

**CHAPTER FOUR
AVIATION INDUSTRY TRENDS AND PROJECTIONS**

In preparing a comprehensive statewide plan for the public use airports in the Pennsylvania system, it is important to have a general understanding of recent and anticipated trends in the aviation industry as a whole. When these trends are considered, it is important to review factors that could impact the use of commercial service and general aviation. Some trends in the aviation industry will undoubtedly have a greater impact on Pennsylvania airports than others; in fact, it is possible that some trends that are anticipated and discussed in this chapter may have no pronounced impact on the Commonwealth’s aviation environment.

National, regional, and state trends provide insight for the development of aviation activity projections for the airports in Pennsylvania’s system. These activity projections are used to determine the role of airports within the Commonwealth system, to evaluate the ability of the existing system to accommodate projected aviation demand, and to plan future airside and landside facilities for the system.

Discussed in the following sections are the projections of aviation demand and the aviation industry trends impacting the projections:

- **Industry Trends**
 - *Recent Commercial Trends*
 - *Anticipated Commercial Trends*
 - *Trends Affecting General Aviation Activity*
 - *Pennsylvania Aviation Trends*

- **Projections of Pennsylvania Aviation Demand**
 - *Forecast Assumptions*
 - *Based Aircraft Projections*
 - *Total Aviation Operations Projections*

I. INDUSTRY TRENDS

Trends in the commercial airline industry could substantially impact air service in Pennsylvania, particularly as they relate to how the Commonwealth’s demand for commercial airline travel will be served in the future. Trends in general aviation are also important to consider because almost every airport in the Pennsylvania system, even the air carrier airports, accommodates some segment of general aviation activity. Furthermore, the vast majority of Pennsylvania airports support only general aviation aircraft operations. Having an understanding of the general aviation trends is important in considering the future demand for this component of the industry. Included in this examination of general aviation trends will be a discussion of changing patterns in the business use of general aviation aircraft.

The industry trends section of this chapter documents trends in each of the various components of aviation identified above. Trends presented in this chapter are generally for the U.S. as a whole, and they are intended to provide a general frame of reference for the reader of this report. The trends analysis sets the stage for an understanding of how aviation activity in Pennsylvania compares to aviation in the country, and it establishes a basis for predicting how aviation may be expected to grow and change in the future. Having this frame of reference is essential to identifying viable alternatives for improving Pennsylvania’s airport system.

Historical trends in total statewide based aircraft and operations are also provided in this chapter. This presentation helps to show how demand has changed or shifted throughout the Commonwealth. For airport-specific activity and forecast data, please consult individual airport master plans, action plans, or airport layout plans (ALPs).

A. Recent Commercial Trends

The airline industry operates in a perpetual state of adjustment and change. During the last 20 years, the United States has experienced unprecedented expansion of air carrier capacity and large investments by carriers to control the flow of traffic through networks of hub airports. In various markets, there have been documented skirmishes between the major carriers and new entrants. Where competition prevailed, air passengers reaped the rewards of low fares. At single carrier hubs and local airports, passengers paid, on average, much higher fares. Then, in the late 1980s, the carriers lost millions of dollars. Those losses had a profound effect on the way airlines operated. Some of the most dramatic changes that occurred included the sudden and complete shutdown of several hub operations and the demise of several flagship carriers, notably Eastern Airlines, Braniff, and Pan Am.

The 1990s ushered in a new period of mergers, global alliances, and joint marketing agreements, as well as domestic alliances between major and regional carriers. In addition, there have been significant structural changes in the way airlines conduct business. The airlines have examined every aspect of their operations to reduce costs. A “shifting downstream” of service to smaller communities marked the mid-1990s. The regional carriers, with generally lower labor costs, came into their own. Shorter haul service to hub airports was turned over to the regional carriers and they provided high frequency, turboprop service to and from their major carrier affiliate’s hub airport. For many communities, the turboprops were never fully accepted. As the domestic system solidified, the major carriers have re-entered this segment of the airline business by acquisition of the regional carriers and by replacement of turboprops with regional jets. This process has left smaller cities with few options for air service.

Four major factors that have helped to shape the development of today’s commercial airline industry are as follows:

- A robust, but cyclical economy – trends in commercial passenger boardings, when compared to the U.S. Gross Domestic Product, indicate a direct relationship between periods of GDP growth and decline to periods of increases and decreases in the total number of U.S. commercial passenger boardings. These trends clearly indicate that the

airline industry and commercial passenger traffic are significantly impacted by upturns and downturns in the U.S. economy. Since the early 1990s, the steady growth in the U.S. economy has resulted in a lengthy period of significant increases in total commercial passenger traffic.

- Over-expansion of the airline industry in the late 1980s – The over-expansion of the airline industry that was experienced in the late 1980s was a major factor that caused airlines to lose over \$13 billion during the early 1990s, the largest losses ever experienced. As a result of these losses, airlines were forced to re-evaluate their systems and make the following changes:
 - Implement major adjustments to their route structures, concentrating on the most profitable routes.
 - Increase seating capacity and maximize frequencies to achieve higher load factors.
 - Eliminate secondary connecting hubs and introduce point-to-point service in the larger markets.
 - Focus on the development of strategic marketing alliances with regional carriers in the U.S. and other airlines abroad.
 - Rationalize aircraft fleets that, on average, offered lower operating costs.

- Widespread adoption of similar, successful strategies by each of the major carriers – The 3- to 5-year long-term planning horizons under which most airlines operate allow them to observe and quickly emulate the successful strategies of their competitors. This copycat approach to providing air service has resulted in several episodic waves of strategic changes by the airlines. The following are examples of these types of actions that have been taken by most major airlines:
 - Development of hub fortresses to capture and control traffic flows.
 - Initiation of frequent flyer programs.
 - Emulation of Southwest Airlines .
 - Code-sharing alliances with regional carriers.
 - Replacement of jets with turboprop or regional jet aircraft.
 - Abandonment/reduction of 19-seat aircraft.
 - Acquisition of whole or part of code-sharing partners.

Widespread adoption of these strategies has intensified their impact on air service within the U.S.

- Technological advances including computer reservation systems, yield management, and e-commerce – The use of computers has had a profound impact on the air carrier industry from the standpoint of operations, marketing, pricing, and ticket distribution. One of the most significant changes has been the ability of airlines to implement Yield Management Systems that allow them to constantly track price, bookings, and fare information for many airlines. These systems allow airlines to have up-to-the-minute information about passenger demand and fares, which allows their pricing departments to constantly adjust fares, frequently over one million times per day, to adjust the number of seats and airfares

to maximize load factors and revenues. In addition, the recent growth in the use of electronic and paperless tickets, as well as the direct purchase of tickets from the airlines, as opposed to the traditional travel agent process, has also significantly impacted the industry.

B. Anticipated Commercial Trends

The preceding descriptions of historic commercial airline trends are the background from which the Federal Aviation Administration (FAA) has developed forecasts of future levels of commercial passenger activity. The most recent forecasts of commercial passenger activity presented by the FAA in *FAA Aerospace Forecasts, Fiscal Years 2001-2012* reflect anticipated strong growth over the study period in both domestic and international passenger activity at U.S. airports. The following paragraphs summarize the FAA's forecasts of future commercial airline passenger activity.

Based on the FAA's forecast of continued, yet slowing, economic expansion in the U.S. over the forecast period, commercial passenger enplanements in the U.S. are anticipated to experience sustained growth throughout the forecast period. The FAA projects that total domestic passenger enplanements on large U.S. carriers and regional/commuter carriers combined will increase from approximately 639.1 million in 2000 to approximately 982.9 million in 2012, representing an average annual growth rate of approximately 3.6 percent.

FAA forecasts of international passenger activity are based on the assumption that the world economy (based on international GDPs) will grow at a pace that exceeds the U.S. GDP growth over the forecast period. Based on this assumption, international passenger enplanements on U.S. carriers are projected to increase from approximately 54.6 million in 2000 to approximately 111.0 million in 2012. This growth represents a relatively robust forecasted average annual growth rate of approximately 6.1 percent. The strongest growth in total international passenger traffic on U.S. carriers is anticipated to be experienced in the Latin American and Pacific markets, forecast to grow at average annual rates of approximately 6.8 percent and 6.2 percent, respectively. The average annual growth rate in the Atlantic market is projected at approximately 5.2 percent between 2000 and 2012.

Table 4-1 presents a summary of historic passenger enplanement levels at U.S. airports and the FAA's most recent domestic and international passenger enplanement forecasts on U.S. carriers (large air carriers and regional/commuter carriers) for each year in forecast period.

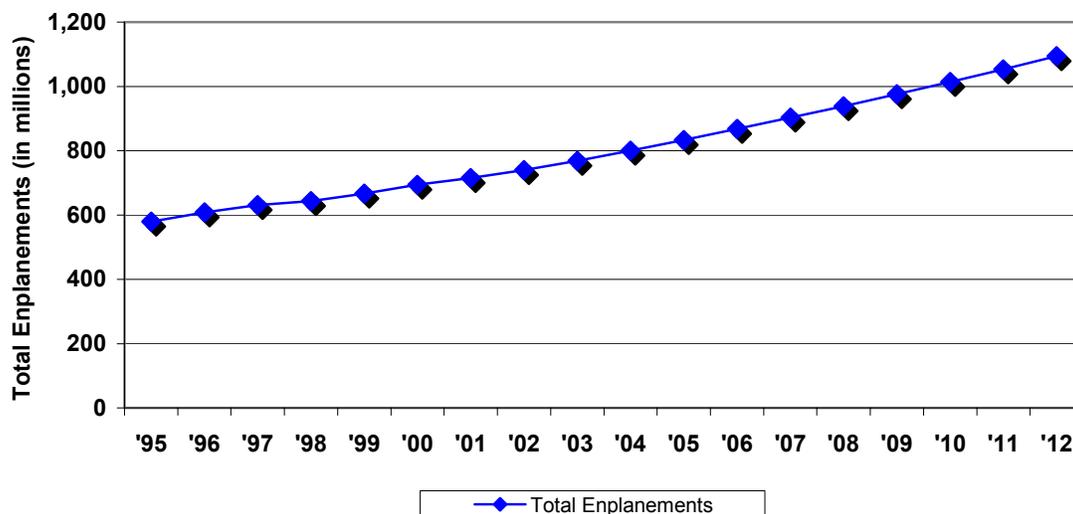
**Table 4-1
Projection Of U.S. Carrier Enplanements**

Year	Domestic Enplanements (millions)	International Enplanements (millions)	Total Enplanements (millions)
Historical			
1995	531.1	48.6	579.7
1996	558.1	50.0	608.1
1997	579.1	52.3	631.4
1998	590.4	53.1	643.5
1999	612.9	53.3	666.2
2000	639.1	54.6	693.7
Average Annual Growth Rate 1995-2000	3.8 %	2.4 %	3.7 %
Forecast			
2001	657.2	58.1	715.3
2002	678.1	62.1	740.1
2003	702.2	66.4	768.6
2004	728.8	70.8	799.6
2005	757.8	75.2	833.1
2006	788.4	79.6	868.0
2007	818.8	84.1	902.9
2008	849.5	89.1	938.6
2009	881.1	94.3	975.4
2010	913.8	99.8	1,013.5
2011	947.7	105.4	1,053.1
2012	982.9	111.0	1,093.9
Average Annual Growth Rate 2000-2012	3.6%	6.1 %	3.9 %

Source: FAA Aerospace Forecasts, Fiscal Years 2001 – 2012

U.S. carrier total passenger enplanement data presented in the Table 4-1 is depicted in **Exhibit 4-1**.

**Exhibit 4-1
Projection Of Total U.S. Enplanements**



Source: FAA Aerospace Forecasts, Fiscal Years 2001 – 2012

In summary, current FAA forecasts for commercial passenger activity for U.S. carriers project stable and relatively strong growth in both domestic and international enplanements at U.S. airports. Domestic passenger enplanements are projected to increase at an average annual rate of approximately 3.6 percent from 2000 to 2012, slightly below the growth rate experienced at U.S. airports between 1995 and 2000. International passenger enplanements are projected to increase at an average annual rate of approximately 6.1 percent over the forecast period, a rate significantly greater than the 2.4 percent average annual growth rate experienced in this category of enplanements between 1995 and 2000.

The FAA also forecasts other factors related to U.S. commercial large air carrier domestic passenger activity. According to *FAA Aerospace Forecasts, Fiscal Years 2001-2012*, between 2000 and 2012 air carrier aircraft operations are projected to increase from 15.2 million to 21.8 million; average passenger trip length is expected to increase from 832.3 to 887.3 miles; average seats per aircraft departure will increase from 139.3 to 147.4; and the average load factor is expected to drop slightly from 70.9 percent to 70.5 percent.

The FAA also forecasts that aircraft operations for regional/commuter carriers will increase from 10.8 million to 14.3 million between 2000 and 2012; average passenger trip length is expected to increase from 280.4 to 338.8 miles; average seats per aircraft departure will increase from 37.5 to 46.0; and the average load factor is expected to increase from 59.0 percent to 62.8 percent.

C. Trends Affecting General Aviation Activity

General aviation aircraft are all aircraft that are not flown by airlines or the military; this class of aircraft operates at each Pennsylvania airport. Following a decline that lasted throughout most of the 1980s and into the mid-1990s, the general aviation industry and general aviation activity

appear to be revitalized. Prior to 1994, declines in the number of manufacturers and shipments of single-engine aircraft continued to indicate a sagging general aviation industry. Other indicators such as active aircraft, hours flown, and active pilots, all of which are important indicators of the overall health of the general aviation industry, also declined annually during that time period. The impact of this downturn was the decline in production of new aircraft from almost 18,000 aircraft in 1978 to a low of 928 aircraft in 1994. This decline in the production of new aircraft resulted in the loss of approximately 100,000 jobs in the industry.

The enactment of the General Aviation Revitalization Act of 1994, which established an 18-year Statute of Repose on all general aviation aircraft and components, in terms of liability to the manufacturer, signaled a significant change in the industry. This Act spurred manufacturers such as Cessna and Piper Aircraft to reenter the single-engine piston manufacturing sector. In January 1997, Cessna produced its first new single-engine aircraft since 1986. Lancer International, Diamond Aircraft, and Mooney are also producing new piston aircraft domestically.

The positive impacts that the Act has had on the general aviation industry since its passage are currently reflected in general aviation activity statistics. Since 1994, activity statistics indicate an increase in general aviation activity at FAA air traffic facilities, an increase in the active general aviation aircraft fleet size, and record shipments and billings of fixed-wing general aviation aircraft. These recent positive trends in the general aviation industry are anticipated to continue into the future due to a number of factors, including the following:

- ❑ Construction of new aircraft manufacturing facilities
- ❑ Expansion of existing manufacturing facilities
- ❑ Increased expenditures on research and development of aircraft and avionics intended to make flying even safer and easier to learn

In addition, the general aviation industry is giving increased attention to “learn to fly” educational and promotional activities that should bring new pilots and aircraft mechanics into the industry.

Specific trends related to general aviation activity, as identified in the *FAA Aerospace Forecasts, Fiscal Years 2001-2012* developed by the U.S. Department of Transportation and other national groups, are identified in following sections. These anticipated future trends are discussed in terms of the number of aircraft shipments and billings, active aircraft and pilots, changes in the active aircraft fleet mix, and business use of general aviation aircraft.

1. Aircraft Shipments and Billings

The General Aviation Manufacturers Association (GAMA) tracks and reports total shipments and billings of general aviation aircraft. GAMA statistics for 2000 indicate continued strong growth in the sales of general aviation aircraft, both piston and turbojet. During 2000, general aviation aircraft shipments totaled 2,816 aircraft, an increase of approximately of 12.5 percent over 1999. This represents the sixth consecutive year of increased demand for general aviation aircraft. Statistics also indicate that growth in turboprop and jet aircraft shipments are outpacing other sectors of the general aviation aircraft market. A number of factors contribute to this

increase in general aviation aircraft shipments, such as the introduction new aircraft (including three new Cessna Citation business jets), the general strength of the U.S. economy, increases in the number of fractional ownership arrangements, and increases in the number of traditional corporate flight departments among U.S. businesses.

In addition, GAMA tracks total billings of general aviation aircraft, for both domestic and international customers. During 2000, aircraft billings totaled over \$8.6 billion, an increase of approximately 9.1 percent over total billings in 1999. Total billings have nearly quadrupled since the early 1990s. Currently, international general aviation shipments and billings represent nearly 21 percent of the U.S. manufactured aircraft.

Table 4-2 presents total general aviation aircraft shipments and billings, on an annual basis, over the time period 1990 through 2000.

**Table 4-2
Historic General Aviation Aircraft Shipments And Billings**

Year	Total General Aviation Aircraft Shipments	Total General Aviation Aircraft Billings (\$ millions)
1990	1,144	2,007.5
1991	1,021	1,968.3
1992	941	1,839.6
1993	964	2,143.8
1994	928	2,357.1
1995	1,077	2,841.9
1996	1,130	3,126.5
1997	1,569	4,674.3
1998	2,200	5,873.9
1999	2,504	7,843.6
2000	2,816	8,558.4

Source: General Aviation Manufacturers Association

The statistics presented by GAMA illustrate the continued strength of the general aviation aircraft manufacturing industry. In addition to the significant increases in total shipments and billings of general aviation aircraft in recent years, it is important to note that the strongest growth appears to be occurring in the jet and turboprop segments of the market. The growth in these segments can be attributed to increased business use of aircraft, and their desire to operate safe, efficient, and high-performance aircraft. These high-performance aircraft require airport facilities to be developed to a relatively higher and more demanding standard, a factor that will be considered as system development plans are identified in this analysis.

2. Active Pilots

In 1999, the four major segments of the pilot population (student pilots, private pilots, commercial pilots, and airline transport pilots) each experienced growth. As a result, the total number of active pilots increased to approximately 648,539 pilots in 2000, an increase of almost 13,000 pilots compared to 1999. One of the strongest growth rates was experienced in the student pilot population, which increased by approximately 7.0 percent. These students

represent the future of general aviation and are not only learning to fly for recreational reasons, but also because of career opportunities created by the needs of air carriers, fractional ownership providers, and corporate flight departments. Also worthy of noting is the 2.0 percent growth rate experienced in instrument-rated pilots in 2000. Currently, approximately 48.6 percent of the total active pilot population is instrument-rated, another reflection of the increased sophistication of aircraft and pilots.

The FAA has developed forecasts of the future pilot population, by certificate type, based on historic trends, as well as anticipated future trends. These projections estimate that the total active pilot population in the U.S. will increase from 648,539 in 2000 to 827,177 by 2012, representing an average annual growth rate of approximately 2.0 percent.

Table 4-3 presents the FAA forecasts of the active pilot population, by pilot certificate type, on an annual basis over the forecast period.

**Table 4-3
Projection Of Active Pilots, By Type Of Certificate**

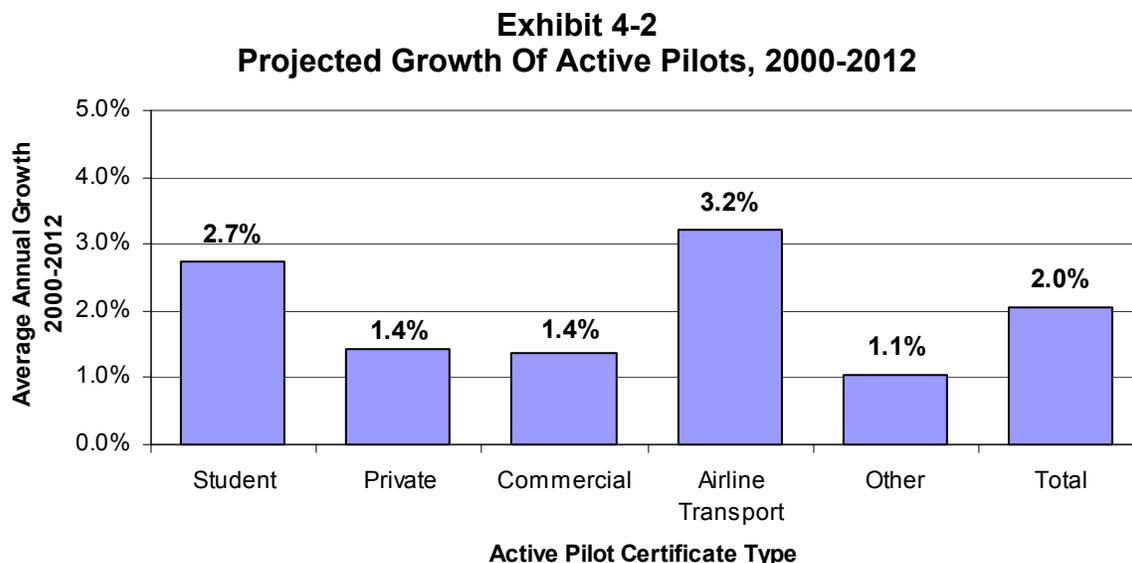
Year	Student	Private	Commercial	Airline Transport	Other 1/	Total
Historical						
1995	101,279	261,399	133,980	123,877	18,417	639,184
1996	94,947	254,002	129,187	127,486	16,639	622,261
1997	96,101	247,604	125,300	130,858	16,479	616,342
1998	97,736	247,226	122,053	134,612	16,671	618,298
1999	97,359	258,749	124,261	137,642	17,461	640,113
2000	104,150	260,700	126,200	139,700	17,789	648,539
Average Annual Growth Rate 1995-2000	0.6%	-0.1%	-1.2%	2.4%	-0.9%	0.3%
Forecast						
2001	107,600	267,400	128,400	144,400	18,104	665,904
2002	110,500	272,000	130,600	149,500	18,348	680,948
2003	113,500	277,500	133,300	154,400	18,563	697,263
2004	116,600	283,700	136,300	159,300	18,717	714,617
2005	119,700	288,000	138,300	164,000	18,882	728,882
2006	122,900	291,400	139,900	169,300	19,076	742,576
2007	126,200	294,600	141,500	174,400	19,265	755,965
2008	129,600	297,600	142,900	180,000	19,465	769,565
2009	133,100	300,600	144,300	186,000	19,664	783,664
2010	136,700	303,600	145,800	192,000	19,829	797,929
2011	140,400	306,600	147,300	198,100	20,003	812,403
2012	144,200	309,600	148,800	204,400	20,177	827,177
Average Annual Growth Rate 2000-2012	2.7%	1.4%	1.4%	3.2%	1.1%	2.0%

Sources: FAA U.S. Civil Aviation Registry; FAA Aerospace Forecasts, Fiscal Years 2001 – 2012

Note: 1/ Other pilot category includes pilots with recreational, rotorcraft-only, and glider-only certificates.

As shown in Table 4-3, the student and airline transport categories of pilots are anticipated to experience the strongest growth over the 12-year forecast period, experiencing average annual growth rates of 2.7 percent and 3.2 percent, respectively. The populations of both private and commercial pilots are anticipated to increase at an average annual rate of 1.4 percent over the forecast period.

Exhibit 4-2 compares the average annual growth rate projected for each pilot type during the study period 2000 to 2012.



Source: FAA Aerospace Forecasts, Fiscal Years 2001 - 2012
 Note: Includes aircraft classified by FAA as experimental and other.

The data presented in Exhibit 4-2 show relatively strong growth, ranging from an average annual rate of 1.1 percent in the “other” pilot category to an average annual rate of 3.2 percent in the airline transport pilot category. The strong growth anticipated in the student pilot category is important to note because of the potential impacts that this growing number of pilots may have on all components of general aviation activity in the future. Student pilots, in most cases, will graduate to become active private, commercial, and/or airline transport pilots, which in turn may impact overall active aircraft fleet and general aviation activity statistics.

3. Aircraft Fleet

The FAA annually tracks the number of active aircraft in the U.S. Active aircraft are those aircraft that are currently registered and fly at least one hour during the year. By tracking this information, the FAA is able to identify trends in the total number of active aircraft, as well as the types of aircraft operating in the active fleet. Based on FAA estimates, the active general aviation aircraft fleet is anticipated to increase from 221,213 aircraft in 1999 to 245,965 in 2012, representing an average annual growth rate of approximately 0.9 percent. FAA forecasts for the total active aircraft fleet, as well as each major type of aircraft, are summarized in **Table 4-4**.

**Table 4-4
Projected Active Aircraft Fleet**

Aircraft Type	2000	2012	Average Annual Growth Rate
Single-engine piston	151,640	164,800	0.7%
Multi-engine piston	21,143	21,200	0.0%
Turboprop	5,736	6,600	1.2%
Jet	7,440	12,280	4.3%
Rotorcraft	7,649	9,460	1.8%
Other 1/	27,605	31,625	1.1%
TOTAL	221,213	245,965	0.9%

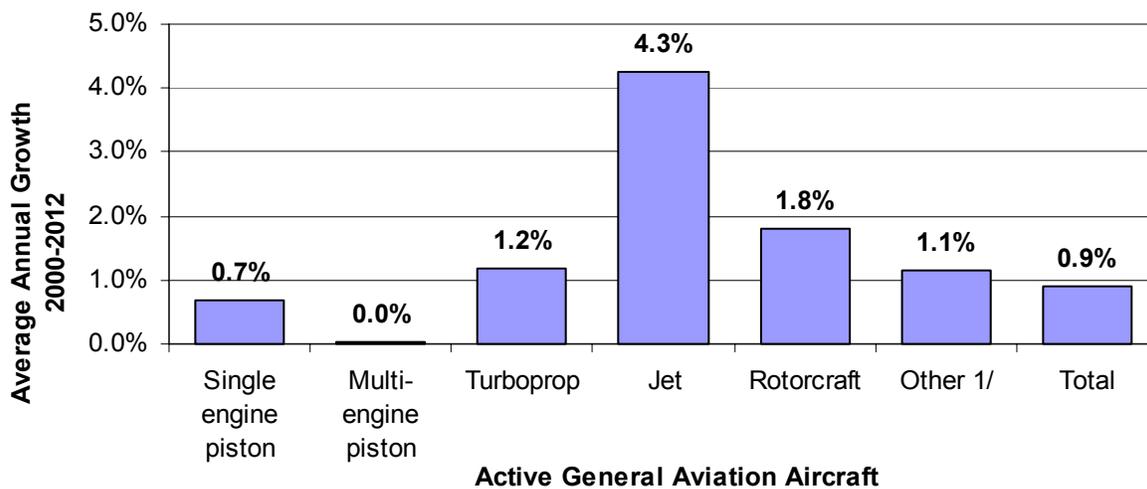
Source: FAA Aerospace Forecasts, Fiscal Years 2001-2012

Note: 1/ Includes aircraft classified by FAA as experimental and other.

As shown in Table 4-4, the total active aircraft fleet is forecasted to experience an average annual growth rate of below 1 percent. One of the most important trends identified in these forecasts is the relatively strong growth anticipated in active jet aircraft. This trend illustrates a movement in the general aviation community towards higher-performing, more demanding aircraft. This trend will impact the types of activities occurring at general aviation airports and the types of facilities that may be required at those airports.

Exhibit 4-3 compares the projected average annual growth rate for each type of aircraft in the fleet mix over the period 2000 through 2012. The graph illustrates the extent to which the growth in jet aircraft is projected to significantly outpace growth in all other components of the aircraft fleet. As shown, turboprop, rotorcraft, and other aircraft are projected to experience an average annual growth rate of over 1 percent per year over the forecast period, while the number of active multi-engine piston aircraft is anticipated to remain stable over the forecast period.

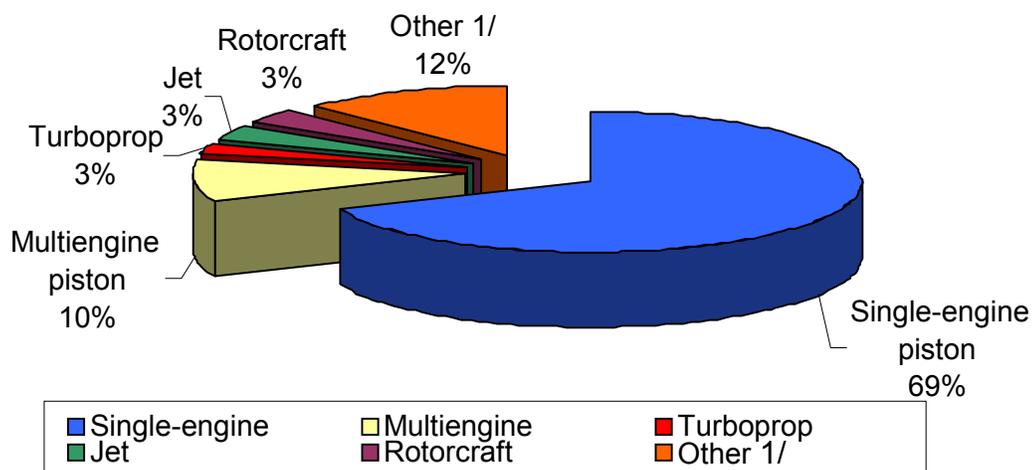
Exhibit 4-3
Projected Growth Of General Aviation Aircraft, 2000-2012



Source: FAA Aerospace Forecasts, Fiscal Years 2001-2012
 Note: 1/ Includes aircraft classified by FAA as experimental and other.

It is also useful to examine the existing and anticipated active aircraft fleet in terms of the percentage of the total fleet that each aircraft class represents. **Exhibit 4-4** presents the existing mix of the 2000 active fleet, and **Exhibit 4-5** presents the anticipated mix projected for the fleet of 2012.

Exhibit 4-4
General Aviation Aircraft Fleet Mix, 2000

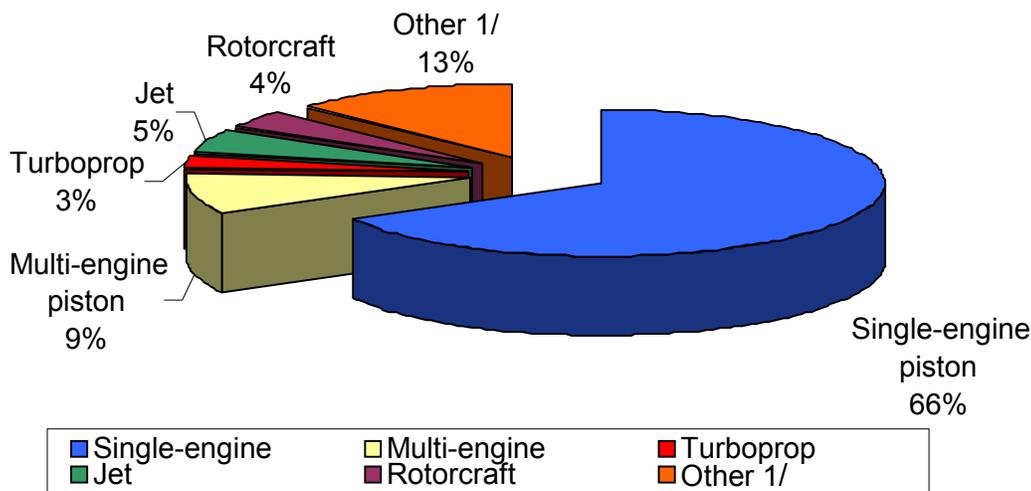


Source: FAA Aerospace Forecasts, Fiscal Years 2001-2012
 Notes: 1/ Includes both gliders and lighter-than-air aircraft.

As shown in Exhibit 4-4, the majority of the active aircraft in the current fleet are single-engine piston aircraft. As shown in Exhibit 4-5, it is anticipated that the percentage of single-engine

piston aircraft will decline from 69 percent to 66 percent of the active fleet, as older aircraft are retired and replaced with more demanding general aviation aircraft.

**Exhibit 4-5
Projected General Aviation Aircraft Fleet Mix, 2012**



Source: FAA Aerospace Forecasts, Fiscal Years 2001-2012
Notes: 1/ Includes both gliders and lighter-than-air aircraft.

Forecast data presented by the FAA indicates that each component of the general aviation aircraft fleet mix will either remain steady (multi-engine piston) or grow in terms of total number of active aircraft. Data depicted in the previous exhibits indicates that jet and other aircraft will be the only components of the general aviation aircraft fleet mix that will see their share of the active fleet grow over the forecast period. Jet aircraft are anticipated to grow from approximately 3 percent of the active general aviation fleet mix in 2000 to approximately 5 percent of the active fleet by 2012, indicating the relative increase in sophistication that is anticipated in the active aircraft fleet and pilot population. The “other” category of aircraft is also forecasted to become a larger component of the active fleet, primarily because of growth in experimental aircraft, growing from approximately 12 percent of the fleet to 13 percent of the fleet by 2012.

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

- ❑ Recent and continued increases in the number of annual general aviation aircraft shipments
- ❑ Growth in the number of licensed pilots augmented by a relatively strong growth in the number of student pilots
- ❑ Moderate growth in the active aircraft fleet and a trend towards the operation of more demanding and more sophisticated jet aircraft, as opposed to piston or turboprop aircraft

4. Business Use of General Aviation Aircraft

Many businesses throughout the U.S. depend on scheduled commercial service airlines, as well as general aviation aircraft, to add to their productivity and efficiency. Pennsylvania's airports are essential to economic progress of the citizens and businesses of Pennsylvania. Without these airports, the Commonwealth would be severely hampered in its ability to participate in an increasingly global community and marketplace. Air transportation makes possible the quick movement of millions of people and billions of dollars worth of goods to markets around the world. Pennsylvania needs to be able to compete in those markets, and there is often no practical alternative to air transportation. Similarly, the growth of a competitive domestic economy depends more and more on our ability to move by air.

A major benefit of Pennsylvania's airports is the Commonwealth's ability to use air transportation to support its competitive advantage in a global economy. Today's economy can present commercial opportunities at any time and in any place. To remain competitive and take advantage of those opportunities, the businesses of Pennsylvania must be able to move people and products anywhere in the world safely, quickly, and conveniently. Air transportation is the preeminent means for commerce and communication among people, with long-range jet aircraft providing nonstop air service to major cities. In addition to the use of scheduled commercial airline services, more and more businesses throughout the nation are looking to general aviation aircraft, and the flexibility and efficiency that they provide, to support their domestic and international business operations.

Many of the nation's leading employers that use general aviation as a business tool are members of the National Business Aircraft Association (NBAA). Data from NBAA shows that many of the top U.S. businesses use general aviation aircraft. The NBAA's Business Aviation Fact Book 2000 indicates that approximately 70 percent of all businesses included in the *Fortune 500* operate general aviation aircraft. In addition, 90 of the *Fortune 100* companies operate general aviation aircraft. A detailed analysis conducted for NBAA in 1998 also indicated that among the Fortune 500 there were more than twice as many companies operating general aviation aircraft as nonoperators.

Business use of general aviation aircraft can range from the rental of small, single-engine aircraft to multiple aircraft corporate fleets that are supported by dedicated flight crews and mechanics. The use of general aviation aircraft allows employers to efficiently transport priority personnel and air cargo. Businesses use general aviation aircraft to link multiple office locations and to reach existing and potential customers. The use of business aircraft by smaller companies has escalated as various chartering, leasing, time-sharing, interchange agreements, partnerships, and management contracts have emerged. NBAA statistics support this claim by indicating that the number of flight departments among all the nation's businesses had increased from 6,584 in 1991 to 8,778 in 1999, an increase of approximately 33 percent. Fractional ownership arrangements have also experienced a recent trend of rapid growth. In 1998, NBAA estimated that 1,125 companies used fractional ownership arrangements; by 1999, that number had grown to 1,693 companies, a growth of over 50 percent in a single year.

Regardless of how the aircraft are owned or what type of aircraft is flown, businesses choose to use general aviation because it provides safe, efficient, flexible, and reliable transportation. Of all the benefits provided to businesses by general aviation, flexibility is the most valued by all businesses using general aviation aircraft. While there are many reasons that businesses use general aviation in their day-to-day operations, some of the most important factors, according to the businesses themselves, are as follows:

- ❑ Flexibility
- ❑ Time Savings
- ❑ Reliability
- ❑ Safety
- ❑ Improved Marketing Efficiency
- ❑ Facility/Branch Office Control
- ❑ Personnel Development Training
- ❑ Privacy and Comfort
- ❑ Efficiency
- ❑ Security

One other benefit that is becoming increasingly important to both employees and employers using general aviation aircraft for business travel is that it minimizes non-business hours away from home. Using business aircraft increases the flexibility of scheduling and provides rapid, safe, and efficient access to meeting locations. These factors allow employees using general aviation aircraft to travel to and from their destination in less time than would be required in a traditional commercial service airline schedule that includes layovers, delays, and other time-consuming events. The positive effect that minimizing non-business time away from home has on employee morale and productivity is impossible to measure, yet growing in importance.

The use of general aviation as a business tool adds to productivity and to the bottom line. According to an NBAA survey of key *Forbes* and *Fortune 500* companies, those businesses that use general aviation aircraft routinely significantly outperform businesses who do not use general aviation aircraft. Performance indicators such as annual sales, number of employees, value of assets, and annual income are significantly higher for employers using general aviation aircraft.

D. Pennsylvania Aviation Trends

Data regarding historic activity levels at Pennsylvania airports is presented in the following sections. Airport activity data typically provides a good indication of not only the total amounts of activity occurring at an airport, but also recent increases or declines in activity levels that may have been experienced at Pennsylvania facilities. Data will be presented for the following components of airport activity:

- ❑ Based Aircraft
- ❑ Total Aircraft Operations

Many of the airports in the Pennsylvania SASP report based aircraft and operations annually to the FAA. The FAA in turn publishes the information and provides projections of activity for each airport in its *Terminal Area Forecasts*. However, in 1999, 49 percent of the airports in the SASP were included in the statewide NPIAS and were required to report aviation activity to the FAA's *Terminal Area Forecasts*.

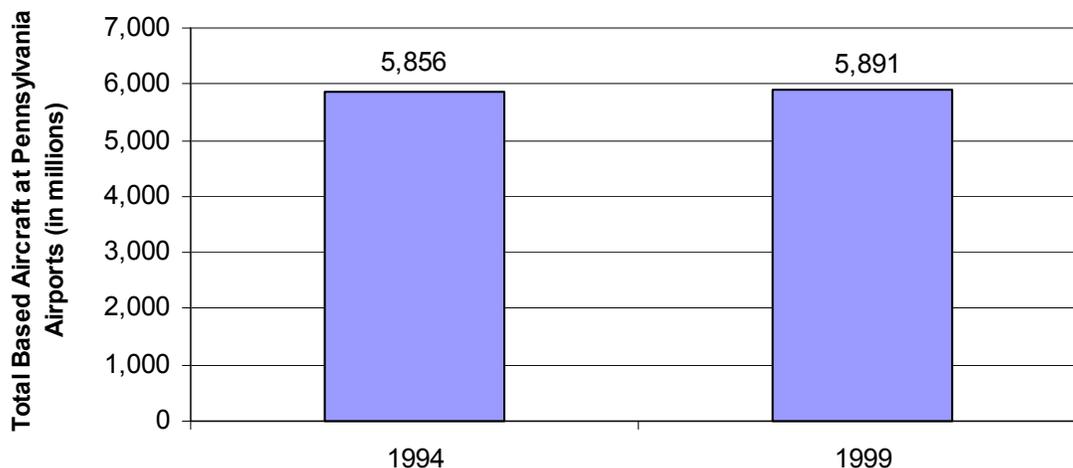
For the other 51 percent of Pennsylvania's system airports, historic based aircraft and operations data was obtained in the inventory process of the SASP. Data was collected during onsite airport visits and discussions with airport managers. This data however, is not collected annually. The last time the data was collected was for the 1994 Pennsylvania State Aviation System Plan. For this reason, a historic comparison of airports in Pennsylvania can only be made for the five-year period from 1994 to 1999.

1. Based Aircraft

Exhibit 4-6 presents based aircraft data for Pennsylvania's airports. Based aircraft are those general aviation aircraft that are permanently stored at an airport either in aircraft storage hangar units or tied down. Based aircraft numbers at airports frequently fluctuate based on a number of factors, including pilot preferences and availability of aircraft storage hangar units.

Total based aircraft at Pennsylvania public use airports were approximately 5,856 in 1994. Over the five-year period, total based aircraft in the Commonwealth have grown slightly to 5,891, an overall increase of 0.6 percent. On an average annual basis, total based aircraft have grown at a rate of approximately 0.1 percent.

**Exhibit 4-6
Historic Based Aircraft In Pennsylvania**



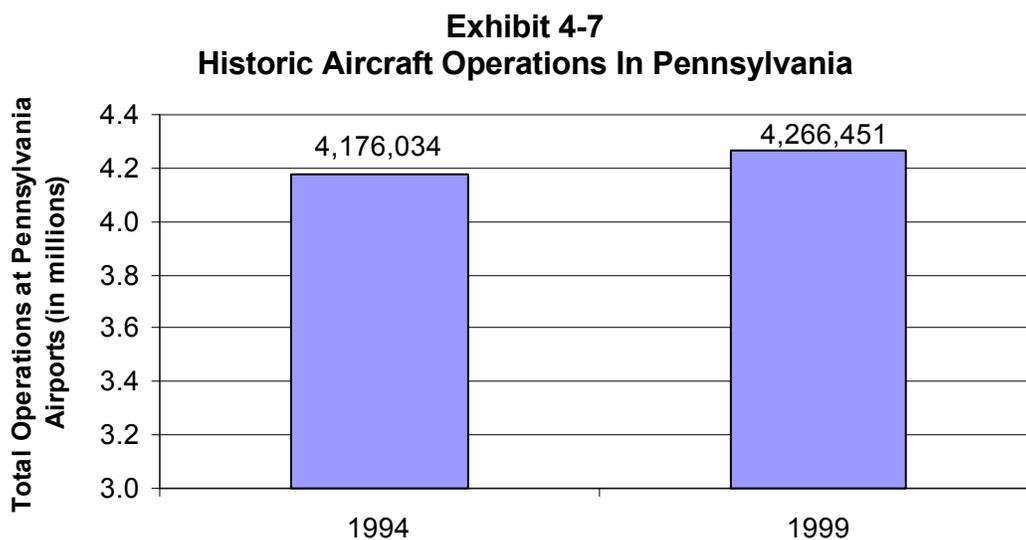
Source: Wilbur Smith Associates, Inc.

While the FAA does not track based aircraft, they do track active aircraft nationally through a survey titled "General Aviation and Air Taxi Activity Survey." The results of the survey show that the active fleet in the U.S. has increased for five consecutive years, with an overall increase of over 18 percent. The most recent survey period showed an average annual growth rate of 3.3

percent in national active aircraft. The FAA projects that active general aviation aircraft will increase at an average annual rate of 0.9 percent over the 2000 to 2012 period. This rate is higher than the rate at which Pennsylvania’s total based aircraft have grown in the most recent five-year period.

2. Total Aircraft Operations

Historic total operations data for Pennsylvania general aviation airports is presented in **Exhibit 4-7**. It is important to note that, at those airports without an FAA Tower, aircraft operations data represents “best guess” estimates that were made by airport managers/operators.



Source: Wilbur Smith Associates, Inc.

Total aircraft operations at public use airports in Pennsylvania were approximately 4.18 million in 1994. Over the 5-year period, total aircraft operations in the Commonwealth have grown slightly to 4.27 million, an overall increase of 2.2 percent. On an average annual basis, total aircraft operations have grown at a rate of approximately 0.43 percent. Comparatively, aircraft operations recorded by the FAA at U.S. towered airports grew at an average annual rate of 1.7 percent between 1995 and 2000. The FAA projects that general aviation activity at U.S. towered airports will increase at an average annual rate of 2.5 percent over the 2000 to 2012 period.

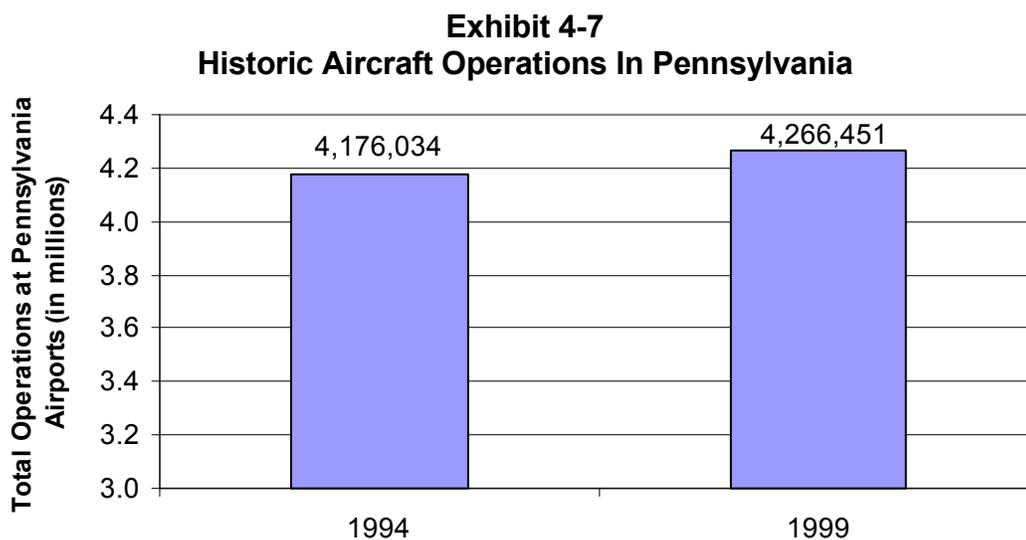
II. PROJECTIONS OF PENNSYLVANIA AVIATION DEMAND

The development of aviation activity projections for Pennsylvania's aviation system is a critical step in assessing the need for and phasing of future development requirements. For the purpose of the SASP projections, the airports in the Commonwealth have been grouped into districts. The 11 districts are equivalent to the Engineering Districts defined by the Pennsylvania Department of Transportation. The Districts and the counties, as well as the airports that are located in each district, are graphically depicted in **Exhibit 4-8**. In **Table 4-5**, the counties and airports in each aviation district are listed.

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Source: Wilbur Smith Associates, Inc.

Total aircraft operations at public use airports in Pennsylvania were approximately 4.18 million in 1994. Over the 5-year period, total aircraft operations in the Commonwealth have grown slightly to 4.27 million, an overall increase of 2.2 percent. On an average annual basis, total aircraft operations have grown at a rate of approximately 0.43 percent. Comparatively, aircraft operations recorded by the FAA at U.S. towered airports grew at an average annual rate of 1.7 percent between 1995 and 2000. The FAA projects that general aviation activity at U.S. towered airports will increase at an average annual rate of 2.5 percent over the 2000 to 2012 period.

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The assumptions and methodologies used to prepare aviation demand projections for the districts in Pennsylvania as part of the State Aviation System Plan are discussed in the following sections:

- Forecast Assumptions
- Based Aircraft Projections
- Total Aircraft Operations Projections

A. Forecast Assumptions

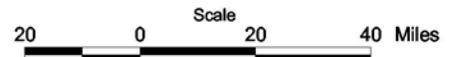
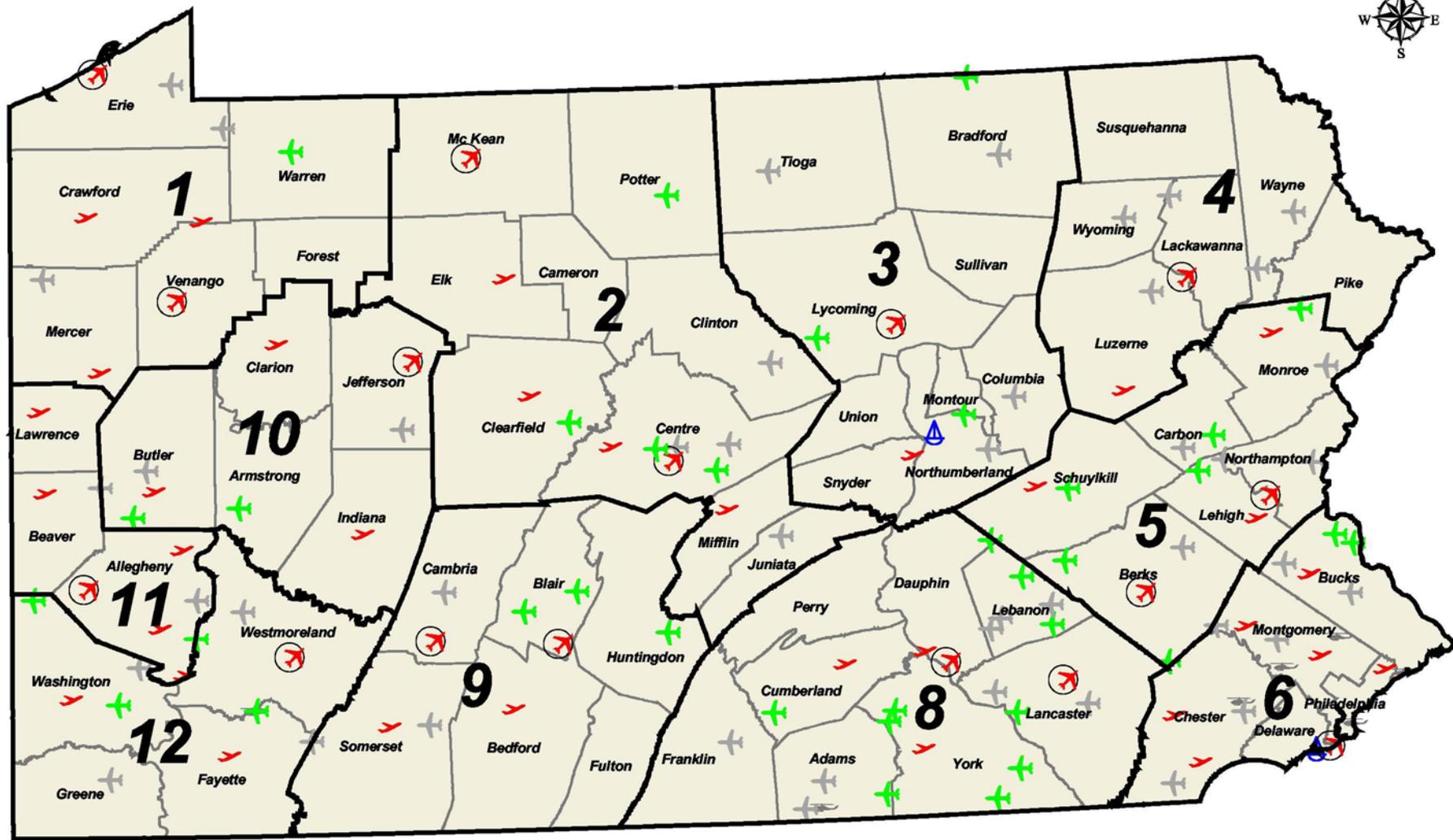
The general approach often used to develop aviation forecasts is to identify historic relationships between state aviation factors and U.S. aviation activity. As discussed in the previous section, reliable historical data for each airport in the Commonwealth is not readily available for various activity indicators for the Pennsylvania State Aviation System Plan. Consistent historic data for the Pennsylvania airports is only available for the years 1994 and 1999.

A major concern of the Pennsylvania Department of Transportation has been the accuracy of the historic aviation activity data. Because based aircraft figures can be more easily counted than aircraft operations, greater confidence can be placed in the number of based aircraft reported by the individual airports. This provides a more accurate baseline for based aircraft projections, as well as future historic trends analysis. Aircraft operations data, on the other hand, represents "best guess" estimates that were made by airport managers/operators at general aviation airports without an air traffic control tower. In many instances, these "best guess" estimates of aircraft operations may have been inflated based on the subjective nature of the process. Broad airport activity estimations have been the case not only for Pennsylvania airports. Many other states throughout the U.S. experience a similar overstatement of aviation activity.

Due to a lack of accurate historic based aircraft and aviation operations data at all Pennsylvania airports, the presentation of the national trends, as discussed in previous sections of this chapter, is important to understanding how Pennsylvania's aviation activity is expected to change. National and regional aviation historic and projected growth rates are presented in this section. This growth rate comparison provides an indication of an appropriate projection methodology for based aircraft and operations activity in the Commonwealth.

1. Based Aircraft Trends

Table 4-6 shows the variety of sources that have developed projections of based aircraft. FAA projections have been prepared on national, regional, and state levels, based largely on historic growth trends, as well as industry dynamics. Delaware Valley Regional Planning Commission (DVRPC) also developed projections of based aircraft for the airports in the metropolitan Philadelphia area. Each projection is discussed briefly below.



Legend		
Aviation District		
Airport Level of Service		
1	Aviation District	(Red circle with wings) Scheduled Service
(Grey outline)	Political Boundary	(Green cross) General Service (Grass)
		(Grey cross) General Service (Paved)
		(Blue triangle) Seaplane Service
		(Grey circle with wings) Heliport Service
		(Red arrow) Business Service

Source: National Transportation Atlas Database and Pennsylvania Department of Transportation

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 Exhibit 4-8
 Pennsylvania Aviation Service Districts

**TABLE 4-5
PENNSYLVANIA AVIATION DISTRICTS**

DISTRICT	PA County	Airport(s) included in District
DISTRICT 1	Crawford Erie Mercer Venango Warren	Port Meadville Erie County, Erie International* Greenville, Grove City Titusville, Venango Regional* Brokenstraw, Corry-Lawrence
DISTRICT 2	Centre Clearfield Clinton Elk Juniata McKean Mifflin Potter	Bellefonte, Centre, Mid-State, Penn's Cave, Ridge Soaring Gliderport, University Park* Albert, Clearfield Lawrence William T. Piper St. Marys Municipal Mifflintown, EWT-4 Bradford Regional* Mifflin County Cherry Springs
DISTRICT 3	Bradford Columbia Lycoming Northumberland Snyder Tioga	Blue Swan, Bradford County Bloomsburg Municipal Jersey Shore, Williamsport* Danville, Northumberland County, Sunbury, Sunbury SPB Penn Valley Grand Canyon
DISTRICT 4	Lackawanna Luzerne Wayne Wyoming	Seamans Field Hazleton Municipal, Wilkes-Barre/Scranton International*, Wilkes-Barre/Wyoming Valley Cherry Ridge, Spring Hill Sky Haven
DISTRICT 5	Berks Carbon Lehigh Monroe Northampton Schuylkill	Grimes, Kutztown, Morgantown, Reading Regional* Beltzville, Jake Arner Memorial Flying M Aerodrome, Lehigh Valley International*, Queen City, Slatington Flying Dollar, Pocono Mountains Municipal, Stroudsburg Pocono Braden Airpark Schuylkill County-Joe Zerbey
DISTRICT 6	Bucks Chester Delaware Montgomery Philadelphia	Doylestown, Pennridge, Quakertown, Total RF Heliport, Van Sant Brandywine, Chester County, Keystone Heliport, New Garden Flying Field Philadelphia Seaplane Base Horsham Valley, Perkiomen Valley, Pottstown Limerick, Pottstown Municipal, Valley Forge Heliport, Wings Field Northeast Philadelphia, Penn's Landing Heliport, Philadelphia International*
DISTRICT 8	Adams Cumberland Dauphin Franklin Lancaster Lebanon York	Gettysburg, Mid-Atlantic Soaring Center, Southern Adams County Carlisle, Shippensburg Bendigo, Harrisburg International* Chambersburg Municipal Donegal Springs, Lancaster*, McGinness, Smoketown Deck, Farmers Pride, Keller Brothers, Millard, Reigle Baublitz, Bermudian Valley, Capital City, Hanover, Kampel, Shoestring Aviation, York
DISTRICT 9	Bedford Blair Cambria Huntingdon Somerset	Bedford County Altoona-Blair County*, Blue Knob, Cove Valley Ebensburg, Johnstown-Cambria County* Huntingdon County Somerset County
DISTRICT 10	Armstrong Butler Clarion Indiana Jefferson	McVile Butler County, Butler Farm Show, Lakehill Clarion County Indiana County-Jimmy Stewart Dubois-Jefferson County*, Punxsutawney
DISTRICT 11	Allegheny Beaver Lawrence	Allegheny County, Culmerville, Pittsburgh International*, Pittsburgh-Monroeville, Rock Beaver County, Zelenople New Castle
DISTRICT 12	Fayette Greene Washington Westmoreland	Connellsville, Mt. Pleasant-Scottsdale, Seven Springs, WPHS Greene County Bandel, Finleyville, Miller, Washington County Arnold Palmer*, Greensburg-Jeannette, Inter-County, Rostraver

**Table 4-6
Comparison Of Based Aircraft Growth Rates**

Growth Rate Source Area Included In Forecast	Historic Growth			Projected Growth		
	Base Year	Out Year	AAG	Base Year	Out Year	AAG
FAA Aerospace Forecasts						
U.S.- Active GA Aircraft	1995	1999	3.93%	2000	2012	0.89%
FAA Terminal Area Forecasts						
U.S.	1989	1999	0.79%	1999	2015	0.59%
Eastern Region	1989	1999	0.69%	1999	2015	0.50%
PA Airports	1989	1999	1.47%	1999	2015	0.55%
Delaware Valley Regional Planning Commission (DVRPC)						
PA Airports in Metro. Philadelphia	1995	2000	1.45%	2000	2025	0.88%

Sources: FAA Aerospace Forecasts, Fiscal years 2001-02; FAA Terminal Area Forecasts; Delaware Valley Regional Planning Commission

FAA Aerospace Forecasts Fiscal Years 2001-2012

The *FAA Aerospace Forecasts Fiscal Years 2001-2012* provides projections of the total U.S. active general aviation fleet. For any given year, the U.S. fleet is defined as the sum of new production flowing into the fleet, the fleet size carried over from the previous year, and the attrition of existing aircraft during the current year. A detailed summary of the FAA’s projected aircraft fleet and fleet mix was previously presented. An estimated 219,000 active general aviation aircraft were based at U.S. airports in 1999. Between 1995 and 1999, active general aviation aircraft increased 3.93 percent per year, on average. This historic growth greatly exceeded the minimal growth in based aircraft at all Pennsylvania airports between 1994 and 1999. The national growth in aircraft fleet is expected to slow over the 12-year forecast period, increasing at an average annual growth rate of 0.89 percent per year, reaching 246,000 active general aviation aircraft in 2012.

FAA Terminal Area Forecasts

Terminal Area Forecasts (TAF) are the official projections of aviation activity at individual FAA facilities, including FAA towered airports, federally-contracted towered airports, nonfederal towered airports, and non-towered airports. Many of the smaller general aviation airports, as well as privately owned public use airports, do not submit their aviation activity to the FAA. In Pennsylvania, 49 percent of the airports in the system were included in the NPIAS and were therefore required to report to the FAA’s TAF. Between 1989 and 1999, based aircraft at all U.S. airports reporting to the TAF grew at an average annual growth rate of 0.79 percent. Airports in the FAA-defined Eastern Region grew at a rate just slightly below the national rate (0.69 percent per year, on average). The Eastern Region includes airports in the states of Pennsylvania, New York, New Jersey, Maryland, Delaware, West Virginia, and Virginia. Pennsylvania airports reporting to the TAF experienced a historic average annual rate of growth of 1.47 percent.

The FAA TAF projections of based aircraft are updated annually. Between 1999 and 2015, the FAA projected similar rates of growth for based aircraft at all airports in the U.S., FAA’s Eastern Region, and Pennsylvania, growing at an average annual rate of 0.59 percent, 0.50 percent, and 0.55 percent, respectively. Again, it is important to note that only 49 percent, or 69 of the 141 airports in the system, were included in the latest TAF.

Delaware Valley Regional Planning Commission (DVRPC) 2025 Regional Airport System Plan

The Delaware Valley Regional Planning Commission (DVRPC) is the regional planning agency for the area surrounding metropolitan Philadelphia. In December 2000, DVRPC developed the 2025 Regional Airport System Plan (RASP) for a 12-county area, including Montgomery, Bucks, Chester, Delaware, and Philadelphia counties in Pennsylvania. These airports experienced average annual growth in based aircraft of 1.45 percent between 1995 and 2000. During this time, DVRPC changed the way it collected aviation activity data at the airports in the regional system. It is possible that this growth may be overstated. DVRPC projected based aircraft to grow at an average annual rate of 0.88 percent between 2000 and 2025.

2. Operations Trends

In **Table 4-7**, a comparison of historic and projected aircraft operations growth rates are presented. The FAA has prepared national operations projections in conjunction with the *Aerospace Forecasts*, as well as annual airport projections as part of the *Terminal Area Forecasts*. The Delaware Valley Regional Planning Commission also has developed for operations forecasts for airports located in the metropolitan Philadelphia area. These projections provide a basis for the SASP operational forecasts.

**Table 4-7
Comparison Of Operations Growth Rates**

Growth Rate Source Area Included In Forecast	Historic Growth			Projected Growth		
	Base Year	Out Year	AAG	Base Year	Out Year	AAG
FAA Aerospace Forecasts						
U.S. Towered Airports (All Ops)	1995	2000	1.9%	2000	2012	2.42%
U.S. Towered Airports (GA Ops Only)	1995	2000	1.8%	2000	2012	2.19%
U.S- GA Hours Flown	1995	1999	4.5%	2000	2012	2.20%
FAA Terminal Area Forecasts						
U.S.- Total Ops	1989	1999	0.5%	1999	2015	1.14%
U.S.- GA only	1989	1999	0.1%	1999	2015	1.00%
Eastern Region-Total Ops	1989	1999	-0.4%	1999	2015	0.93%
Eastern Region-GA only	1989	1999	-0.8%	1999	2015	0.68%
PA Airports- Total Ops	1989	1999	1.3%	1999	2015	1.00%
PA Airports-GA only	1989	1999	1.4%	1999	2015	0.70%
FAA-Tower Counts						
PA Towered Airports-Total Ops	1990	2000	0.0%			
PA Towered Airports-GA Ops only	1990	2000	-0.8%			
PA Towered (excl. PIT& PHL)-Total	1990	2000	-1.1%			
Delaware Valley Regional Planning Commission (DVRPC)						
PA Airports in DE Valley (incl. PHL)	1995	2000	0.9%	2000	2025	0.89%
PA Airports in DE Valley (excl. PHL)	1995	2000	-1.6%	2000	2025	0.67%

Sources: FAA Aerospace Forecasts, Fiscal years 2001-02; ; FAA Air Traffic Control Tower Counts; FAA Terminal Area Forecasts; Delaware Valley Regional Planning Commission

FAA Aerospace Forecasts Fiscal Years 2001-2012

As part of the *FAA Aerospace Forecast Fiscal Years 2001-2012*, the FAA projected aviation activity at combined FAA and contract towered airports only. Between 1995 and 2000, total operations at towered airports grew at an average annual rate of 1.9 percent, just slightly higher than the growth experienced in general aviation operations, up 1.8 percent per year on average. Total operations are projected to experience strong growth between 2000 and 2012, up 2.42 percent per year, on average, over the period. The FAA has projected general aviation operations to experience a slightly lower average annual growth rate of 2.19 percent.

The FAA also projects the hours flown by general aviation aircraft, another indicator of general aviation activity. Based on results from the 1999 General Aviation and Air Taxi Activity Survey, hours flown grew 4.5 percent annually, on average between 1995 and 1999. While active aircraft is projected to grow just 0.9 percent annually between 2000 and 2012, general aviation hours flown are projected to increase 2.2 percent annually over the 12-year period.

FAA Terminal Area Forecasts (TAF)

The FAA also annually forecasts operations by airport as part of the *Terminal Area Forecasts*. While both total activity and general aviation operations experienced little growth at all U.S.

airports reporting to the FAA TAF, operations at airports in FAA’s Eastern Region actually declined between 1989 and 1999. General aviation operations are projected to decline at a rate slightly less than total operations. According to the TAF, between 1999 and 2015, total operations at all U.S. airports are projected to increase at an average annual rate of 1.14 percent. Total operations at airports in the FAA’s Eastern region are expected to increase 0.93 percent per year, on average. General aviation operations are projected to grow at 1.00 nationally and 0.68 percent regionally between 1999 and 2015.

Between 1989 and 1999, total aircraft operations at the Pennsylvania airports that reported to the FAA TAF (49 percent) increased at an average annual rate of 1.3 percent. General aviation operation at these airports grew 1.4 percent annually over the 10-year period. The FAA-TAF projects total operations at Pennsylvania airports to grow at 1.00 percent between 1999 and 2015. General aviation operations are projected to increase slightly below that rate, at 0.7 percent per year, on average.

FAA Tower Counts

Twelve airports in Pennsylvania have FAA contracted towers, including three general aviation airports (Allegheny County, Northeast Philadelphia, and Capital City). Between 1990 and 2000, these airports experienced no growth in total aviation operations. General aviation operations at the 12 airports dropped at an average annual rate of 0.8 percent per year. Excluding Pittsburgh and Philadelphia, Pennsylvania’s largest airports, total operations at Pennsylvania towered airports declined 1.1 percent per year, on average, between 1990 and 2000.

Delaware Valley Regional Planning Commission (DVRPC) 2025 Regional Airport System Plan

DVRPC projected operations for the airports in the metropolitan Philadelphia airports, which includes airports in Montgomery, Bucks, Chester, Delaware, and Philadelphia counties. DVRPC initiated an operations counting program in 1997 at airports in the Delaware Valley. Operations data at these airports cannot be accurately compared in 1995 and 2000 due to this difference in reporting. DVRPC projects total operations in this region of the Commonwealth to increase 0.89 percent annually between 2000 and 2025. Excluding Philadelphia International Airport, the largest airport in the region, operations are projected to increase at an average annual rate of 0.67 percent.

B. Based Aircraft Projections

Two methodologies were used to project based aircraft for each district in Pennsylvania to ensure a reasonable forecast. Both methodologies are bottom-up approaches. The first methodology used the historic trend experienced in each district to forecast future based aircraft. The second methodology projected based aircraft for each district based on historic population growth in each district. Each of these methodologies, their resultant projections, as well as the preferred based aircraft projections, are discussed in the following sections.

1. Projections Based on Historic District Based Aircraft Growth

The first methodology used to project based aircraft for each of the districts in Pennsylvania was a bottom-up approach based on historic growth in based aircraft in each district. As shown in **Table 4-8**, the historic data for each district shows varying degrees of growth and decline. Overall, statewide based aircraft only increased by 35 aircraft over the 1994 to 1999 period.

To project based aircraft using this methodology, the combined average annual growth between 1994 and 1999 at all airports in each district was used. Because of the swings in historical growth and decline, airports were categorized into ranges of average annual growth to project future based aircraft by district. Growth rates were developed for the various ranges based on the FAA's projection of based aircraft in the FAA-defined Eastern Region between 1999 and 2015. The FAA projected in its *Terminal Area Forecasts*, published in December 2000, that based aircraft at airports in the Eastern Region will experience an average annual growth rate of 0.50 percent between 1999 and 2015.

To project based aircraft for each district in the Pennsylvania system, variations of the FAA's Eastern Region projected average annual growth rate were used. Airports in districts that lost based aircraft between 1994 and 1999 were given a 0.25 percent average annual growth rate, one-half of the FAA Eastern Region growth rate. For airports that had between 0.1 percent and 1.0 percent average annual growth during the 1994 and 1999 time frame, the FAA's rate of 0.5 percent was applied. For those airports that experienced growth greater than 1.0 percent, a growth rate of 1.0 percent, or double the FAA's projected growth rate, was applied. Table 4-8 presents the district based aircraft projections developed using this methodology. As shown, statewide based aircraft are projected to increase from 5,891 in 1999 to 6,544 in 2020, an average annual growth rate of 0.5 percent. Although this rate is slightly higher than the growth experienced statewide between 1994 and 1999, it is the same as the FAA's Eastern Region projected average annual rate.

**TABLE 4-8
BASED AIRCRAFT PROJECTIONS
Bottom Up Methodology, Based on Historic Based Aircraft Growth**

District	Pennsylvania Counties	Historic Based Aircraft			Applied Avg. Annual Growth Rate	Projected Based Aircraft		
		1994	1999	AAG		2005	2010	2020
District 1	Erie, Crawford, Mercer, Venango, Forest, Warren	252	278	2.0%	1.00%	295	310	343
District 2	Cameron, Centre, Clearfield, Clinton, Elk, Juniata, McKean, Mifflin, Potter	283	324	2.7%	1.00%	344	361	399
District 3	Bradford, Columbia, Lycoming, Montour, Northumberland, Snyder, Sullivan, Tioga, Union	282	285	0.2%	0.50%	294	301	316
District 4	Lackawanna, Luzerne, Pike, Susquehanna, Wayne, Wyoming	347	342	-0.3%	0.25%	347	352	360
District 5	Berks, Carbon, Lehigh, Northampton, Monroe, Schuylkill	682	650	-1.0%	0.25%	660	668	685
District 6	Bucks, Chester, Delaware, Montgomery, Philadelphia	1,368	1,334	-0.5%	0.25%	1,354	1,371	1,406
District 8	Adams, Cumberland, Dauphin, Franklin, Lancaster, Lebanon, Perry, York	896	1,014	2.5%	1.00%	1,076	1,131	1,250
District 9	Bedford, Blair, Cambria, Fulton, Huntington, Somerset	259	235	-1.9%	0.25%	239	242	248
District 10	Armstrong, Butler, Clarion, Indiana, Jefferson	334	330	-0.2%	0.25%	335	339	348
District 11	Allegheny, Beaver, Lawrence	606	547	-2.0%	0.25%	555	562	576
District 12	Fayette, Greene, Washington, Westmoreland	547	552	0.2%	0.50%	569	583	613
TOTAL BASED AIRCRAFT		5,856	5,891	0.1%	0.50%	6,068	6,221	6,544

If historic based aircraft growth:

< 0.0%, apply 1/2 of Eastern Region FAA-TAF growth rate (0.25%)

>0.1%<1.0%, apply Eastern Region FAA-TAF growth rate (0.50%)

>1.0%, apply 2 times Eastern Region FAA-TAF growth rate (1.00%)

Source: Wilbur Smith Associates, Inc.

2. Projections Based on Historic District Population Growth

Table 4-9 presents projected based aircraft for Pennsylvania also using a bottom-up approach. This methodology is similar to the first methodology explained above. However, the projected growth rate is based on projected population growth rather than historic based aircraft growth. As shown in Table 4-9, according to 2000 U.S. Census data, the population in the Commonwealth has grown slightly, up 0.33 percent per year, on average, between 1990 and 2000. The population of each district in Pennsylvania shows varying degrees of growth and decline. Districts 2, 5, and 8 demonstrated the greatest population growth between 1990 and 2000. On the other hand, Districts 9 and 11 experienced a decline in population over the period.

Similar to the first methodology described above, the districts were categorized into ranges of historic growth in order to assign a projected rate of growth. However, for this methodology, historic population growth was used as the basis for based aircraft projections. The projected rate of growth is again based on the FAA's Eastern Region based aircraft projections published in the *Terminal Area Forecasts*. Based aircraft in the Eastern Region are projected to grow at 0.5 percent per year, on average, between 1999 and 2015.

Variations of the FAA Eastern Region growth rate were then used to project based aircraft in Pennsylvania by district. For those districts in Pennsylvania that experienced a decline in population between 1990 and 2000, a growth rate of 0.25 percent, half of the FAA Eastern Region growth rate, was used. For the districts that had actual population growth between 0.0 percent and 0.66 percent annually, the FAA's Eastern Region annual average growth rate of 0.50 percent was applied. Districts that had average annual population growth greater than 0.66 percent were assigned a projected based aircraft growth rate of 1.0 percent, double the FAA's Eastern Region projected average annual growth rate. As shown in Table 4-9, using this methodology, statewide based aircraft are projected to increase from 5,891 in 1999 to 6,740 in 2020, an average annual growth rate of 0.64 percent.

3. Preferred Based Aircraft Projection

The results from the two based aircraft projection methodologies developed in the SASP were compared for each district. In 1999, the Pennsylvania airports accommodated 5,891 based aircraft. The first methodology, based on historic based aircraft by district, produced a 2020 projection of 6,544 based aircraft, an average annual growth rate of 0.50 percent. The second methodology, based on historic population growth, produced a 2020 projection of 6,740 based aircraft, an average annual growth rate of 0.64 percent.

Although the methodologies produce similar projections of statewide based aircraft, the bottom-up methodology based on historic population growth was chosen as the preferred methodology. This projection takes district population changes into account, which can directly relate to the

**TABLE 4-9
BASED AIRCRAFT PROJECTIONS
Bottom Up Methodology, Based on Historic Population Growth**

District	Pennsylvania Counties	1999 Based Aircraft	1990-2000 Pop Growth (2000 census)	Applied Avg. Annual Growth Rate	Projected Based Aircraft		
					2005	2010	2020
District 1	Erie, Crawford, Mercer, Venango, Forest, Warren	278	0.10%	0.50%	286	294	309
District 2	Cameron, Centre, Clearfield, Clinton, Elk, Juniata, McKean, Mifflin, Potter	324	0.80%	1.00%	344	361	399
District 3	Bradford, Columbia, Lycoming, Montour, Northumberland, Snyder, Sullivan, Tioga, Union	285	0.19%	0.50%	294	301	316
District 4	Lackawanna, Luzerne, Pike, Susquehanna, Wayne, Wyoming	342	0.19%	0.50%	352	361	380
District 5	Berks, Carbon, Lehigh, Northampton, Monroe, Schuylkill	650	0.91%	1.00%	690	725	801
District 6	Bucks, Chester, Delaware, Montgomery, Philadelphia	1,334	0.32%	0.50%	1,375	1,409	1,481
District 8	Adams, Cumberland, Dauphin, Franklin, Lancaster, Lebanon, Perry, York	1,014	0.94%	1.00%	1,076	1,131	1,250
District 9	Bedford, Blair, Cambria, Fulton, Huntington, Somerset	235	-0.13%	0.25%	239	242	248
District 10	Armstrong, Butler, Clarion, Indiana, Jefferson	330	0.50%	0.50%	340	349	366
District 11	Allegheny, Beaver, Lawrence	547	-0.38%	0.25%	555	562	576
District 12	Fayette, Greene, Washington, Westmoreland	552	0.03%	0.50%	569	583	613
TOTAL BASED AIRCRAFT		5,891	0.33%	0.64%	6,120	6,319	6,740

If projected population growth:

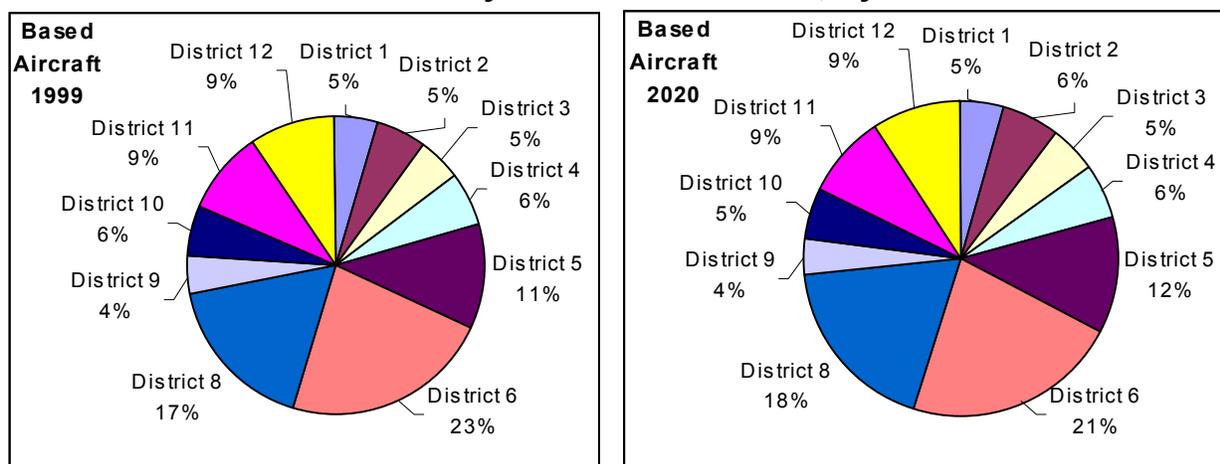
- < 0.00%, apply 1/2 of Eastern Region FAA-TAF growth rate (0.25%)
- > 0.01% < 0.66%, apply Eastern Region FAA-TAF growth rate (0.50%)
- > or = 0.66%, apply 2 times Eastern Region FAA-TAF growth rate (1.0%)

Source: Wilbur Smith Associates, Inc.

need for future based aircraft in the district. **Exhibit 4-9** presents the growth in based aircraft projected by district.

In **Exhibit 4-10**, each district’s share of statewide based aircraft in 1999 and 2020 is presented. Although none of the districts’ market share of the statewide total changed dramatically over the forecast period, there are a few changes to note. Based on the results of the preferred based aircraft projection methodology, District 2, District 5, and District 8 each increased their share of Pennsylvania based aircraft by 2020. District 8 had the largest increase in projected based aircraft with 236 additional aircraft in 2020. The metropolitan Philadelphia area (District 6) lost the greatest share of Pennsylvania’s based aircraft, down from 23 percent in 1999 to 21 percent in 2020.

Exhibit 4-10
Share Of Pennsylvania Based Aircraft, By District

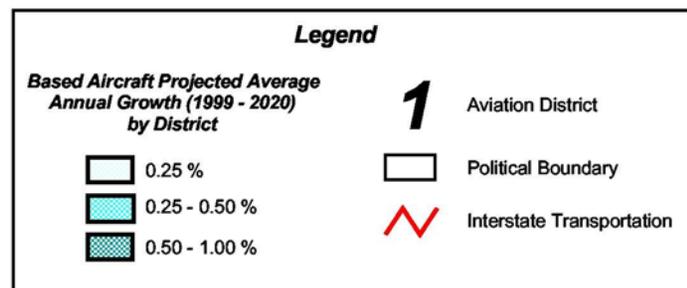
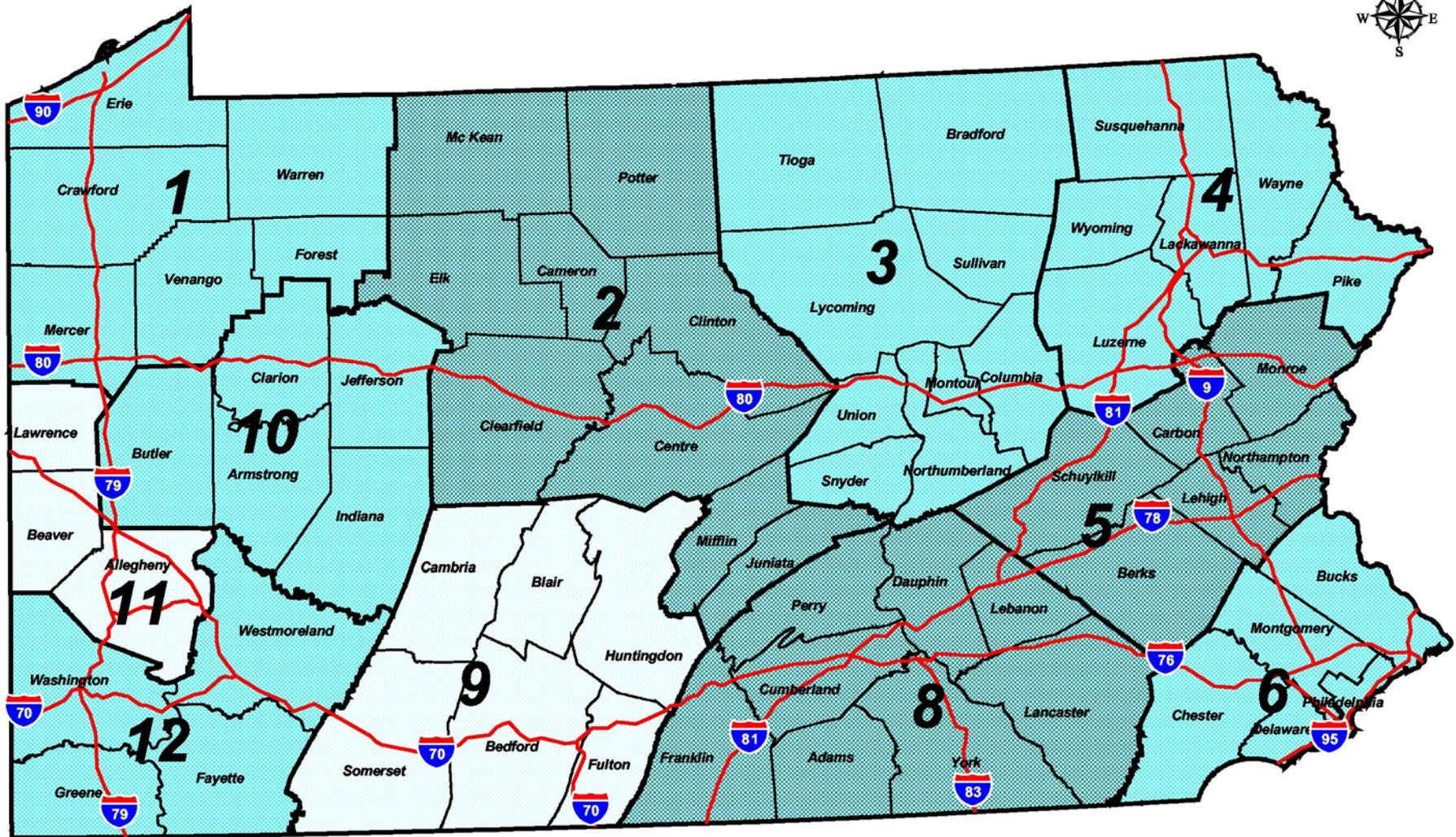


Source: Wilbur Smith Associates, Inc.

C. Total Aircraft Operations Projections

The projection of operational demand is critical to determining the need for airside improvements throughout Pennsylvania. Total operational demand projected in this section consists of several types of activity including commercial air carrier (including major/national and regional/commuter operations), air taxi, military, and general aviation activity.

Similar to the based aircraft projections, two bottom-up methodologies were used to project total operations for each district to ensure a reasonable forecast. One methodology examined the historic growth in total annual operations in each district in Pennsylvania, while the second methodology examined historic population growth in each district. For each of these methodologies, future growth rates were then assigned to each district’s existing operational level based on historic operational growth or population growth, as well as anticipated national trends in aviation activity. These two methodologies are discussed below.



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Exhibit 4-9

Projected Growth in
Based Aircraft 1999-2020

Source: National Transportation Atlas Database and Pennsylvania Department of Transportation



1. Projections Based on Historic District Operations Growth

The first methodology examined the historical growth in operations experienced at each of the districts in Pennsylvania. As shown in **Table 4-10**, total operations at all Pennsylvania airports grew at an average annual rate of 0.43 percent between 1994 and 1999. Districts 2 and 4 experienced the greatest growth over the period; Districts 1, 9, and 12 experienced large declines in operations between 1994 and 1999.

The FAA's projected growth in total operations in the FAA-defined Eastern Region was used to project annual operations in each district in Pennsylvania. In its most recent forecast, the FAA projected that total operations in the Eastern Region would increase at an average annual rate of 0.93 percent per year, on average. The districts in Pennsylvania were categorized into ranges based on their estimated annual historic growth in operations to project total annual operations.

Variations of the FAA's projected growth rate were applied to the ranges to develop operations projections for each district. Airports that experienced negative growth were assigned a growth rate of 0.47 percent, or one-half of the FAA's Eastern Region operations growth rate. For airports with an average annual growth rate of between 0.0 percent and 3.0 percent, the FAA's Eastern Region operations average annual growth rate (0.93 percent) was applied to project future operations. Those airports with growth rates greater than 3.0 percent were assigned a growth rate of 1.86 or double the FAA Eastern Region growth rate. The results of this analysis are presented in Table 4-10.

This methodology results in statewide operations growing from approximately 4,266,451 in 1999 to 5,152,136 in 2020. The overall growth represents an average annual rate of 0.90 percent.

2. Projections Based on Historic District Population Growth

The second operations projection methodology also uses a bottom-up approach. Similar to the second based aircraft methodology, this approach is based on population growth between 1990 and 2000 in each district. The districts are then categorized into ranges based on historic population growth reported to the 2000 U.S. Census. The population in Pennsylvania increased 0.33 percent per year, on average, between 1990 and 2000.

A variation of the FAA's Eastern Region growth rate for projected operations was then applied to each of the districts to develop individual operations projections. Districts that experienced a decline in historic population were assigned a growth rate of 0.47 percent, or one-half of the FAA's Eastern Region projected average annual growth rate. For a district experiencing historic population growth between 0.0 percent per year and 0.3 percent per year, a projected operations growth rate of 0.93 percent was applied (the FAA's Eastern Region projected growth rate). Districts with population growth greater than 3.0 percent were assigned an operations growth rate of 1.47 percent per year, or double the FAA's Eastern Region projected growth rate.

Table 4-11 presents the district operations projections using this methodology based on historic population growth. As shown, statewide operations are projected to increase from 4,266,451 in

TABLE 4-10
TOTAL OPERATIONS PROJECTION
 Growth Rate Projection, Based on Historic Operations Growth

District	Pennsylvania Counties	Historic Operations			Applied Avg. Annual Growth Rate	Projected Operations		
		1994	1999	AAG		2005	2010	2020
District 1	Erie, Crawford, Mercer, Venango, Forest, Warren	169,391	155,347	-1.72%	0.47%	159,732	163,480	171,243
District 2	Cameron, Centre, Clearfield, Clinton, Elk, Juniata, McKean, Mifflin, Potter	216,888	252,473	3.09%	1.86%	281,992	309,211	371,785
District 3	Bradford, Columbia, Lycoming, Montour, Northumberland, Snyder, Sullivan, Tioga, Union	155,453	155,675	0.03%	1.86%	173,877	190,660	229,243
District 4	Lackawanna, Luzerne, Pike, Susquehanna, Wayne, Wyoming	192,370	247,065	5.13%	1.86%	275,952	302,588	363,821
District 5	Berks, Carbon, Lehigh, Northampton, Monroe, Schuylkill	500,376	536,621	1.41%	0.93%	567,269	594,143	651,769
District 6	Bucks, Chester, Delaware, Montgomery, Philadelphia	1,134,086	1,152,251	0.32%	0.93%	1,218,060	1,275,763	1,399,500
District 8	Adams, Cumberland, Dauphin, Franklin, Lancaster, Lebanon, Perry, York	534,534	523,576	-0.41%	0.47%	538,355	550,988	577,152
District 9	Bedford, Blair, Cambria, Fulton, Huntingdon, Somerset	140,484	130,760	-1.42%	0.47%	134,451	137,606	144,140
District 10	Armstrong, Butler, Clarion, Indiana, Jefferson	144,829	150,925	0.83%	0.93%	159,545	167,103	183,310
District 11	Allegheny, Beaver, Lawrence	789,344	782,259	-0.18%	0.47%	804,339	823,215	862,305
District 12	Fayette, Greene, Washington, Westmoreland	221,344	179,499	-4.10%	0.47%	184,566	188,897	197,867
TOTAL OPERATIONS		4,176,034	4,266,451	0.43%	0.90%	4,498,137	4,703,654	5,152,136

If historic operations growth:

< 0.0%, apply 1/2 of Eastern Region FAA-TAF growth rate (0.47%)

>0.0%<3.0%, apply Eastern Region FAA-TAF growth rate (0.93%)

>3.0%, apply 2 times Eastern Region FAA-TAF growth rate (1.86%)

Source: Wilbur Smith Associates, Inc.

TABLE 4-11
TOTAL OPERATIONS PROJECTION
 Growth Rate Projection, Based on Historic Population Growth

District	Pennsylvania Counties	1999 Total Operations	1990-2000 Pop Growth (2000 census)	Applied Avg. Annual Growth Rate	Projected Operations		
					2005	2010	2020
District 1	Erie, Crawford, Mercer, Venango, Forest, Warren	155,347	0.10%	0.93%	164,219	171,999	188,681
District 2	Cameron, Centre, Clearfield, Clinton, Elk, Juniata, McKean, Mifflin, Potter	252,473	0.80%	1.86%	281,992	309,211	371,785
District 3	Bradford, Columbia, Lycoming, Montour, Northumberland, Snyder, Sullivan, Tioga, Union	155,675	0.19%	0.93%	164,566	172,362	189,080
District 4	Lackawanna, Luzerne, Pike, Susquehanna, Wayne, Wyoming	247,065	0.19%	0.93%	261,176	273,548	300,080
District 5	Berks, Carbon, Lehigh, Northampton, Monroe, Schuylkill	536,621	0.91%	1.86%	599,363	657,216	790,214
District 6	Bucks, Chester, Delaware, Montgomery, Philadelphia	1,152,251	0.32%	0.93%	1,218,060	1,275,763	1,399,500
District 8	Adams, Cumberland, Dauphin, Franklin, Lancaster, Lebanon, Perry, York	523,576	0.94%	1.86%	584,792	641,239	771,004
District 9	Bedford, Blair, Cambria, Fulton, Huntingdon, Somerset	130,760	-0.13%	0.47%	134,491	137,681	144,291
District 10	Armstrong, Butler, Clarion, Indiana, Jefferson	150,925	0.50%	0.93%	159,545	167,103	183,310
District 11	Allegheny, Beaver, Lawrence	782,259	-0.38%	0.47%	804,580	823,666	863,207
District 12	Fayette, Greene, Washington, Westmoreland	179,499	0.03%	0.93%	189,751	198,740	218,016
TOTAL OPERATIONS		4,266,451	0.33%	1.15%	4,562,535	4,828,529	5,419,168

If historic population growth:

- < 0.00%, apply 1/2 of Eastern Region FAA-TAF growth rate (0.47%)
- >0.01%<0.66%, apply Eastern Region FAA-TAF growth rate (0.93%)
- >or=0.66%, apply 2 times Eastern Region FAA-TAF growth rate (1.86%)

Source: Wilbur Smith Associates, Inc.

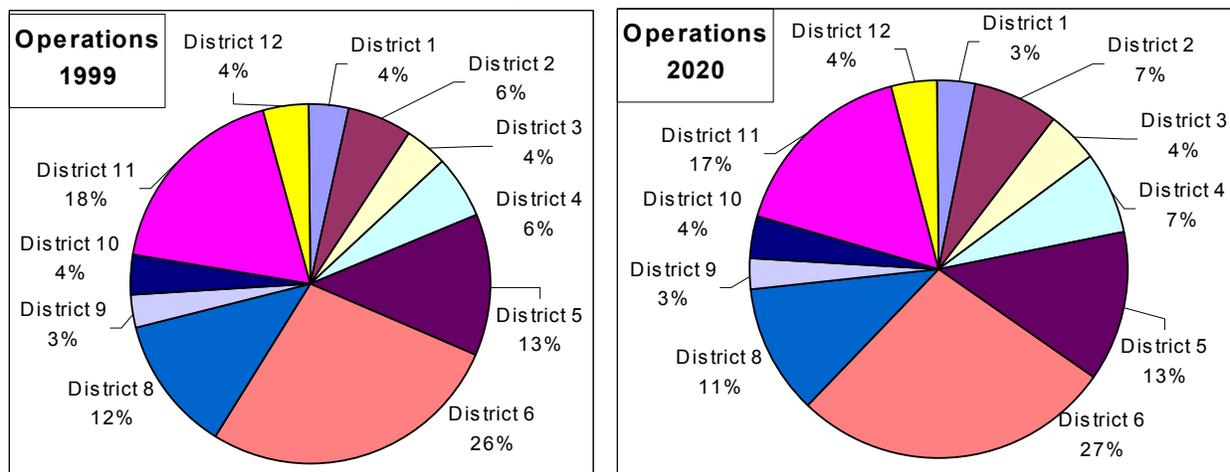
1999 to 5,419,168 in 2020. This represents an average annual growth rate of 1.15 percent over the period, just slightly higher than the FAA’s projected growth rate for the Eastern Region.

3. Preferred Operations Projection

The results from the two methodologies were compared for each district in Pennsylvania. Based on the review of the two methodologies, the bottom-up operations projection methodology based on historic district operations growth was selected as the preferred operations projection. This methodology provided the closest projection to the FAA’s Eastern Region forecast, as well as what has historically happened in the past at the airports in the districts in Pennsylvania. The projections by district based on the preferred methodology are presented in **Exhibit 4-11**.

Exhibit 4-12 presents each district’s share of statewide operations in 1999 and 2020. Districts 2, 4, and 8 are each projected to gain one percentage point of their share of statewide operations in 2020. Districts 1, 8, and 11 are each projected to lose one percentage point of their share of statewide operation in 2020.

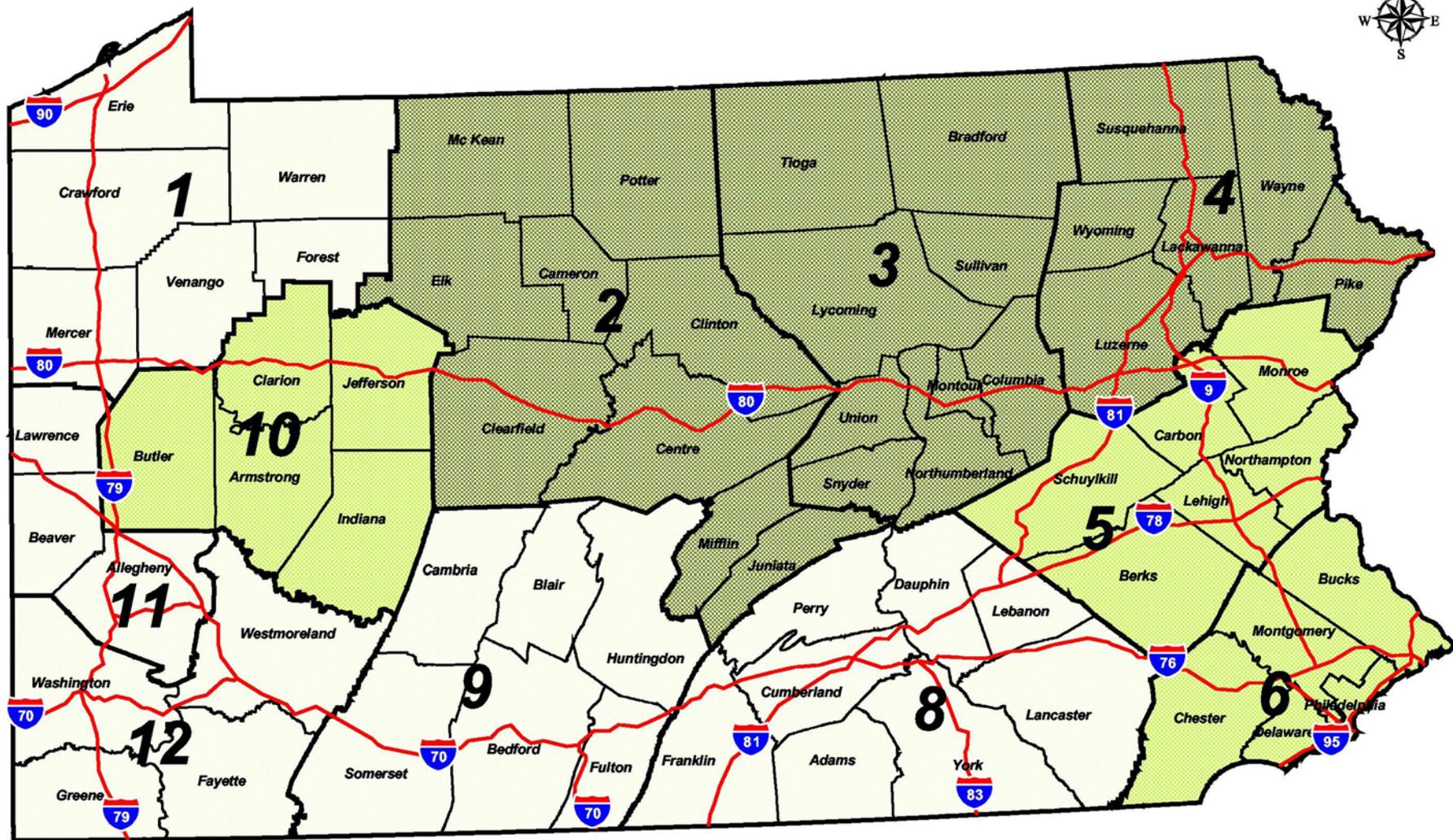
Exhibit 4-12
Share Of Pennsylvania Operations, By District



Source: Wilbur Smith Associates, Inc.

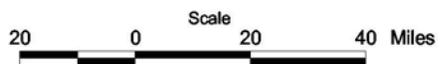
III. SUMMARY

The data presented as part of this chapter will be used in subsequent chapters to identify inadequacies within Pennsylvania’s aviation system, as well as surpluses. The forecast of aviation demand provides the baseline for evaluating the system as a whole and for evaluating the ability of each region to accommodate the demand for its facilities.



Legend

<p>Total Operations Projected Average Annual Growth (1999 - 2020) by District</p> <ul style="list-style-type: none"> 0.47 % 0.47 - 0.93 % 0.93 - 1.86 % 	<ul style="list-style-type: none"> 1 Aviation District Political Boundary Interstate Transportation
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Exhibit 4-11
 Projected Growth in
 Total Operations 1999-2020



Source: National Transportation Atlas Database and Pennsylvania Department of Transportation