway, defined as RVR values in measurements of feet at 1,200, 1,600, 2,400, 4,000, and 5,000 (corresponding to lower than ¼ mile, lower than ½ mile but not lower than ¼ mile, lower than ¾ mile but not lower than ½ mile, lower than one mile but not lower than ¾ mile, and not lower than 1 mile respectively).

The FAA's specified criteria for AAC, ADG, and Visibility Minimums, as referenced in AC 150/5300-13A, Airport Design, Change 1, are presented in **Tables B28, B29, and B30**.

Table B28 AIRCRAFT APPROACH CATEGORY (AAC)

AAC	V <sub>Ref</sub> /Approach Speed
A	Approach speed less than 91 knots
B	Approach speed 91 knots or more but less than 121 knots
C	Approach speed 121 knots or more but less than 141 knots
D	Approach speed 141 knots or more but less than 166 knots
E	Approach speed 166 knots or more

**SOURCE:** FAA AC 150/5300-13A, Airport Design, Change 1, February 2014.

Table B29 AIRPLANE DESIGN GROUP (ADG)

ADG	Tail Height	Wingspan
I	Less than 20 Feet	Less than 49 Feet
II	Greater than 20, but less than 30 Feet	Greater than 49, but less than 79 Feet
III	Greater than 30, but less than 45 Feet	Greater than 79, but less than 118 Feet
IV	Greater than 45, but less than 60 Feet	Greater than 118, but less than 171 Feet
V	Greater than 60, but less than 66 Feet	Greater than 171, but less than 214 Feet
VI	Greater than 66, but less than 80 Feet	Greater than 214, but less than 262 Feet

**SOURCE:** FAA AC 150/5300-13A, Airport Design, Change 1, February 2014.

Table B30 VISIBILITY MINIMUMS

RVR (ft)	Instrument Flight Visibility Category (statute miles)
VIS	Visual Approach
5000	Not lower than 1 mile
4000	Lower than 1 mile but not lower than ¾ mile
2400	Lower than ¾ mile but not lower than ½ mile
1600	Lower than ½ mile but not lower than ¼ mile
1200	Lower than ¼ mile

**SOURCE:** FAA AC 150/5300-13A, Airport Design, Change 1, February 2014.

## Runways

**Runway 14R/32L (Primary).** According to operational data collected in part from BFI using the Passur Aerospace data tool and information provided by BFI Operations Staff, the Airport's primary runway (Runway 14R/32L), has a RDC of D-IV, with the most critical aircraft being a combination of commercial service jets. The design aircraft for Runway 14R/32L is various models of the Boeing 767 (200 and 300 series). Each of the aircraft has an ADG of IV and an AAC of C & D. The operations per each aircraft are depicted in **Table B31**.

Table B31 RUNWAY 14R/32L CRITICAL AIRCRAFT OPERATIONS, 2015

Aircraft	Operations
Boeing 767 (All Models)	4,200
Boeing 767-300 ER & ERW	2,666
<b>Total</b>	<b>4,200</b>

**SOURCE:** BFI Passur Data estimates & Airport Staff.

**Runway 14R/32L (Secondary).** The Airport's secondary parallel runway (Runway 14L/32R) has a RDC of B-I (Small Aircraft Only), with the most critical aircraft being a combination of various small general aviation aircraft (e.g., the Piper Navajo PA, Cessna's 172 Skyhawk and 182 Skylane, and the Cirrus SR 22). These aircraft have an ADG of I and an AAC of A & B. The estimated operations for each aircraft are depicted in the **Table B32**.

Table B32 RUNWAY 14L/32R CRITICAL AIRCRAFT OPERATIONS, 2015

Aircraft	Operations
Piper Navajo PA	5,502
Cessna 172 Skyhawk	10,599
Cessna 182 Skylane	9,652
Cirrus SR 22	1,561
<b>Total</b>	<b>27,314</b>

**SOURCE:** BFI Passur Data estimates.

Aircraft depicting the various RDCs at BFI are presented in **Figure B13**.

## Runway 13R/31L

### ARC C/D-IV: LARGE COMMERCIAL JET

- > **Boeing 767-200 & 300**
- > **Boeing 757-200**
- > **Airbus A-300**
- > **Boeing MD-11**



## Runway 13L/31R

### RDC A/B-I: Small General Aviation: $\geq 12,500$ lbs.

- > **Piper Navajo PA**
- > **Cessna 172 Skyhawk**
- > **Cessna 182 Skylane**
- > **Cirrus SR 22**



Representative Aircraft not to scale.

FIGURE B13 **Representative Aircraft by  
Runway Design Code (RDC)**



## Forecast Approval

The Aviation Forecast Guidance APP-400 specifies that local aviation forecasts are approved by regional airports division offices or airports district offices (ADOs). Local forecasts that are consistent with the FAA's Terminal Area Forecast (i.e., the local forecast differs by less than 10 percent in the first five years, differs by less than 15 percent in the remaining forecast periods, and does not affect the timing or scale of an airport project) do not need to be coordinated with APP-400 and APO-110. Local forecasts that are not consistent with the TAF, but which do not affect the timing or scale of an airport project and do not impact the analysis of a National Environmental Policy Act (NEPA) document or Benefit Cost Analysis (BCA), may be accepted (not approved) for information purposes by the regional office/ADO without APP/APO coordination.

**Tables B33 & B34** present BFI's FAA TAF forecast comparison summary and the planning forecast summary. As can be noted in **Table B33**, BFI's projected aircraft operations are within the specified TAF thresholds of 10 & 15 percent for FAA acceptance. However, the forecasted passenger enplanements do not comply with these specified thresholds due to a filing error on a T-100 Market All Carrier Report by Sierra Pacific Airlines, who is a large certificated air carrier that serves BFI. It was determined by FAA Headquarters that this filing error likely resulted in an underreporting of approximately 2,562 enplanements to the Bureau of Transportation Statistics (BTS) database, which is the source for FAA's existing TAF enplanement data.

FAA Headquarters believes Airport Staff correctly reported those enplanements when they responded to the FAA's preliminary enplanement data request to determine AIP funding, and therefore the enplanements were accounted for in the 2015 ACAIS total (see **Appendix One** for a copy of the 2015 BFI ACAIS report) but were not included in the corresponding TAF total for the same year. In addition, the TAF does not include enplanements from Nonscheduled/On-Demand Air Carriers, filing FAA Form 1800-31, which would account for an additional 402 enplanement differential between the 2015 base year ACAIS and TAF totals. After accounting for any additional discrepancy between the calendar year and fiscal year data sets, this should explain the difference between the 2015 base year ACAIS and TAF enplanement totals that result in BFI's master plan enplanement forecast exceeding the 10 percent allowance for the five-year planning horizon and the 15 percent allowance for the 10-year planning horizon.

The FAA ADO has concurred with the stated reasons for the discrepancy in the 2015 base year enplanement counts and has approved the BFI Master Plan Update forecasts, as presented (see **Appendix Two** for a copy of the FAA Forecast Approval Letter).

Table B33 FAA TAF FORECAST COMPARISON, 2015-2030

Forecast Component	Year	Airport Forecast <sup>1</sup>	FAA TAF <sup>2</sup>	AF/TAF (% Difference)
<b>Passenger Enplanements</b>				
Base yr.	2015	18,945 <sup>3</sup>	15,236 <sup>4</sup>	24.3%
Base yr. + 5yrs.	2020	20,211	16,373	23.4%
Base yr. + 10yrs.	2025	21,562	18,340	17.6%
Base yr. + 15yrs.	2030	23,004	20,565	11.9%
<b>Commercial Operations <sup>5</sup></b>				
Base yr.	2015	40,683	40,072	1.5%
Base yr. + 5yrs.	2020	44,076	43,418	1.5%
Base yr. + 10yrs.	2025	47,735	47,106	1.3%
Base yr. + 15yrs.	2030	50,725	51,110	-0.8%
<b>Total Operations</b>				
Base yr.	2015	165,571	170,950	-3.1%
Base yr. + 5yrs.	2020	159,239	173,347	-8.1%
Base yr. + 10yrs.	2025	153,148	178,563	-14.2%
Base yr. + 15yrs.	2030	161,807	184,115	-12.1%

**SOURCE:** Forecast: Consultant Forecast (2015 to 2035), Conducted April, 2017.

Notes: <sup>1</sup> The Airport Forecast is based on Calendar Year (CY) data.

<sup>2</sup> TAF data is based on the U.S. Government Fiscal Year (FY) basis (October through September).

<sup>3</sup> Actual CY ACAIS data for 2015.

<sup>4</sup> Total does not include accounting of 2,974 base year enplanements due to a T-100 Market All Carrier Report filing error and non-reporting of enplanements by Nonscheduled/On-Demand Air Carriers.

<sup>5</sup> TAF projections of commercial operations include air cargo operations and some general aviation air taxi operations.

The airport forecasts include operations of commercial service airline aircraft, air cargo aircraft, air taxi aircraft, and Boeing production/delivery aircraft projections.

Table B34 FAA TAF - AIRPORT PLANNING FORECAST SUMMARY

Forecast Component	Base Yr. Level 2015	Base Yr. + 1yr. 2016	Base Yr. + 5yrs. 2020	Base Yr. + 10yrs. 2025	Base Yr. + 15yrs. 2030	2030 % Change
<b>Passenger Enplanements <sup>1</sup></b>	<b>18,945</b>	<b>19,628</b>	<b>20,211</b>	<b>21,562</b>	<b>23,004</b>	<b>1.3%</b>
Air Carrier (Non-Scheduled)	8,128	8,302	9,030	10,016	11,094	2.1%
Commuter (Scheduled)	10,817	10,890	11,181	11,546	11,910	0.6%
<b>Annual Aircraft Operations<sup>1</sup></b>	<b>165,571</b>	<b>160,623</b>	<b>159,239</b>	<b>153,148</b>	<b>161,807</b>	<b>-0.2%</b>
<b><u>Itinerant</u></b>	<b>129,648</b>	<b>126,007</b>	<b>125,341</b>	<b>121,256</b>	<b>128,112</b>	<b>-0.1%</b>
Air Carrier	3,646	3,710	3,977	4,341	4,740	1.8%
Commuter/Air Taxi	37,037	37,639	40,099	43,394	45,985	1.5%
Total Commercial	<b>40,683</b>	<b>41,349</b>	<b>44,076</b>	<b>47,735</b>	<b>50,725</b>	<b>1.5%</b>
General Aviation	88,000	83,686	80,263	72,482	76,307	-0.9%
Military	965	972	1,002	1,040	1,079	0.8%
<b><u>Local</u></b>	<b>35,923</b>	<b>34,616</b>	<b>33,898</b>	<b>31,892</b>	<b>33,696</b>	<b>-0.4%</b>
General Aviation	35,280	33,968	33,230	31,199	32,976	-0.4%
Military	643	648	668	693	719	0.8%
<b>Instrument Operations <sup>1</sup></b>	<b>58,088</b>	<b>56,352</b>	<b>55,866</b>	<b>53,730</b>	<b>56,768</b>	<b>-0.2%</b>
<b>Peak Hour Operations <sup>1</sup></b>	<b>93</b>	<b>90</b>	<b>86</b>	<b>91</b>	<b>96</b>	<b>0.2%</b>
<b>Cargo/Mail (Enp+Dep Tons) <sup>1</sup></b>	<b>134,371</b>	<b>136,336</b>	<b>144,196</b>	<b>154,021</b>	<b>163,846</b>	<b>1.3%</b>
<b>Based Aircraft (Rounded) <sup>1</sup></b>	<b>380</b>	<b>379</b>	<b>379</b>	<b>377</b>	<b>375</b>	<b>-0.1%</b>
Single Engine (Non-Jet)	203	202	198	194	189	-0.5%
Multi Engine (Non-Jet)	60	60	61	62	62	0.2%
Jet	86	86	88	89	91	0.4%
Helicopter	31	31	32	32	33	0.4%
Other	N/A	N/A	N/A	N/A	N/A	N/A
<b>Average Aircraft Size (seats)</b>						
Air Carrier	125.0	127.0	130.0	132.0	135.0	--
Commuter	9.0	9.0	9.0	9.0	9.0	--
<b>Avg. Enplaning Load Factor</b>						
Air Carrier	60%	60%	60%	60%	60%	--
Commuter	45%	48%	50%	50%	50%	--
<b>GA Ops Per Based Aircraft</b>	<b>436</b>	<b>424</b>	<b>420</b>	<b>406</b>	<b>431</b>	<b>--</b>

**SOURCE:** Forecast: Consultant Forecast (2015 to 2035), Conducted April 2017.

Notes: <sup>1</sup>The Airport Forecast is based on Calendar Year (CY) data.