CRITICAL AIRCRAFT FORECASTS

The critical aircraft is used to determine future airport design based on the category of aircraft as defined by its approach speed and wingspan (see table notes for description based on Advisory Circular 150/5300-13, *Airport Design*). The aircraft mix indicates the structural and land use needs of the airport, and also relates to the preservation of airspace to accommodate instrument approach capabilities. Typically aircraft fall into the following categories, as assumed for forecasting purposes in this study:

Single-engine airplanes - ARC A-I and B-I
Twin-piston engine airplanes - ARC B-I
Twin-turbopropeller airplanes - ARC B-II
Business jets (small cabin) - ARC B-II
Business jets (medium to large cabin) - ARC C-II

The more demanding aircraft (turbopropeller and business jets) are typically purchased and operated under different circumstances than small aircraft, which tend to be used for a higher percentage of recreational use. For the purpose of relating the ARC to projected aviation operational levels, the following factors most notably increase the frequency of business twin-propeller and jet activity at airports reasonably capable of accommodating this type of demand:

1) addition of new aircraft services offered at the airport for passengers and crew (fuel and hangars);
2) upgrade the instrument approaches to a more reliable system with lower visibility minimums (ILS);
3) expansion of the terminal-area tie-down apron for larger itinerant business aircraft;
4) favorable / improved ground access from point of origin (business center) to the airport.

For this study, any airport which had a minimum net gain of 500 annual operations by turboprops and business jets became a candidate for consideration of a larger airport reference code (ARC) / critical aircraft family. Those airports which resulted in an ARC change satisfied the potential, in terms of fleet mix operations, to accommodate larger aircraft based on adequate facilities (primarily a runway length which corresponds with the FAA recommended length to accommodate the ARC designated critical aircraft family – or representative aircraft type / model).

Table 1R lists the airports which experienced a change in their airport reference code / critical aircraft, While Exhibit K depicts representative aircraft in each airport reference code.

TABLE 1R
Change in Airport Reference Code / Critical Aircraft
WSDOT Forecast Analysis & Economic Impact Analysis Study

Airport	*Existing ARC / Critical Aircraft Change*	*Future (20-Year) ARC / Critical Aircraft Change*
Anacortes	ARC A-I	ARC B-II
Arlington Municipal	ARC B-I	ARC C-II
Auburn Municipal	ARC A-I	ARC B-II
Battle Ground	ARC B-I	ARC B-II
Bellingham International	ARC C-III	To Be Determined
Grove Field	ARC A-I	ARC B-I/B-II
Chehalis Centralia	ARC B-I	ARC B-II
Chelan Municipal	ARC B-I	ARC B-II
Concrete Municipal	ARC A-I	ARC B-I/B-II
Gorge Regional / The Dallas	ARC B-I	ARC B-I/B-II
Orcas Island	ARC B-I	ARC B-I/B-II
Ephrata Municipal	ARC B-I	ARC B-I/B-II
Kelso-Longview	ARC B-I	ARC B-I/B-II
Whidbey Airpark	ARC B-I	ARC B-I/B-II
Lynden	ARC B-I	ARC B-I/B-II
Firstair Field	ARC B-I	ARC B-I/B-II
Jefferson County International	ARC B-I	ARC B-I/B-II
Prosser	ARC B-I	ARC B-I/B-II
Apex Airpark	ARC A-I	ARC B-I/B-II
Harvey Field	ARC B-I	ARC B-II
Willapa Harbrr	ARC C-I/C-II	To Be Determined
Felts Field	ARC C-II/C-III	ARC C-III
Tacoma Narrows	ARC C-I	ARC C-II
Vinlock Ed Carlson	ARC B-II	To Be Determined
Tonasket Municipal	ARC B-II	To Be Determined
Evergreen Field	ARC A-II	ARC B-II
Pangborn Municipal	ARC B-III	ARC C-II/C-III

Aircraft Approach Category – This grouping is based on 1.3 times the stall speed of the aircraft at the maximum certified landing weight in the landing configuration (knots).

Airplane Design Group - A grouping of aircraft based on wingspan dimension (feet).

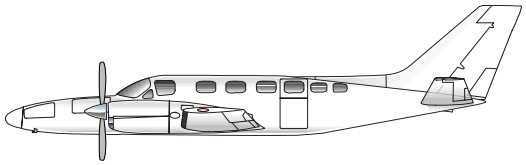
Aircraft Approach Category (approach speed)	Airplane Design Group (airplane wing span)
Category A (Less than 91 Knots)	Category I (Less than 49')
Category B (92 to 120 Knots)	Category II (49' to 78')
Category C (121 to 140 Knots)	Category III (79' to 118')
Category D (141 to 161 Knots)	Category IV (118' to 171')

Source: BWR Forecast of Aircraft Mix – December, 2000.

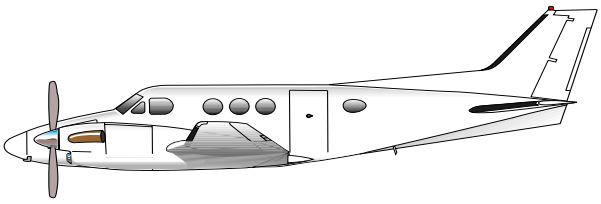
AIRPORT REFERENCE CODE (ARC) REPRESENTATIVE AIRCRAFT

ARC A-I (SINGLE-ENGINE AIRCRAFT – 2 TO 6 SEATS)

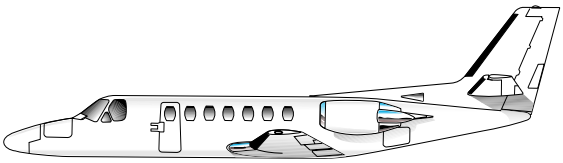
ARC B-I (TWIN-PISTON AIRCRAFT – 4 TO 10 SEATS)



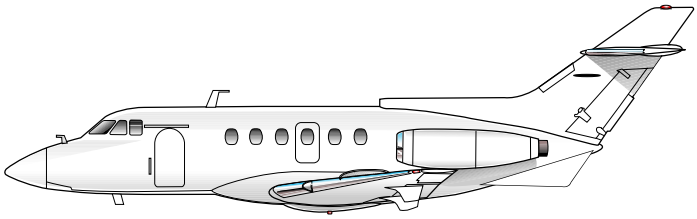
ARC B-II (TWIN-TURBOPROP AIRCRAFT – 6 TO 10 SEATS) INCLUDES MOST COMMERCIAL TURBOPROP AIRCRAFT



ARC B-II (BUSINESS JET / SMALL CABIN – 4 TO 8 SEATS) INCLUDES COMMERCIAL REGIONAL JET AIRCRAFT



ARC C-II (BUSINESS JET / MEDIUM TO LARGE CABIN 10+ SEATS)



MILITARY ACTIVITY

Information regarding military aircraft operations at system airports was gathered from FAA 5010 Forms for each airport. In determining the military activity at airports, attention was specifically focused on those airports reporting military activity whose associated community had some type of military presence. These communities were identified on the Washington National Guard web site.

Military activity, unlike other aviation activity, does not necessarily experience steady growth. Changes in activity are dependent upon immediate needs, the stability of various regions of the world, and budgetary constraints. Additionally, in keeping with national security, the military is usually not forthcoming with their plans, making changes in military activity difficult to forecast. In reviewing FAA Form 5010's for the subject airports it was discovered that, for the most part, military activity has been reported as static for the past several years. With no basis to show an increase or decline, military activity, summarized in **Table 1S**, has been shown as static throughout the planning period. A summary of annual aircraft operations for each airport is presented in **Appendix B**.

TABLE 1S
MILITARY OPERATIONS

Associated City	Airport Name	Military Operations				
		2000	2005	2010	2015	2020
Anacortes	Anacortes	404	500	500	500	500
Bellingham	Bellingham International	442	500	500	500	500
Bremerton	Bremerton National	1,000	1,100	1,100	1,100	1,100
Ellensburg	Bowers Field	100	200	200	200	200
Ephrata	Ephrata Municipal	1,400	1,500	1,500	1,500	1,500
Everett	Snohomish County/Paine Field	24,064	24,000	24,000	24,000	24,000
Moses Lake	Grant County	10,660	10,700	10,700	10,700	10,700
Okanogan	Okanogan Legion	50	100	100	100	100
Olympia	Olympia	871	900	900	900	900
Pasco	Tri-Cities	2,016	2,100	2,100	2,100	2,100
Pullman/ Moscow	Pullman/Moscow Regional	50	100	100	100	100
Shelton	Sanderson Field	21,888	21,900	21,900	21,900	21,900
Snohomish	Harvey Field	1,133	1,200	1,200	1,200	1,200
Spokane	Felts Field	219	300	300	300	300
Spokane	Spokane International	1,498	1,500	1,500	1,500	1,500
Tacoma	Tacoma Narrows	239	300	300	300	300
Vancouver	Pearson Field	1,100	1,200	1,200	1,200	1,200
Walla Walla	Walla Walla Regional	253	300	300	300	300
Wenatchee	Pangborn Memorial	500	600	600	600	600
Yakima	Yakima Air Terminal	5,843	5,900	5,900	5,900	5,900

CARGO ACTIVITY

The fastest growing segment of aviation is that of air cargo. Initially used to transport small, high value goods, this segment has seen drastic changes over the past decade. Air cargo (both freight and mail) is responsible for the same phenomenon today as the railroads were in the 1800's. By facilitating the quick movement of goods and documents, the local economy is stimulated; thus creating the opportunity for increased employment and income. Air cargo is viewed as a crucial part of this study because, not only does it provide direct economic impacts, such as the wages paid to those in the cargo industry; there is a range of secondary economic impacts related to the shipment of high-value or time sensitive materials. These impacts will be discussed further in the economic analysis portion of this study.

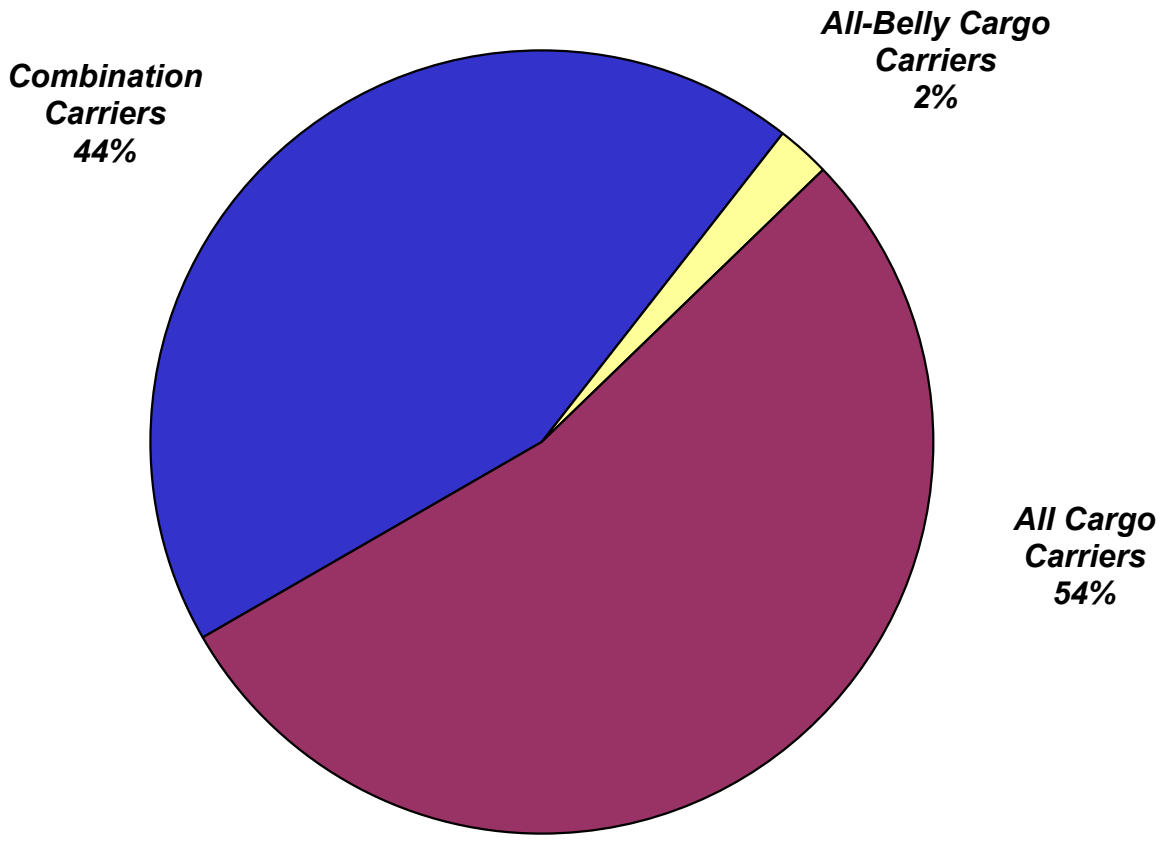
It is difficult to document freight activity at many smaller airports, where aircraft carrying freight may simply taxi to the airport's FBO unannounced and leave after loading or unloading. Potentially any airline serving a given airport can, and often does, carry freight and mail. In fact, when airlines operated under a regulated environment, airlines were actually subsidized for flying unprofitable routes by being apportioned mail to carry. Those airlines serving airports in the System include Air Canada, Alaska, Delta, Kenmore Air, Northwest, Southwest, United, and West Isle Air. Airlines typically load freight and mail in the belly hold of the aircraft, leaving the main cabin for passengers. Of these airlines, the only exception to this is Alaska, whose fleet includes several aircraft, known as "combi's," in which both cargo and passengers may be carried in separate sections of the main cabin. The breakdown of air freight movement in Washington by type of cargo hold is depicted in **Exhibit K**.

Several all-cargo airlines or their subsidiaries potentially operate at Washington airports. These include UPS, FedEx, Burlington, Evergreen, Kitty Hawk, DHL, Emery, and Airborne Express. In many smaller communities, all cargo carriers may contract with operators of small aircraft to provide feed to larger airports or their hub facilities.

The United States Postal Service (USPS) does not have its own cargo aircraft, but instead contracts with several all-cargo carriers, some of whom paint aircraft dedicated to Postal Service operations in USPS livery. These include Emery, Evergreen, Ryan, Cargolux, and Kitty Hawk, among others. These aircraft are used chiefly to transport express mail and parcels, while regular mail is typically sent via the scheduled airlines. Recently, FedEx and DHL have entered into agreements with the USPS to transport postal express shipments.

According to *FAA Aerospace Forecasts – Fiscal Years 2000 – 2011*, domestic air freight revenue ton-miles for passenger and all-cargo air carriers in the United States are expected to increase from 11,527.3 million ton miles in 1998 to 21,601.8 ton-miles in 2011, representing a 4.95 percent annual increase. Domestic air mail revenue ton miles for the same group of air carriers is expected to increase from 2,300.8 million ton-miles in 1998 to 3,762.6 million ton-miles in 2011, representing a 3.9 percent annual increase. National freight and mail statistics are summarized in **Table 1T**. Much of the increase in

Washington Air Freight Movement by Type of Cargo Hold,



Source: Washington State Air Freight Movement
Allison Consulting, Janauary, 1998

TABLE 1T
DOMESTIC AIR CARGO REVENUE TON MILES
U.S. COMMERCIAL CARRIERS

Year	Freight		Mail		Total	Change
	Million Tons	Change	Million Tons	Change	Million Tons	
1995	10,342.1	10.79%	2,073.6	4.26%	12,415.7	9.6%
1996	10,655.3	3.03%	2,126.4	2.55%	12,781.7	2.9%
1997	11,177.9	4.90%	2,276.2	7.04%	13,454.1	5.3%
1998	11,527.3	3.13%	2,300.8	1.08%	13,828.1	2.8%
2005	15,672.2	4.5%	3,040.5	4.1%	18,712.7	4.4%
2010	20,533.4	5.2%	3,639.7	3.4%	24,173.1	5.3%
2015	26,458.6	5.2%	4,301.0	3.4%	30,759.6	4.9%
2020	34,091.4	5.2%	5,083.6	3.4%	39,175.0	5.0%

Source: FAA Aerospace Forecasts, Fiscal Years 2000 - 2011

airmail tonnage is owed to express mail products, since the popularity of fax and e-mail has supplanted a substantial amount of regular mail. Another major contributor to the demand for overnight freight and mail service is the Internet; whereby consumers may order goods on line and have them delivered the next day.

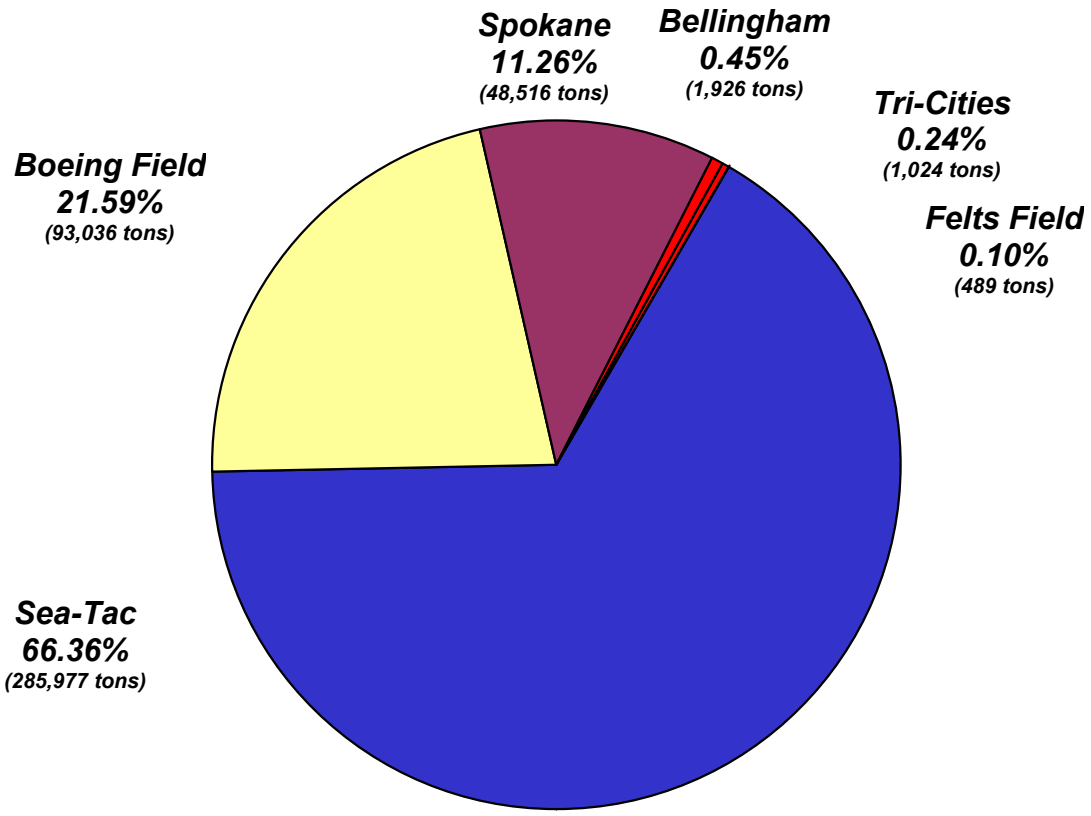
An air freight study, "*Washington State Air Freight Movement*," was completed in 1998. This study provides a "snapshot" of air freight activity in the State based on 1996 data. While this study provides a wealth of information, it was not intended to provide historical air cargo activity, which is central to system planning forecast efforts. Additionally, the Study does not provide information on the movement of airmail in the State. Excerpts from the 1998 Air Freight Study have been included in **Exhibits L, M, and N**. **Exhibit L** depicts freight tonnage for Sea-Tac, Boeing Field, Spokane International, Bellingham International, Tri-Cities, and Spokane Felts Field. **Exhibit M** illustrates the percentage of interstate versus intrastate air freight movements in Washington. **Exhibit N** graphically represents intrastate air freight movements between Sea-Tac and other airports in the State.

Enplaned freight and mail statistics obtained from the Department of Transportation, Bureau of Transportation Statistics for 1995 through the first quarter of 2000, as well as information obtained directly from airport sponsors were used in this study. The airports for which data was available included Bellingham International, Boeing Field, Bremerton National, Bowers Field, Ephrata, Grant County, Omak Municipal, Snohomish County, Spokane International, Felts Field, Tri Cities, Walla Walla, Pangborn Memorial, Richland, Snohomish County, Spokane International, Spokane Felts Field, Tri Cities, Walla Walla, William R. Fairchild International, and Yakima.

Models used to forecast freight at all airports included time series analysis, regression analysis with national revenue ton miles as the independent variable, and increasing local freight in lock-step with FAA forecasts. The time series and lock-step methods were generally more successful in forecasting freight enplaned at Washington airports.

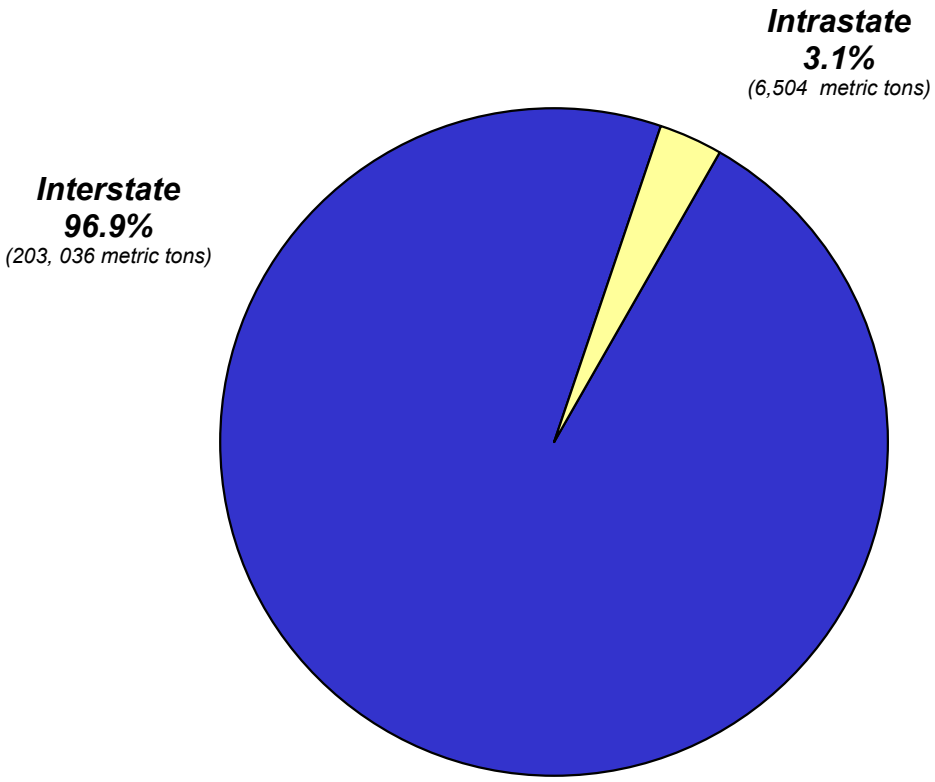
For those airports with a significant amount of air mail, the time series and lock-step methods described above were also used, with the lock-step method proving superior every time. For airports reporting either sporadic or nominal mail tonnage, the forecasts reflect a nominal amount throughout the planning period. For those airports which the Bureau of Transportation statistics had no record of enplaned mail, none was forecast. Freight and mail forecasts are summarized in **Table 1U**.

Washington Air Freight Tonnage by Reporting Airport,



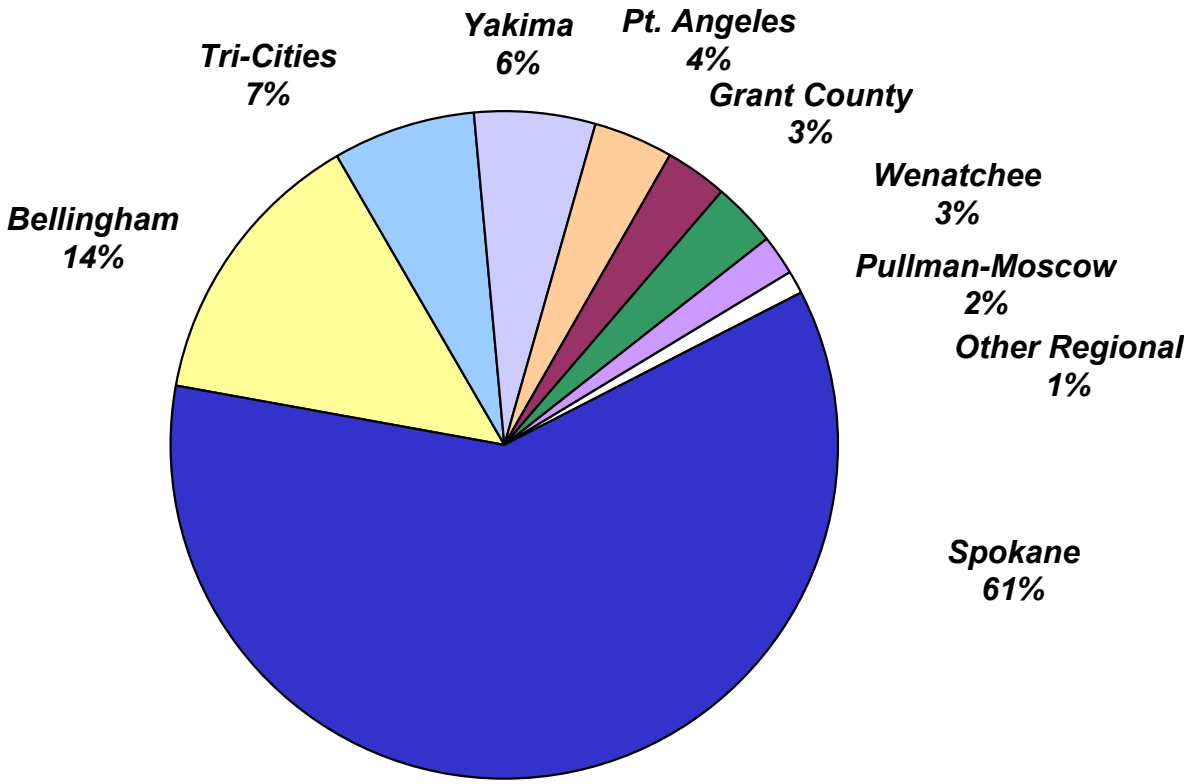
Source: Washington State Air Freight Movement
Allison Consulting, Janauary, 1998

Washington Interstate and Intrastate Air Freight Movements,



Source: Washington State Air Freight Movement
Allison Consulting, Janauary, 1998

Washington Air Freight Between Sea-Tac and Other Washington Airports, 1996



Source: Washington State Air Freight Movement
Allison Consulting, Janauary, 1998

TABLE 1U
ENPLANED AIR CARGO TONNAGE AT WASHINGTON AIRPORTS

Airport	Year	Freight	Mail	Total
Bellingham International	1995	N/A	N/A	
	1996	1,168	9	1,177
	1997	1,173	13	1,186
	1998	1,239	17	1,256
	1999	1,240	14	1,254
	2005	1,400	18	1,418
	2010	1,600	21	1,621
	2015	1,700	25	1,725
	2020	1,800	30	1,830
Boeing Field	1995	2,739	0	2,739
	1996	11,223	3	11,226
	1997	26,625	8	26,633
	1998	47,748	10	47,758
	1999	45,499	N/A	45,499
	2000	52,617	N/A	52,617
	2005	65,300	10	65,310
	2010	84,200	10	84,210
	2015	108,500	10	108,510
	2020	139,800	10	139,810
Bremerton National	1995	319	0	319
	1996	313	0	313
	1997	134	0	134
	1998	0	0	0
	1999	17	0	17
	2005	10	0	10
	2010	10	0	10
	2015	10	0	10
	2020	10	0	10
Ellensburg/Bowers Field	1995	1	0	1
	1996	0	0	0
	1997	2	0	2
	1998	1	0	1
	1999	1	0	1
	2005	1	0	1
	2010	1	0	1
	2015	1	0	1
	2020	1	0	1

TABLE 1U
ENPLANED AIR CARGO TONNAGE AT WASHINGTON AIRPORTS

Airport	Year	Freight	Mail	Total
Ephrata	1995	1	0	1
	1996	0	0	0
	1997	1	0	1
	1998	0	0	0
	1999	1	0	1
	2005	1	0	1
	2010	1	0	1
	2015	1	0	1
	2020	1	0	1
Friday harbor	1995			0
	1996			0
	1997			0
	1998	74	0	74
	1999	72	0	72
	2005	75	0	75
	2010	75	0	75
	2015	80	0	80
	2020	80	0	80
Grant County	1995	201	0	201
	1996	166	0	166
	1997	157	5	162
	1998	271	0	271
	1999	272	0	272
	2005	300	1	301
	2010	325	1	326
	2015	330	1	331
	2020	335	1	336
Omak Municipal Airport	1995	N/A	N/A	N/A
	1996	N/A	N/A	N/A
	1997	N/A	N/A	N/A
	1998	N/A	N/A	N/A
	1999	50	0	50
	2005	55	0	55
	2010	55	0	55
	2015	60	0	60
	2020	60	0	60

TABLE 1U
ENPLANED AIR CARGO TONNAGE AT WASHINGTON AIRPORTS

Airport	Year	Freight	Mail	Total
Port Angeles / William R. Fairchild International	1995	93	3	96
	1996	109	3	112
	1997	120	1	121
	1998	109	0	109
	1999	119	0	119
	2005	150	1	151
	2010	180	1	181
	2015	200	1	201
	2020	230	1	231
Richland Airport	1995	300	0	300
	1996	300	0	300
	1997	300	0	300
	1998	300	0	300
	1999	300	0	300
	2005	305	0	305
	2010	305	0	305
	2015	310	0	310
	2020	310	0	310
Seattle-Tacoma International Airport	1995	182,330	52,548	234,878
	1996	174,091	53,774	227,865
	1997	171,157	59,803	230,960
	1998	171,317	72,380	243,697
	1999	170,284	75,849	246,133
	2005	237,900	137,000	374,900
	2010	271,600	169,400	441,000
	2015	302,100	203,600	505,700
	2020	335,800	243,600	579,400
Snohomish County	1995	4	0	4
	1996	1	5	6
	1997	6	0	6
	1998	3	1	4
	1999	0	0	0
	2005	2	1	3
	2010	2	1	3
	2015	2	1	3
	2020	2	1	3

TABLE 1U
ENPLANED AIR CARGO TONNAGE AT WASHINGTON AIRPORTS

Airport	Year	Freight	Mail	Total
Skagit Regional	1995	594	0	594
	1996	610	0	610
	1997	485	0	485
	1998	491	0	491
	1999	497	0	497
	2005	500	0	500
	2010	500	0	500
	2015	550	0	550
	2020	575	0	575
Spokane International	1995	34,983	8,462	43,445
	1996	43,405	10,227	53,632
	1997	59,229	13,019	72,248
	1998	63,918	14,667	78,585
	1999	60,398	23,050	83,448
	2005	78,600	29,300	107,900
	2010	107,600	34,700	142,300
	2015	144,700	41,000	185,700
	2020	191,300	48,400	239,700
Spokane/Felts Field	1995	105	0	105
	1996	202	0	202
	1997	186	0	186
	1998	182	0	182
	1999	228	0	228
	2005	360	0	360
	2010	470	0	470
	2015	590	0	590
	2020	700	0	700
Tri-Cities	1995	866	558	1,424
	1996	791	570	1,361
	1997	847	624	1,471
	1998	844	603	1,447
	1999	906	490	1,396
	2005	1,000	540	1,540
	2010	1,000	580	1,580
	2015	1,100	620	1,720
	2020		660	660

TABLE 1U
ENPLANED AIR CARGO TONNAGE AT WASHINGTON AIRPORTS

Airport	Year	Freight	Mail	Total
Walla Walla	1995	57	0.24	58
	1996	64	0.31	64
	1997	57	0.67	58
	1998	51	0.16	51
	1999	55	0.22	55
	2005	57	0.30	57
	2010	60	0.30	60
	2015	63	0.50	64
	2020	65	0.50	66
Wenatchee/Pangborn Memorial	1995	206	0	206
	1996	194	0	194
	1997	260	0	260
	1998	162	0	162
	1999	171	0	171
	2005	180	0	180
	2010	200	0	200
	2015	221	0	221
	2020	245	0	245
Yakima	1995	283	0	283
	1996	303	0	303
	1997	395	0	395
	1998	372	0	372
	1999	412	0	412
	2005	500	0	500
	2010	600	0	600
	2015	800	0	800
	2020	1,000	0	1,000

Source: Department of Transportation, Bureau of Transportation Statistics
Results of Airport Surveys

CONCLUSION OF FORECAST FINDINGS

As discussed in the forecast methodology section, it is recognized there might be certain airports with a baseline of activity which is, or appears to be, inconsistent with documented levels widely accepted for official recording purposes as reported in this study. Therefore, additional information provided by the Planning Advisory Committee (PAC), combined with any newly revealed local information (unique factors or other means of documentation), and airport survey information might necessitate an assessment for further planning considerations. Based on the merit of this information, this would present the opportunity to re-assess the baseline level of activity (gain or loss) for an airport, and an appropriate adjustment of the forecast of activity.

Any revisions to the baseline or forecast values will be reflected in revised working papers to be made available to the PAC for further consideration. This information will be presented prior to the next scheduled meeting date.