2.0 Aviation Activity Forecast

The previous FAA approved forecast for DVT was prepared and approved June 9, 2006 for the 2007 Phoenix Deer Valley Airport Master Plan Update. Since that time, the aviation sector has been buffeted by a number of events, most importantly the Great Recession and fuel price volatility. Changes in DVT and the environment within which it functions warrant a new examination of projected airport activity.

This chapter contains the annual and derivative activity forecasts for DVT. Except where noted, the forecasts contained herein are unconstrained; they assume landside and airfield capacity will be available to accommodate the anticipated demand. Aviation Activity Forecasts (Forecast) are presented for the base year (2013) and future years: 2018, 2023, and 2033. The chapter begins with a discussion of recent aviation activity at DVT and current local and national industry trends. The Forecast reviews historical and projected socioeconomic activity levels along with fuel costs. Key assumptions are then presented, followed by the forecasts of based aircraft and annual aircraft operations. More detailed derivative forecasts, including fleet mix and peak activity estimates follow. The chapter concludes with a summary of the forecasts, comparison with other forecasts, and a presentation of alternative forecast scenarios.

2.1 Historical Activity and Industry Trends

Measured in terms of aircraft operations, DVT is the busiest general aviation facility in the country. In addition to serving a large part of the general aviation community in Phoenix, DVT is also a major training center for commercial pilots throughout the world. Since it serves a wide variety of users, historical activity at DVT has been subject to many factors, including economic, cost, and competition, and as a result, future activity will also be determined by these factors.

Table 2-1 presents the recent history of based aircraft at DVT. The two sources that are presented include Airport Records maintained by the Aviation Department and FAA's Terminal Area Forecast (TAF) records that were originally drawn from FAA 5010 Airport Master Records. The two sources vary in that they are updated at differing times with varying frequency and sometimes are based on actual counts (Aviation Department) and other times on estimates (FAA). Although they differ in the specifics, both sources agree that the number of aircraft at DVT have been increasing at a moderate rate with a peak occurring prior to the recent recession and fuel spike, followed by a decline, and then a more recent turnaround.

Table 2-1: Historical Based Aircraft at DVT

Year	Previous Master Plan and Airport Records Based Aircraft (a)	FAA Terminal Area Forecast Based Aircraft (b)
1983	657	548
1984	669	548
1985	638	698
1986	764	698
1987	754	820
1988	716	806
1989	637	820
1990	815	820
1991	778	722
1992	796	722
1993	805	722
1994	803	684
1995	898	748
1996	903	748
1997	918	918
1998	912	918
1999	918	918
2000	1,206	918
2001	1,046	923
2002	1,275	923
2003	1,250	946
2004	1,252	923
2005	n/a	923
2006	n/a	1149
2007	n/a	1149
2008	1,212	943
2009	1,190	943
2010	987	981
2011	1,181	981
2012	964	995
2013	1,033	n/a
2014	1,058	n/a
1983-2012	1.3%	2.1%
1983-2014	1.5%	

Sources: As noted and HNTB analysis; n/a = not available; (a) Phoenix Deer Valley Master Plan Update, 2007, and City of Phoenix Aviation Department records; (b) FAA, 2013 Terminal Area Forecast, 2014

As a comparison, active general aviation aircraft in the U.S. declined slightly over the same period, from 213,292 in 1983 to 202,865 in 2013.[2]

Table 2-2 presents historical aircraft operations at DVT over the past 23 years. Total operations decreased during the early 1990's, then increased rapidly over the next ten years. Operations remained at a high level from 2002 through 2009, peaking at 406,507 in 2006. Operations then declined significantly during the most recent recession. Operations have recovered since 2011, but are not yet back to pre-recession levels.

Among the various operating categories, general aviation operations have been increasing over the long term, military activity has been declining, and there is no discernible trend in commercial activity (air carrier and air taxi).

Table 2-3 demonstrates how DVT operations have compared to other towered general aviation airports serving the Phoenix Metropolitan area. The table also includes general aviation operations associated with PHX. Some of the airports either did not have control towers or were operated by the military in the early part of the comparison period, and therefore show no data for those years. The table indicates that since 1998, when all airports began reporting, the DVT share of general aviation, military, and non-scheduled air taxi operations, has been gradually increasing, from 20% in 1998 to 26% in 2013.

Total general aviation operations at U.S. towered airports have declined over the same period, falling from 38.0 million operations in 1998 to 25.8 million in 2013.[3] The Phoenix area in general and DVT in particular, have been increasing their share of U.S. general aviation operations. This increase in share resulted from the rapid population and economic growth in the Phoenix area, and the continuing development of the area as a center for pilot training.

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[2] General Aviation Manufacturers Association, _2012 General Aviation Statistical Databook & Industry Outlook_, and FAA, _FAA Aerospace Forecast Fiscal Years 2014-2034_.

[3] FAA Aerospace Forecasts: Fiscal Years 2002-2013, and FAA Aerospace Forecast Fiscal Years 2014-2034.

Table 2-2: Historical Aircraft Operations at DVT

Calendar Year	Itinerant Air Carrier	Itinerant Air Taxi	Itinerant General Aviation	Itinerant Military	Itinerant Total	Local Civil	Local Military	Local Total	Total Operations
1990	5	1,933	103,836	631	106,405	171,079	342	171,421	277,826
1991	2	993	99,735	554	101,284	159,394	391	159,785	261,069
1992	-	3,545	98,693	759	102,997	117,619	236	117,855	220,852
1993	30	7,313	99,570	1,034	107,947	103,122	95	103,217	211,164
1994	-	5,905	101,113	680	107,698	104,322	81	104,403	212,101
1995	-	3,675	105,144	563	109,382	106,313	33	106,346	215,728
1996	-	3,539	119,135	515	123,189	127,297	237	127,534	250,723
1997	-	4,598	121,701	237	126,536	140,234	62	140,296	266,832
1998	1	4,782	129,248	208	134,239	147,008	151	147,159	281,398
1999	3	6,385	135,646	478	142,512	144,829	165	144,994	287,506
2000	-	6,783	164,979	610	172,372	198,331	76	198,407	370,779
2001	-	5,869	147,799	343	154,011	185,966	93	186,059	340,070
2002	-	4,990	166,777	55	171,822	217,730	18	217,748	389,570
2003	-	4,153	152,934	55	157,142	232,155	12	232,167	389,309
2004	-	4,079	137,550	44	141,673	198,759	5	198,764	340,437
2005	-	4,584	146,136	51	150,771	226,325	745	227,070	377,841
2006	-	5,216	150,111	52	155,379	251,107	21	251,128	406,507
2007	21	5,676	135,527	11	141,235	236,472	642	237,114	378,349
2008	284	6,217	133,150	40	139,691	236,853	90	236,943	376,634
2009	-	3,804	149,934	11	153,749	248,586	-	248,586	402,335
2010	-	2,973	135,651	389	139,013	229,732	2	229,734	368,747
2011	1	3,832	124,086	89	128,008	189,276	159	189,435	317,443
2012	159	4,690	139,389	54	144,292	221,110	30	221,140	365,432
2013	17	4,518	135,772	56	140,363	214,601	31	214,632	354,995
Average Annual Growth Rate									
1990-2002	-	8.2%	4.0%	-18.4%	4.1%	2.0%	-21.8%	2.0%	2.9%
2002-2013	-	-0.9%	-1.9%	0.2%	-1.8%	-0.1%	5.1%	-0.1%	-0.8%
1990-2013	5.5%	3.8%	1.2%	-10.0%	1.2%	1.0%	-9.9%	1.0%	1.1%

Sources: FAA, Air Traffic Activity System (ATADS) and HNTB analysis

Table 2-3: DVT Share of Regional Air Taxi, General Aviation and Military Operations (Excludes Air Carrier)

Year	Deer Valley (DVT)	Chandler (CHD)	Falcon Field (FFZ)	Glendale (GEU)	Goodyear (GYR)	Mesa Gateway (IWA)	Phoenix Sky Harbor (PHX)	Scottsdale (SDL)	Total	DVT Share
1990	277,821	n/a	203,465	n/a	202,410	n/a	124,736	265,517	1,073,949	25.9%
1991	261,067	n/a	238,700	n/a	180,214	n/a	122,789	234,597	1,037,367	25.2%
1992	220,852	n/a	225,852	n/a	166,037	n/a	116,917	197,577	927,235	23.8%
1993	211,134	n/a	191,536	n/a	138,901	n/a	136,629	184,512	862,712	24.5%
1994	212,101	n/a	194,290	n/a	86,336	n/a	105,701	166,736	765,164	27.7%
1995	215,728	n/a	184,905	n/a	62,106	n/a	116,707	178,109	757,555	28.5%
1996	250,723	156,212	196,353	119,866	92,400	n/a	89,610	183,299	1,088,463	23.0%
1997	266,832	184,139	209,599	130,263	116,153	n/a	91,274	185,108	1,183,368	22.5%
1998	281,397	196,511	220,957	115,056	103,717	194,985	86,268	208,177	1,407,068	20.0%
1999	287,503	221,018	263,945	133,220	136,105	235,197	88,492	230,596	1,596,076	18.0%
2000	370,779	249,811	274,447	112,570	142,258	157,579	134,264	207,024	1,648,732	22.5%
2001	340,070	232,449	251,597	110,631	134,342	160,348	118,003	184,557	1,531,997	22.2%
2002	389,570	230,538	288,338	118,702	138,312	177,647	101,419	195,563	1,640,089	23.8%
2003	389,309	219,671	281,434	88,449	132,392	181,186	106,514	194,468	1,593,423	24.4%
2004	340,437	233,079	261,890	118,140	105,055	239,504	98,228	202,673	1,599,006	21.3%
2005	377,841	235,111	270,136	132,865	100,703	275,544	57,590	212,429	1,662,219	22.7%
2006	406,507	269,059	249,072	150,772	159,078	279,598	47,230	196,298	1,757,614	23.1%
2007	378,328	265,212	314,109	146,208	187,925	294,714	44,273	191,982	1,822,751	20.8%
2008	376,350	236,842	319,413	136,212	177,886	223,550	33,627	191,411	1,695,291	22.2%
2009	402,335	204,370	255,232	104,062	177,949	180,724	24,804	166,435	1,515,911	26.5%
2010	368,747	165,784	214,612	82,198	145,962	171,153	24,450	133,515	1,306,421	28.2%
2011	317,442	161,583	220,075	87,124	138,459	163,418	23,088	141,635	1,252,824	25.3%
2012	365,273	197,427	190,599	76,127	144,036	147,722	24,475	146,082	1,291,741	28.3%
2013	354,978	211,636	263,691	67,811	120,479	178,649	23,250	142,345	1,362,839	26.0%
Average Annual Growth Rate										
1990-2002	2.9%		2.9%		-3.1%		-1.7%	-2.5%		
2002-2013	-0.8%	-0.8%	-0.8%	-5.0%	-1.2%	0.1%	-12.5%	-2.8%		
1990-2013	1.1%		1.1%		-2.2%		-7.0%	-2.7%		

Sources: FAA, Air Traffic Activity System (ATADS) and HNTB analysis

2.2 Socioeconomic Trends

This section discusses the definition of the DVT catchment area, and the historical and projected population and economic trends that are major drivers of aviation demand. Since most socioeconomic projections are based on political units such as counties or metropolitan statistical areas (MSA) it is typically recommended that the defined catchment area follow county boundaries. Most DVT based aircraft are registered in the Phoenix MSA (Maricopa and Pinal Counties) with lesser numbers in Gila and Yavapai Counties (see **Figure 2-1**). Therefore, the DVT catchment area for this Forecast was defined as the complete Phoenix MSA. The previous Master Plan Update defined a generalized service area encompassing the areas that are closer to DVT than other airports with comparable facilities, and was therefore much more restricted. As shown in **Figure 2-1**, many DVT based aircraft are now registered in areas beyond DVT’s immediate environs; therefore, a broader catchment area was considered more appropriate for this study.

Population in the catchment area is an indicator of the size of the market and a major driver of general aviation demand. **Table 2-4** shows historical population growth and alternative population forecasts for the Phoenix MSA. Between 2000 and 2012, population grew at an average of 2.36% per year. The Office of Employment and Population Statistics in the Arizona Department of Administration (ADOA) has generated medium, high, and low population forecasts for the Phoenix MSA. Woods & Poole (W&P) is an economic forecasting firm that publishes economic and demographic forecasts for each state, metropolitan area, and county in the U.S. which it updates every year. The W&P forecast is very similar to the ADOA Medium forecast. The Maricopa Association of Governments (MAG) also prepares population forecasts for Maricopa County and divisions within Maricopa County, but none for Pinal County. The ADOA medium population forecast was selected for use in this study because ADOA is more likely to have insight on local Phoenix conditions than W&P and it also includes both counties in the Phoenix MSA.

Total employment (**Table 2-5**) is an indicator of the size and strength of the regional economy and therefore is another useful indicator for aviation activity forecasts. Employment is a more complicated metric than population because different organizations measure employment in different ways. For example, the Bureau of Economic Analysis (BEA) counts all full-time and part-time workers in its numbers, whereas the Bureau of Labor Statistics excludes proprietors, agricultural workers, household workers and the military. The ADOA, the MAG, and W&P all have recently prepared employment forecasts for the region but use differing definitions of employment. The W&P forecast was selected for use in this study because it relies on the more inclusive BEA definition of employment. In addition, the ADOA forecast extends only to 2020 and the MAG forecast excludes Pinal County. This limits their potential application to the DVT Master Plan Forecast.

As shown in **Table 2-5**, employment in the Phoenix MSA grew rapidly until 2007, and then declined significantly during the recession. Although it has begun to grow again, it has not yet recovered to pre-recession levels. Over the long term, employment is projected to grow at a rate consistent with population growth.

Figure 2-1: Total Based Aircraft at DVT by Zip Code of Registration

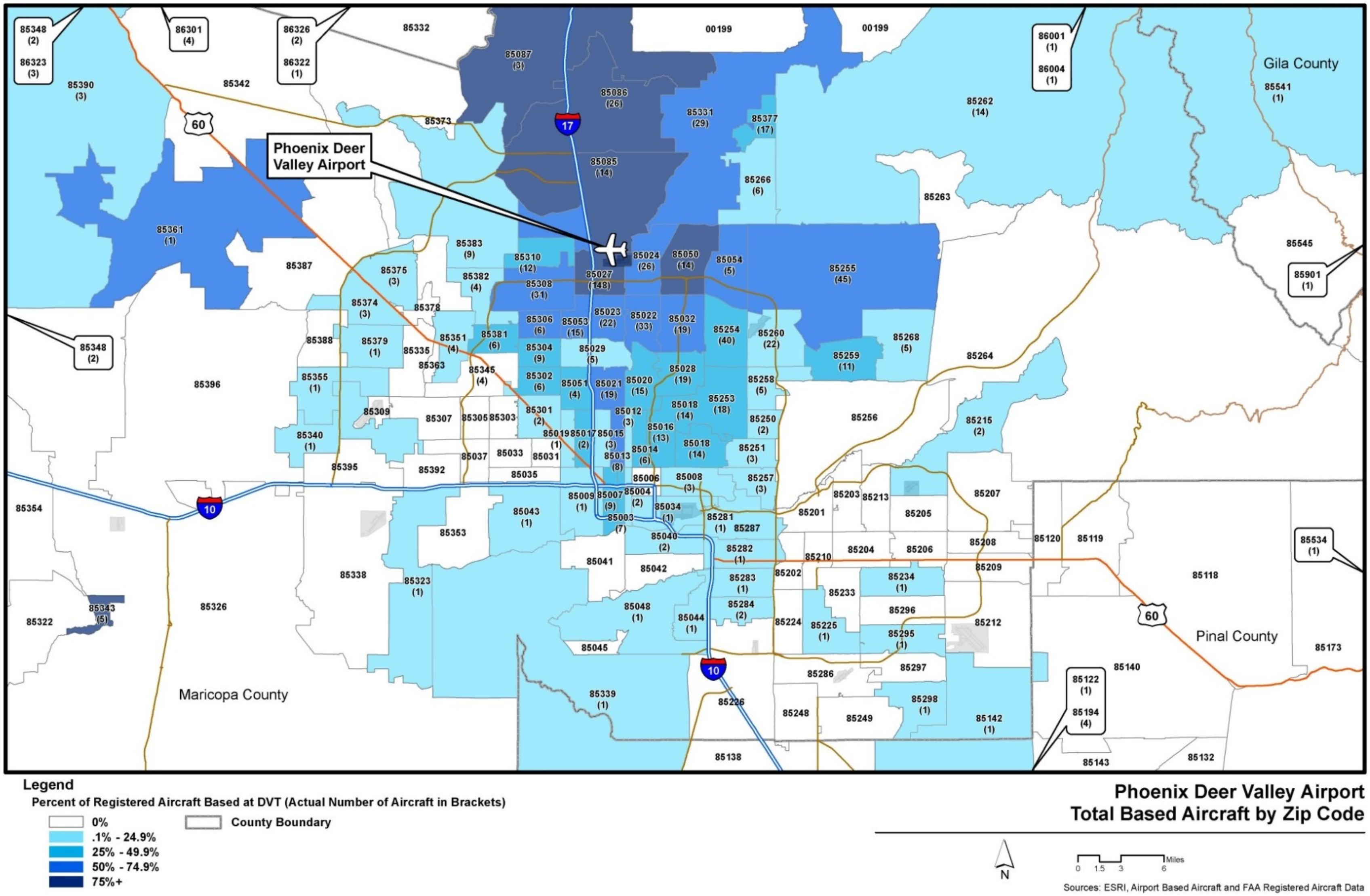


Table 2-4: Population Forecasts (Phoenix MSA)

Year	Actual (a)	Medium (b)	High (b)	Low (b)	W&P (c)
2000	**3,273,477**				
2001	**3,363,736**				
2002	3,452,470				
2003	3,536,388				
2004	3,637,332				
2005	3,774,696				
2006	3,914,212				
2007	4,018,128				
2008	4,106,372				
2009	4,153,609				
2010	4,209,375				
2011	4,252,078				
2012	4,329,534	4,273,900	4,277,300	4,269,700	4,344,587
2018		4,792,000	4,895,100	4,667,300	4,867,021
2023		5,308,700	5,528,100	5,039,500	5,339,825
2033		6,362,300	6,856,600	5,760,500	6,371,231
		Average Annual Growth Rate			
2000-2012	2.36%				
2012-2033		1.91%	2.27%	1.44%	1.84%

Sources: As noted and HNTB analysis; (a) U.S. Department of Commerce, Bureau of Economic Analysis, 2014; (b) Arizona Department of Administration, Office of Employment & Population Statistics, 12/07/2012; (c) Woods & Poole Economics, 2014 State Profile: Arizona and New Mexico, 2014

Table 2-5: Employment Forecasts (Phoenix MSA)

Year	BLS Actual (a)	BEA Actual (b)	ADOA (c)	MAG (d)	W&P (e)
2000	1,609,059	1,925,508			
2001	1,648,750	1,948,119			
2002	1,687,138	1,960,602			
2003	1,727,856	2,009,301			
2004	1,783,726	2,095,792			
2005	1,847,545	2,229,015			
2006	1,930,609	2,346,793			
2007	1,975,503	2,408,578			
2008	1,976,979	2,377,989			
2009	1,900,253	2,249,224			
2010	1,875,333	2,217,888	1,688,905	1,706,300	
2011	1,870,535	2,255,342			
2012	1,889,202	2,301,874	1,767,310	1,827,620	2,301,874
2018		4,792,000	2,002,524	2,191,580	2,601,003
2023		5,308,700		2,543,300	2,878,460
2033		6,362,300		2,936,720	3,521,384
Average Annual Growth Rate					
2000-2012	1.35%	1.50%			
2010-2020			1.72%		
2010-2033				2.39%	2.05%

Sources: As noted and HNTB analysis; (a) Bureau of Labor Statistics, 2014. Excludes proprietors, agricultural workers, household workers, and the military; (b) U.S. Department of Commerce, Bureau of Economic Analysis, 2014. Includes all employment categories; (c) Arizona Department of Administration, Office of Employment & Population Statistics, 2012. Non-farm employment only; (d) Maricopa Association of Governments, Socioeconomic Projections, 2013. Maricopa County only; (e) Woods & Poole Economics, 2014 State Profile: Arizona and New Mexico, 2014

Like employment, total regional income is a significant indicator of the size and health of the local economy. **Table 2-6** presents historical income and two alternative income projections for the Phoenix MSA. Both historical and projected income is presented in constant 2013 prices to net out the effects of inflation. Neither the ADOA nor the MAG publishes independent income forecasts. In addition to the unadjusted W&P forecast, **Table 2-6** includes a hybrid forecast calculated by multiplying the Medium ADOA population forecast by the W&P per capita income forecast. The hybrid forecast of income was selected for use in this study because it is consistent with the ADOA population forecast and, to the extent possible, it incorporates local insight from that forecast.

As shown in **Table 2-6**, regional income, like employment, grew rapidly until 2007 and then dropped significantly during the recession. It began growing again in 2010, but has not yet recovered to pre-recession levels as of 2012. Over the forecast period, income in the Phoenix MSA is projected to grow at about 3.5% per year. As a comparison, real income grew at 4.8% per year between 2000 and 2007.

Tables A-1 through A-5 in **Appendix A** provide more detailed historical socioeconomic information for the Phoenix MSA, including population, employment, unemployment rate, total income, and per capita income.

2.3 Fuel Costs

Fuel prices are an important determinant of general aviation demand since they represent the single greatest component of aircraft operating costs. Turbine operations require jet fuel (known as Jet-A) whereas piston operations require aviation gasoline (known as AVGAS). Both the FAA (from Global Insight, a private economic forecasting firm) and the U.S. Department of Energy (DOE) provide forecasts of jet fuel. Neither source publishes long term forecasts for AVGAS. However, if a practical alternative to leaded AVGAS becomes available, AVGAS prices should track closely with jet fuel prices since they are subject to similar supply and demand considerations.

As shown in **Table 2-7**, the DOE provides medium, high, and low forecasts of jet fuel prices. The base year value for the FAA forecast differs from the other forecasts because it represents a fiscal rather than a calendar year. All of the forecasts except for the DOE high forecast project a decline in real jet fuel costs over the next ten years, primarily because of anticipated increases in domestic oil production. The DOE medium forecast was selected for use in this study because the FAA (Global Insight) forecast is considered to be too optimistic in showing a long-term decline in fuel prices given recent history which has demonstrated a significant increase.

Table A-6 in **Appendix A** shows historical jet fuel prices along with crude oil prices. The table demonstrates the close association between jet fuel costs and crude oil prices.

Table 2-6: Real Income Forecasts (Phoenix MSA) (thousands of dollars in 2013 prices)

Year	Actual (a)	W&P Forecast (b)	Hybrid Forecast (c)
2000	122,239,206		
2001	126,432,950		
2002	129,327,633		
2003	133,360,097		
2004	141,661,932		
2005	152,893,627		
2006	166,209,607		
2007	170,117,208		
2008	165,705,097		
2009	157,888,328		
2010	157,085,037		
2011	162,797,289		
2012	166,410,844	166,410,844	163,703,318
2018		201,633,081	198,525,078
2023		239,440,173	238,044,514
2033		340,591,435	340,114,004
Average Annual Growth Rate			
2000-2012	2.60%		
2012-2033		3.47%	3.54%

Sources: As noted and HNTB analysis; (a) U.S. Department of Commerce, Bureau of Economic Analysis, 2014; (b) Woods & Poole Economics, 2014 State Profile: Arizona and New Mexico, 2014. Converted to 2013 prices; (c) Hybrid forecast consisting of Medium ADOA Population forecast multiplied by W&P per capita income forecast

Table 2-7: Fuel Price Projections (jet fuel price/gallon in 2013 prices)

Year	Actual (a)	Global Insight (b)	DOE Medium (c)	DOE High (c)	DOE Low (c)
2000	1.10				
2001	0.92				
2002	0.86				
2003	1.01				
2004	1.38				
2005	1.99				
2006	2.18				
2007	2.35				
2008	3.18				
2009	1.78				
2010	2.27				
2011	3.09				
2012	3.09	2.99	3.14	3.13	3.13
2018		2.64	2.51	3.99	2.02
2023		2.74	2.87	4.43	2.06
2033		2.70	3.41	5.44	2.17

Sources: As noted and HNTB analysis; (a) Airlines for America, Annual Crude Oil and Jet Fuel Prices, 2014. Converted to 2013 prices by HNTB; (b) FAA Aerospace Forecast: Fiscal Years 2014-2034, 2014. Obtained from Global Insight; (c) U.S. Department of Energy, Energy Information Agency, 2014 Annual Energy Outlook (Medium Case) and 2013 Annual Energy Outlook (High and Low Cases)

2.4 Forecast Assumptions

Forecast assumptions were prepared, with the input of the Aviation Department, for use as inputs to the DVT Master Plan Forecast. The purpose of the assumptions was to provide a reasonable assessment of the key forecast trends and parameters necessary to generate activity forecasts. Some of the background for these assumptions has already been discussed in Sections 2.2 and 2.3. In many instances, multiple outcomes for these trends and parameters are possible. Therefore, in Section 2.10, four independent forecast scenarios are presented to address the impact of potential variations in these factors. The selected Forecast assumptions are presented below.

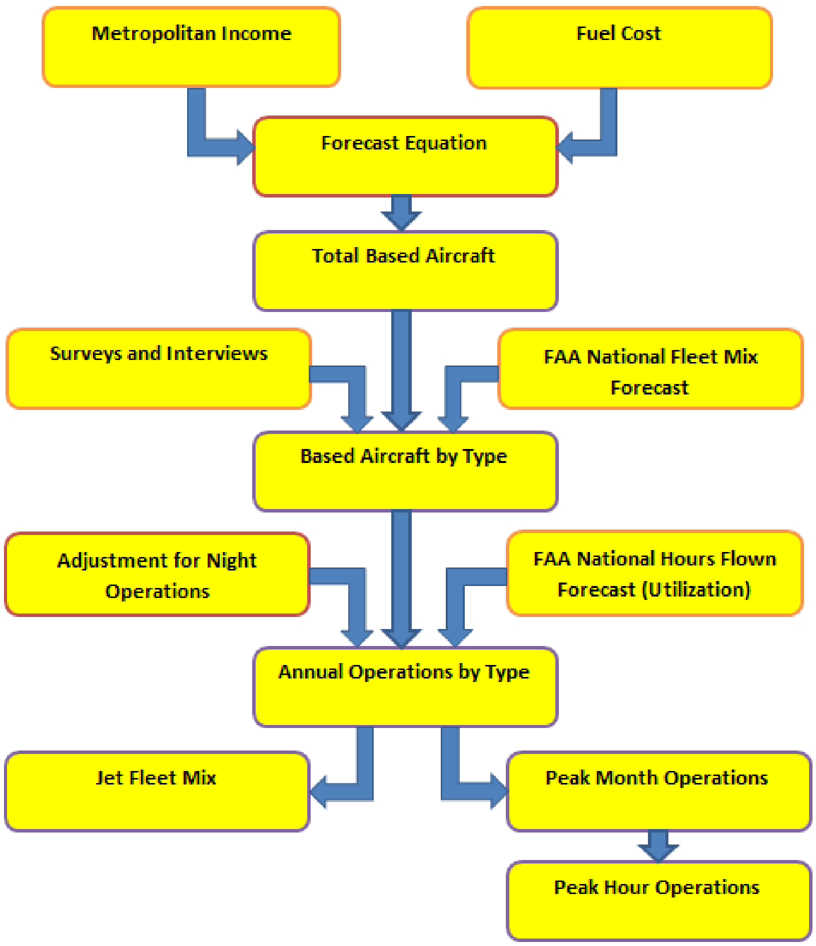
- **Unconstrained Forecast:** Airport infrastructure at DVT is assumed to be sufficient to accommodate projected traffic except where noted. For the purpose of this forecast, it is assumed that infrastructure improvements will be made when necessary without impeding projected activity. Destination airports will have sufficient capacity to accommodate demand from DVT.

- **Airport Role:** DVT's role will evolve in accordance with demand. However, no major changes in DVT's role, such as the introduction of scheduled passenger or cargo service within the forecast period, are assumed.
- **National Airspace System:** FAA will successfully implement any required changes and improvements to the NAS to accommodate the unconstrained forecast of aviation demand. No major bottlenecks will occur that impede normal aviation activity at DVT.
- **Regulatory Assumptions:** No new regulatory restrictions affecting the types of aircraft operating at DVT are assumed. There will be no nighttime restrictions on aircraft operations.
- **General Aviation Taxes and Fees:** Future fuel taxes and other fees related to general aviation at DVT will remain unchanged except for adjustments for inflation.
- **Environmental Factors:** There will be no major changes in the physical environment. It is assumed that global climate changes will not be significant enough to force restrictions on the burning of hydrocarbons or cause major aviation fuel tax increases within the forecast period.
- **Catchment Area:** As discussed in Section 2.2, the DVT catchment area is defined as the Phoenix MSA (**Figure 2-1**).
- **Population Forecasts:** As discussed in Section 2.2, population in the Phoenix MSA is assumed to grow in accordance with the ADOA medium forecast (**Table 2-4**).
- **Employment Forecasts:** As discussed in Section 2.2, Employment in the Phoenix MSA is assumed to grow in accordance with the W&P forecast (**Table 2-5**).
- **Income Forecasts:** As discussed in Section 2.2, real income is projected to grow in accordance with the hybrid income forecast (**Table 2-6**).
- **Fuel Costs:** As discussed in Section 2.3, jet fuel prices are assumed to grow in accordance with the U.S. DOE medium forecast (**Table 2-7**).
- **Flight Training:** Local flight operations from the flight schools are assumed to grow in accordance with past trends. If there are disruptions in demand that would result from Chinese airlines doing more in-country training, the flight schools will back-fill with trainees from other countries.
- **Other Airports:** Other airports serving the Phoenix area, such as GYR, Scottsdale (SDL), Glendale (GEU), and Falcon Field (FFZ) are assumed to continue in their current roles. They will continue to develop their infrastructure to meet local demand and there will be no ATCT closures in the baseline case. PHX will not actively attempt to recapture general aviation activity.

2.5 Forecast Approach Overview

Figure 2-2 graphically describes the overall approach used to develop the Forecast. Assumptions regarding future income growth and fuel prices were incorporated to develop a forecast of total based aircraft (Section 2.6). The based aircraft forecast was then disaggregated by major aircraft category using information from tenant surveys and the FAA's national forecast. FAA projections for aircraft utilization were then applied to the based aircraft forecast to prepare a forecast of annual aircraft operations by category (Section 2.7). The forecast of operations was then adjusted to account for operations that are not tabulated because of the tower closure between midnight and 6 am. The forecast of jet operations was then further disaggregated into a forecast of jet operations by individual aircraft type. In addition, peak month and peak hour operations forecasts were derived from the annual operations forecasts using existing peaking relationships (Section 2.8).

Figure 2-2: Phoenix Deer Valley Airport Forecast Approach



Sources: As noted and HNTB analysis.

2.6 Based Aircraft Forecast

Based aircraft at DVT were projected using a forecast equation developed by applying regression analysis. Regression analysis is a statistical method of generating an equation (or model) which best explains the historical relationship among selected variables, such as based aircraft and real income. If it is assumed that the statistical relationship that best explains historical activity will continue to hold into the future, this equation can be used as a forecasting equation. Several based aircraft forecasting models were tested using historical (1990-2012) data. The potential driving factors tested included socioeconomic variables, aviation industry variables, and instrument variables. The socioeconomic variables included population, employment, and income for the catchment area (see Section 2.2). The aviation industry variables included jet fuel prices, crude oil prices, and the national general aviation fleet. Instrument variables representing the events of September 11, 2001 and ensuing industry recovery were also tested. The model was tested in both linear and logarithmic formulations.

Several of the equations that were calculated showed solid correlations with historical based aircraft at DVT. The model that produced the best results, from both a theoretical and statistical standpoint, was a linear formulation, which specified DVT based aircraft as a function of MSA income and jet fuel prices as independent variables.[4] A further adjustment was made to reconcile the 2012 based aircraft value projected by the equation and the actual based aircraft value for the year. The regression equation and based aircraft forecast is presented in **Table 2-8**.

The forecast equation indicates that based aircraft growth is positively correlated with regional income growth and negatively correlated with increases in jet fuel prices. The R-squared value of 0.68 indicates that 68% of the historical variance in DVT based aircraft can be explained by the income and fuel cost variables. The t-statistics indicate that each of the input variables is statistically significant in explaining the historical variation in based aircraft.

As shown in **Table 2-8**, total DVT based aircraft are projected to increase from 1,058 in 2014 to 1,780 in 2033, resulting in an average annual increase of 2.8%.

[4] Since most based aircraft at DVT are piston-powered, AVGAS prices would be a more relevant variable than jet fuel prices. Unfortunately, as noted in Section 2.3, neither the FAA nor DOE publish forecasts for AVGAS prices. Since AVGAS and jet fuel are both derived from crude oil and serve similar markets, AVGAS and jet fuel price trends have been similar in the past and are expected to be similar in the future. Therefore jet fuel prices serve as a proxy for AVGAS prices in the forecasting equation.

Table 2-8: Based Aircraft Forecast

Year	Income (a)	Jet Fuel Price (b)	Based Aircraft
2000	122,239,206	1.10	1,206
2001	126,432,950	0.92	1,046
2002	129,327,633	0.86	1,275
2003	133,360,097	1.01	1,250
2004	141,661,932	1.38	1,252
2005	152,893,627	1.99	n/a
2006	166,209,607	2.18	n/a
2007	170,117,208	2.35	n/a
2008	165,705,097	3.18	1,212
2009	157,888,328	1.78	1,190
2010	157,085,037	2.27	987
2011	162,797,289	3.09	1,181
2012	166,410,844	3.09	964
2013	n/a	2.92	1,033
2014	n/a	n/a	1,058
2018	198,525,078	2.51	1,167
2023	238,044,514	2.87	1,329
2033	340,114,004	3.41	1,780

Sources: As noted and HNTB analysis; n/a = not available; (a) Table 2-6; (b) Table 2-7; (c) Historical data from Table 2-1, Forecasts based on the Following Equation:
BAC = (479.171 + (.00000567 x INCOME) - (95.6438 x FUEL)) x ADJ, Where:
BAC = Based Aircraft
INCOME = MSA Income (thousands of 2013 dollars)
FUEL = Jet Fuel Cost per gallon (in 2013 dollars)
ADJ = .855 (ratio of actual 2012 based aircraft vs. value calculated by equation)
R-squared = .68
F-statistic = 17.04
t-statistics
intercept = 5.21
income = 5.17
fuel = -2.19

Table 2-9 disaggregates the based aircraft forecast presented in **Table 2-8** by major aircraft type. Each major category was projected to grow at the FAA forecast national growth rate in that category and then adjusted proportionately to sum to the totals projected in **Table 2-8**. An additional adjustment was made to the 2018 forecast of jet aircraft to reflect input provided by DVT airport tenants during the inventory.

Table 2-9: Based Aircraft By Type (a)

Year	SEP	MEP	Turboprop	Jet	Heli	Glider	Other	Total (b)
2012	804	107	(c)	21	26	4	2	964
2013	866	116	(c)	18	23	10	0	1,033
2014	871	104	31	17	24	11	0	1,058
2018	945	113	35	32	30	12	0	1,167
2023	1,066	127	42	40	40	14	0	1,329
2033	1,395	160	72	68	66	19	0	1,780
Average Annual Growth Rate								
2013-2033	(d)	(d)	(d)	6.9%	5.4%	3.3%	0.0%	2.8%
2014-2033	2.5%	2.3%	4.5%	7.6%	5.5%	2.9%	0.0%	2.8%

Sources: As noted and HNTB analysis; (a) Fleet mix based on FAA projected general aviation trends and input from tenant surveys; (b) Table 2-8; (c) Included with single-engine and multi-engine piston; (d) Growth rate could not be calculated because breakout between piston and turboprop was not available for 2013

2.7 Aircraft Operations Forecast

Table 2-10 shows the base year estimate and forecast of DVT aircraft operations by major aircraft type. Historical data by type are not readily available so the base year (2013) distribution was estimated. Operations by more sophisticated aircraft (jets and turboprops) were obtained from data provided by the Aviation Department from their noise monitoring system, and then verified by comparing the results with the FAA's Traffic Flow Management System Counts (TFMSC) and interviews with DVT control tower staff. All jet and turboprop operations were assumed to be itinerant.

Breakouts of smaller piston-powered aircraft types are more difficult to develop because they fly primarily under VFR and therefore are not tabulated by most aircraft monitoring systems. Based on input provided by DVT control tower staff, helicopters were estimated to account for 5% of total operations. Remaining operations were distributed among single engine and twin engine piston aircraft in proportion to their representation in the based aircraft counts.

Table 2-10: Aircraft Operations by Type (a)
(Includes Estimated Operations between Midnight and 6 am) (b)

Year	Itinerant SEP	Itinerant MEP	Itinerant Turboprop	Itinerant Jet	Itinerant Heli	Itinerant Subtotal	Local SEP	Local MEP	Local Heli	Local Subtotal	Total
2013 (c)	120,601	14,400	3,229	2,114	3,323	143,667	182,991	21,850	14,844	219,685	363,352
2018	122,732	14,984	3,669	4,200	4,230	149,815	184,940	22,579	18,766	226,285	376,100
2023	136,715	16,655	4,418	5,662	5,716	169,166	206,010	25,098	25,359	256,467	425,633
2033	185,253	22,363	7,606	9,932	9,609	234,763	279,151	33,698	42,627	355,476	590,239
Average Annual Growth Rate											
2013-2033	2.2%	2.2%	4.4%	8.0%	5.5%	2.5%	2.1%	2.2%	5.4%	2.4%	2.5%

Sources: As noted and HNTB analysis; (a) Projected based on based aircraft forecasts and FAA projected utilization trends; (b) Aircraft operations between midnight and 6 am estimated at 2.3% of daily total based on information provided by the City of Phoenix Aviation Department; (c) Base year distribution of operations based on data provided by City of Phoenix Aviation Department, FAA FTMSC data, and estimates provided by DVT tower

Since the DVT tower does not operate between midnight and 6 am, operations that occur during that time are not tabulated in the official FAA counts. Based on aircraft monitoring data from the Aviation Department, these operations were estimated to account for 2.3% of the daily total. Therefore, the operations in **Table 2-10** were adjusted upwards to compensate for the 2.3% of operations missing from the official totals.

As shown in **Table 2-10**, single and twin engine piston-powered aircraft account for the vast majority of aircraft operations at DVT. Jets and turboprops combined account for less than 2% of the total. Future operations in each aircraft category were assumed to increase based on the growth in the number of based aircraft in that category and the anticipated change in their utilization rate. The future utilization rate within each category was estimated based on the FAA national forecast of hours flown divided by the FAA national activity fleet forecast in that category. The individual operations forecasts within each category were then summed to arrive at a forecast of total annual aircraft operations at DVT.

Also shown in **Table 2-10**, total aircraft operations are projected to increase from 363,352 in 2013 to 590,239 by 2033, an average annual increase of 2.5%. Although jet, turboprop, and helicopter operations are projected to increase more rapidly than piston-powered operations, piston aircraft operations are still expected to account for a large majority of activity at the end of the forecast period.

As noted earlier, the aircraft operations forecast in **Table 2-10** includes operations from midnight to 6 am that are not included in the official ATCT operations counts. To facilitate comparison with the FAA's TAF and actual ATCT counts, **Table 2-11** provides a breakout of the operations forecast between those operations expected to occur between 6 am to midnight, and between midnight and 6 am. As shown, the ATCT counts are projected to increase from 354,995 operations in 2013 to 576,664 in 2033.

Table 2-11: Forecast of Aircraft Operations
(6 am to midnight, and midnight to 6 am)

Year	6 am to Midnight (a)	Midnight to 6 am (b)	Total
2013	354,995	8,357	363,352
2018	367,450	8,650	376,100
2023	415,843	9,790	425,633
2033	576,664	13,575	590,239
Average Annual Growth Rate			
2013-2033	2.5%	2.5%	2.5%

Sources: As noted and HNTB analysis; n/a = not available; (a) Operations counted by ATCT. Comparable to TAF and historical ATCT counts; (b) Estimated operations between midnight and 6 am. Not counted by ATCT; (c) Total from Table 2-10

Table 2-12 provides a breakout of the operations forecast by use category, consistent with the categories the FAA uses to tabulate aircraft operations. Commercial operations include air carrier and air taxi. Air carrier operations consist of intermittent large aircraft operations arriving at DVT for special testing or other infrequent purposes. Air taxi operations consist of for-hire operations by small aircraft operated by the FBOs at DVT. There are no scheduled passenger or cargo operations at DVT. Since the commercial operations at DVT are not scheduled and mostly perform missions typically associated with general aviation, they were assumed to grow at the same rate as general aviation operations.

Combined itinerant and local military activity accounts for less than two operations per week at DVT. Military activity is driven more by national and international policy factors than local economic factors. Since reliable information on the policy factors likely to drive future military operations is not available, military operations at DVT were assumed to remain constant. As shown in **Table 2-12**, the vast majority of activity at DVT consists of general aviation, and is expected to continue to consist of general aviation.

Airfield facility requirements are determined primarily by the number of aircraft operations (**Tables 2-10** through **2-12**) and the performance characteristics of the aircraft operating and projected to operate at DVT. Therefore, a more detailed fleet mix for jet operations at DVT was prepared to help determine the appropriate design standards for DVT.

Table 2-13 provides the detailed fleet mix forecast for jet aircraft at DVT. The individual aircraft types are organized according to their aircraft design group and their approach category. The aircraft design groups relevant to DVT include:

- ADG Group I: tail height less than 20 feet and wingspan less than 49 feet
- ADG Group II: tail height 20 feet to less than 30 feet and wingspan 49 feet to less than 79 feet
- ADG Group III: tail height 30 feet to less than 45 feet and wingspan 79 feet to less than 118 feet
- ADG Group IV: tail height 45 feet to less than 60 feet and wingspan 118 feet to less than 171 feet

The aircraft approach categories are based on the aircraft arrival approach speed and include:

- Category A: less than 91 knots
- Category B: 91 knots to less than 121 knots
- Category C: 121 knots to less than 141 knots
- Category D: 141 knots to less than 166 knots
- Category E: greater than 166 knots

Table 2-12: Aircraft Operations by Use Category (Includes Estimated Operations between Midnight and 6 am) (a)

Year	Itinerant Air Carrier	Itinerant Air Taxi (b)	Itinerant General Aviation	Itinerant Military (c)	Itinerant Subtotal	Local General Aviation	Local Military (c)	Local Subtotal	Total
2013	17	4,622	138,971	57	143,667	219,653	32	219,685	363,352
2018	18	4,820	144,920	57	149,815	226,253	32	226,285	376,100
2023	20	5,442	163,647	57	169,166	256,435	32	256,467	425,633
2033	28	7,553	227,125	57	234,763	355,444	32	355,476	590,239
Average Annual Growth Rate									
2013-2033	2.5%	2.5%	2.5%	0.0%	2.5%	2.4%	0.0%	2.4%	2.5%

Sources: As noted and HNTB analysis; (a) Aircraft operations between midnight and 6 am estimated at 2.3% of daily total based on information provided by the City of Phoenix Aviation Department; (b) Does not include any scheduled commuter operations. Assumed to increase at same rate as itinerant operations; (c) Assumed to remain constant

Table 2-13: Forecast of Jet Fleet Mix at DVT

Aircraft and ARC	2013	2018	2023	2033
ARC B-I				
Beechcraft Beechjet 400	69	72	86	140
Cessna Citation 500	27	22	20	15
Cessna Citation 501	18	15	13	10
Cessna Citation C525 Twin Jet	112	126	162	294
Cessna Citation Mustang	36	91	170	442
Eclipse	198	415	737	1,155
Embraer Twin Jet	34	71	127	198
Falcon 10	12	10	9	7
Learjet 25 Twin Jet	117	97	88	65
Learjet 55 Twin Jet	41	34	31	23
Raytheon 390 RB-45	90	125	186	402
Westwind Jet	22	18	16	12
Other	6	6	7	11
Subtotal	782	1,103	1,652	2,775
ARC B-II				
BAe HS 125/700-800 Twin Engine Jet	51	50	56	81
Cessna 560 Citation V	111	118	143	240
Cessna Citation 560 Excel	47	59	82	164
Cessna Citation Sovereign	10	17	27	64
Cessna Citation Twin Jet CJ2	49	65	95	200
Cessna Citation Twin Jet CJ3	84	141	229	539
Cessna Citation Twin Jet CJ4	18	106	228	643
Cessna Model 550 Citation Bravo	116	96	87	65
Embraer Twin Jet	18	18	21	32
Falcon 20	28	23	21	16
Falcon 50 Mystere 50	17	14	13	10
Falcon 900 Three Engine Jet	76	78	93	149
Falcon 2000	30	34	45	83
Other	9	9	11	16
Subtotal	664	829	1,150	2,301
ARC B-III				
Other	4	4	5	7
ARC C-I				
Learjet 31 Twin Jet	15	12	11	8
Lear Jet 40 Twin Jet	29	49	79	186
Lear Jet 45 Twin Jet	54	68	94	188
Learjet 60 Twin Jet	12	10	9	7
Subtotal	110	138	193	390

Aircraft and ARC	2013	2018	2023	2033
ARC C-II				
Bombardier Challenger 300	54	790	967	1,558
Bombardier CL600/610 Challenger	31	731	855	1,265
Cessna Citation 10 Twin Jet	164	195	262	504
Cessna Citation 3/6/7	11	9	8	6
Other	10	10	12	18
Subtotal	270	1,736	2,104	3,350
ARC C-III				
Boeing 737-700	11	11	13	19
Embraer 175	50	51	59	88
Gulfstream 5 Twin Jet	15	19	26	52
Other	17	28	46	109
Subtotal	93	109	145	269
ARC C-IV				
Other	1	1	1	2
ARC D-I				
Learjet 35 Twin Jet	90	75	67	50
Other	2	2	2	4
Subtotal	92	77	70	54
ARC D-II				
Gulfstream 4 Twin Jet	82	177	302	702
Other	5	10	17	36
Subtotal	87	188	319	738
ARC D-III				
Other	6	10	16	39
ARC D-IV				
Other	3	3	4	5
ARC E-I				
Other	2	2	2	4
TOTAL	2,114	4,200	5,662	9,932

Sources: City of Phoenix Aviation Department for 2013 data and tenant surveys, aircraft manufacturer data and HNTB analysis for projections

The combination of aircraft within each design group and each approach category determine the appropriate airport runway and airfield design standards. These are reviewed in more detail in Chapter 3, Facility Requirements.

The forecast for each individual aircraft type took several factors into consideration, including the average age of the specific aircraft type, whether or not it was still in production, and any published information on future production rates. As a result, the share of newer aircraft types in the DVT jet fleet are expected to increase and the share of older aircraft types are expected to decrease. Additional adjustments were made in cases where airport tenants were able to provide specific information on new aircraft types anticipated to operate at DVT.

Special attention was devoted to higher performance aircraft likely to impact runway design standards for DVT. Specifically, D-II operations (Aircraft Approach Category D and Aircraft Design Group II) were examined at Phoenix-area general aviation airports for which fleet mix data was available (DVT, GYR, GEU, FFZ, and SDL) and it was determined that D-II operations account for 0.25% of all operations at those airports.

It was assumed, that under unconstrained conditions, the DVT share of D-II operations would gradually increase and conservatively achieve half the regional average (0.125%) by the end of the Forecast period. This assumption is further supported by the fact that DVT had a significantly higher number of these operations back in 2004 and 2007 and has therefore demonstrated the ability to attract these operations in the past.

Table 2-14 summarizes the jet fleet mix forecast by aircraft design group and aircraft approach category. The FAA defines the critical aircraft at an airport as the most demanding aircraft, or group of aircraft, using the airport on a regular basis, defined as 500 or more operations per year. Based on this definition, the current critical aircraft at DVT is category C-II. This aircraft category is projected to remain the critical aircraft in 2018 and 2023. However, by 2033 the critical aircraft is expected to be category D-II. It is important to note that these forecasts are sensitive to the basing decisions of individual aircraft owners. If one or two D-II aircraft owners choose to relocate their aircraft to DVT prior to 2033, the critical aircraft designation would change at that time. The critical aircraft is discussed in more detail in Section 3.3.

2.8 Peak Activity Forecasts

Table 2-15 provides the forecast of peak activity at DVT. March is typically the peak month at DVT and accounts for approximately 10% of annual operations. There is a secondary peak in the fall, around October. Operations are relatively light in mid-winter and mid-summer. Although DVT is busy throughout the week, it is typically busier on weekdays than on weekends because of the high proportion of training activity. Since DVT has no scheduled operations, the peak hour can change from day to day, but typically occurs in the morning between 9 am and 12 am, and accounts for between 10% and 11% of daily operations.

Table 2-14: Jet Aircraft Operations by Airport Reference Code

2013								
Airplane Design Group								
		I	II	III	IV	V	VI	Total
Aircraft Approach Category	A							
	B	782	664	4				1,450
	C	110	270	78	1			459
	D	92	87	21	3			203
	E	2						2
	Total	*986*	*1,021*	*103*	*4*	*0*	*0*	*2,114*
2018								
Airplane Design Group								
		I	II	III	IV	V	VI	Total
Aircraft Approach Category	A							
	B	1,103	829	4				1,936
	C	138	1,736	90	1			1,966
	D	77	188	29	3			296
	E	2						2
	Total	*1,320*	*2,753*	*123*	*4*	*0*	*0*	*4,200*
2023								
Airplane Design Group								
		I	II	III	IV	V	VI	Total
Aircraft Approach Category	A							
	B	1,652	1,150	5				2,807
	C	193	2,104	119	1			2,417
	D	70	319	42	4			435
	E	2						2
	Total	*1,917*	*3,574*	*166*	*5*	*0*	*0*	*5,662*
2033								
Airplane Design Group								
		I	II	III	IV	V	VI	Total
Aircraft Approach Category	A							
	B	2,775	2,301	7				5,082
	C	390	3,350	216	2			3,958
	D	54	738	91	5			888
	E	4						4
	Total	3,222	6,389	314	7	0	0	9,932

Sources: Table 2-13 and HNTB Analysis

Table 2-15: Forecasts of Peak Month, AWDPM, and Peak Hour Operations

Year	Annual	Peak Month	Average Weekday Peak Month	Peak Hour
2013	363,352	36,246	1,241	133
2018	376,100	37,517	1,284	137
2023	425,633	42,458	1,453	155
2033	590,239	58,878	2,015	215
Average Annual Growth Rate				
2013-2033	2.5%	2.5%	2.5%	2.4%

Source: Table 2-11, FAA ATADS database, City of Phoenix Airport Aviation Department records, and HNTB analysis

The peak activity forecast in **Table 2-15** assumes, that since no major change in DVT's role is anticipated, the peaking relationships will remain largely unchanged. Therefore, the peak month percentage of annual operations, and the peak hour percentage of daily operations were assumed to remain constant. As shown, peak hour operations are expected to increase from 133 in 2013 to 215 by 2033.

2.9 Forecast Summary and Comparisons

Table 2-16 provides a summary of the baseline Forecast, including based aircraft by type, annual operations by use category and type, and peak hour operations. As shown, jets and helicopters are anticipated to be the fastest growing categories, but piston-powered aircraft are still expected to account for the majority of operations in 2033.

Figure 2-3 and **Table 2-17** provide a comparison of the DVT based aircraft forecast with historical activity and with prior forecasts completed for DVT. The other forecasts include:

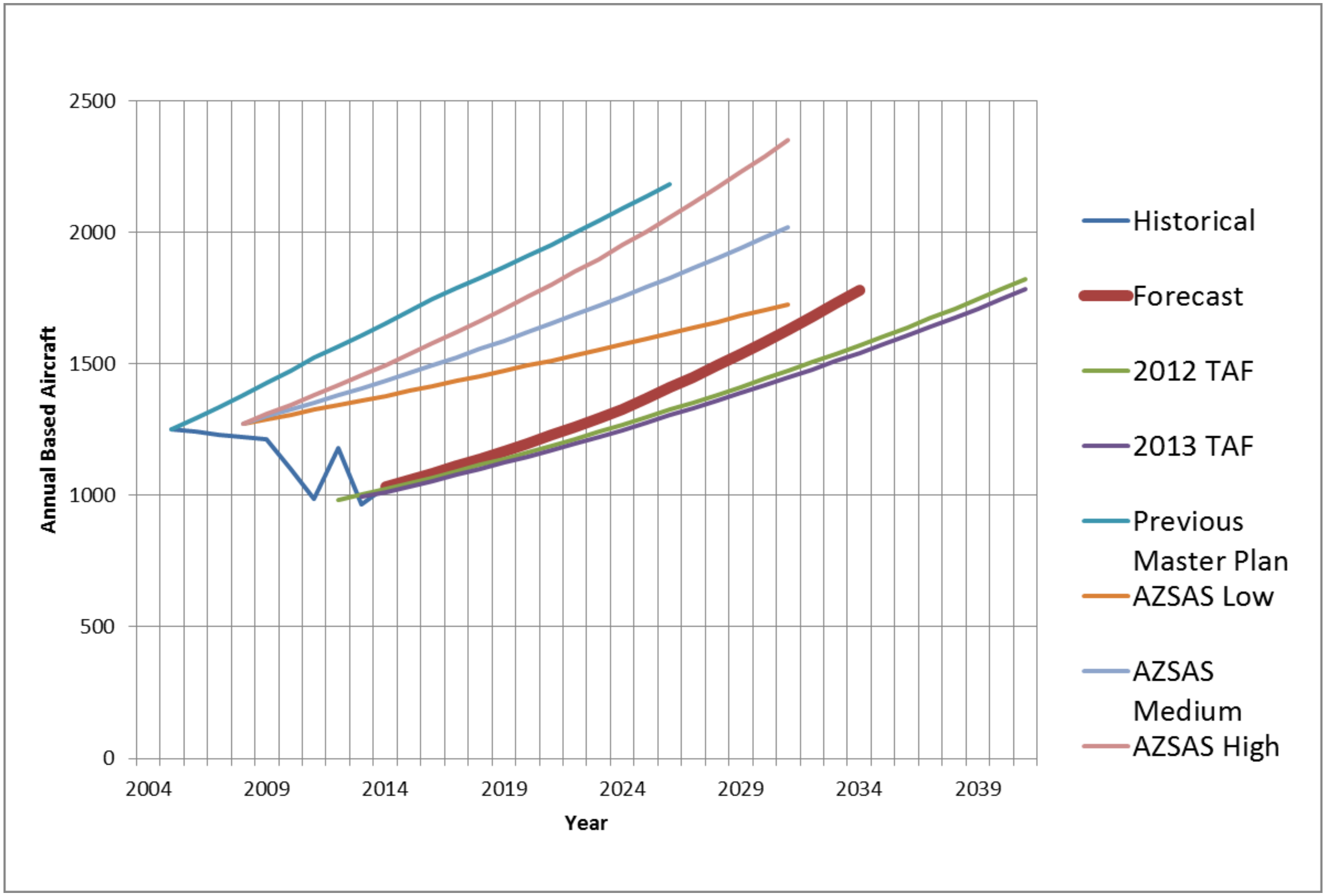
- FAA 2012 TAF (published early 2013)
- FAA 2013 TAF (published early 2014)
- Previous Master Plan Update Forecast (using 2004 as the base year and published in 2007)
- Low, Medium, and High 2008 AZSAS (using 2007 as the base year)

Table 2-16: Forecasts Summary

Category	2013	2018	2023	2028	2033	Average Annual Growth Rate
Based Aircraft						
Single Engine Piston	866	945	1,066	1,220	1,395	2.4%
Multi Engine Piston	116	113	127	143	160	1.6%
Turboprop	(a)	35	42	55	72	4.5%(b)
Jet	18	32	40	52	68	6.9%
Helicopter	23	30	40	51	66	5.4%
Glider	10	12	14	16	19	3.3%
Other	0	0	0	0	0	-
Total	1,033	1,167	1,329	1,538	1,780	2.8%
Annual Operations by FAA Category						
Itinerant						
Air Carrier	17	18	20	24	28	2.5%
Air Taxi	4,622	4,820	5,442	6,407	7,553	2.5%
General Aviation	138,971	144,920	163,647	192,641	227,125	2.5%
Military	57	57	57	79	57	0.0%
Itinerant Subtotal	143,667	149,815	169,166	199,150	234,763	2.5%
Local						
General Aviation	219,653	226,253	256,435	304,481	355,444	2.4%
Military	32	32	32	32	32	0.0%
Local Subtotal	219,685	226,285	256,467	301,940	355,476	2.4%
Total	363,352	376,100	425,633	501,090	590,239	2.5%
Annual Operations by Type (24-hour)						
Itinerant						
Single Engine Piston	120,601	122,732	136,715	159,144	185,253	2.2%
Multi Engine Piston	14,400	14,984	16,655	19,299	22,363	2.2%
Turboprop	3,229	3,669	4,418	5797	7,606	4.4%
Jet	2,114	4,200	5,662	7499	9,932	8.0%
Helicopter	3,323	4,230	5,716	7411	9,609	5.5%
Subtotal Itinerant	143,667	149,815	169,166	199,150	234,763	2.5%
Local						
Single Engine Piston	182,991	184,940	206,010	239,808	279,151	2.1%
Multi Engine Piston	21,850	22,579	25,098	29,082	33,698	2.2%
Helicopter	14,844	18,766	25,359	32,878	42,627	5.4%
Subtotal Local	219,685	226,285	256,467	301,940	355,476	2.4%
Total Annual Ops	363,352	376,100	425,633	501,090	590,239	2.5%
Peak Hour Ops	133	137	155	183	215	2.4%

Sources: Tables 9, 10, and 15; (a) Distributed among single-engine and twin-engine piston during 2013; (b) From 2014

Figure 2-3: Comparison of DVT Based Aircraft Forecasts



Source: Sources: City of Phoenix Aviation Department airport records, FAA 2012 and 2013 Terminal Area Forecasts, Phoenix Deer Valley Airport Master Plan Update, 2007, 2008 Arizona State Airports System Plan, Table 9, and HNTB analysis.
TAF = FAA Terminal Area Forecast
AZSAS = Arizona State Airports System Plan Forecast

Table 2-17: Comparison of Previous Based Aircraft Forecasts

Year	Historical	Forecast	2012 TAF	2013 TAF	Previous MP	AZSAS Low	AZSAS Medium	AZSAS High
2004	1,252				**1,252**			
2005	1,242				1,294			
2006	1,232				1,337			
2007	1,222				1,381	1,274	1,274	1,274
2008	1,212				1,427	1,291	1,300	1,308
2009	1,100				1,475	1,308	1,326	1,344
2010	987				**1,524**	1,326	1,353	1,380
2011	1,181		981		1,566	1,343	1,380	1,418
2012	964		1,003	995	1,610	1,361	1,408	1,456
2013	1,033	**1,033**	1,023	1,014	1,655	1,379	1,437	1,495
2014	1,058	**1,058**	1,044	1,034	1,701	1,397	1,466	1,536
2015		1,084	1,067	1,056	**1,748**	1,416	1,496	1,577
2016		1,111	1,091	1,079	1,787	1,435	1,526	1,619
2017		1,139	1,115	1,102	1,828	1,454	1,557	1,663
2018		**1,167**	1,138	1,124	1,869	1,473	1,589	1,708
2019		1,198	1,162	1,147	1,911	1,493	1,621	1,754
2020		1,229	1,189	1,173	1,954	1,513	1,654	1,801
2021		1,262	1,214	1,197	1,998	1,533	1,687	1,850
2022		1,295	1,242	1,224	2,044	1,553	1,721	1,900
2023		**1,329**	1,268	1,249	2,090	1,574	1,756	1,951
2024		1,368	1,297	1,277	2,137	1,595	1,792	2,004
2025		1,409	1,325	1,304	**2,185**	1,616	1,828	2,058
2026		1,451	1,354	1,332		1,638	1,865	2,113
2027		1,494	1,383	1,360		1,660	1,903	2,170
2028		1,538	1,413	1,389		1,682	1,942	2,229
2029		1,584	1,444	1,419		1,704	1,981	2,289
2030		1,631	1,475	1,449		1,727	2,021	2,351
2031		1,679	1,507	1,480				
2032		1,729	1,539	1,511				
2033		**1,780**	1,572	1,543				
2034			1,605	1,575				
2035			1,639	1,608				
2036			1,674	1,642				
2037			1,709	1,676				
2038			1,745	1,711				
2039			1,783	1,748				
2040			1,821	1,785				
Average Annual Growth Rate								
		2.8%	2.2%	2.1%	2.7%	1.3%	2.0%	2.7%

Source: Sources: City of Phoenix Aviation Department airport records, FAA 2012 and 2013 Terminal Area Forecasts, Phoenix Deer Valley Airport Master Plan Update, 2007, 2008 Arizona State Airports System Plan, Table 9, and HNTB analysis.

TAF = FAA Terminal Area Forecast

AZSAS = Arizona State Airports System Plan Forecast

The previous Master Plan Update forecast and the three AZSAS forecasts were prepared prior to the recession and therefore reflect the much better economic conditions that were anticipated at the time. The two TAFs were prepared much more recently and are therefore more similar to the current Master Plan Forecast. **Figure 2-4** and **Table 2-18** provide a comparison of the current aircraft operations forecasts with the previous Master Plan Update, the AZSAS, and the most recent 2013 TAF.

As was the case with the based aircraft forecasts, the prior Master Plan and AZSAS operations forecasts were developed before the recession, and therefore show higher forecasts than the more recent projections. The current Master Plan Forecast track very closely with the TAF projections initially but then diverge later in the forecast period. This is due in part to the difference in the based aircraft forecast, but also due to the difference in assumptions on average utilization.

Table 2-19 provides a more detailed comparison of the baseline Forecast with the most recent 2013 TAF using the standard FAA format for comparing forecasts. Note that the Master Plan Forecast numbers have been adjusted to include only 6 am to midnight operations, so as to provide a more accurate basis for comparison. According to FAA guidance:

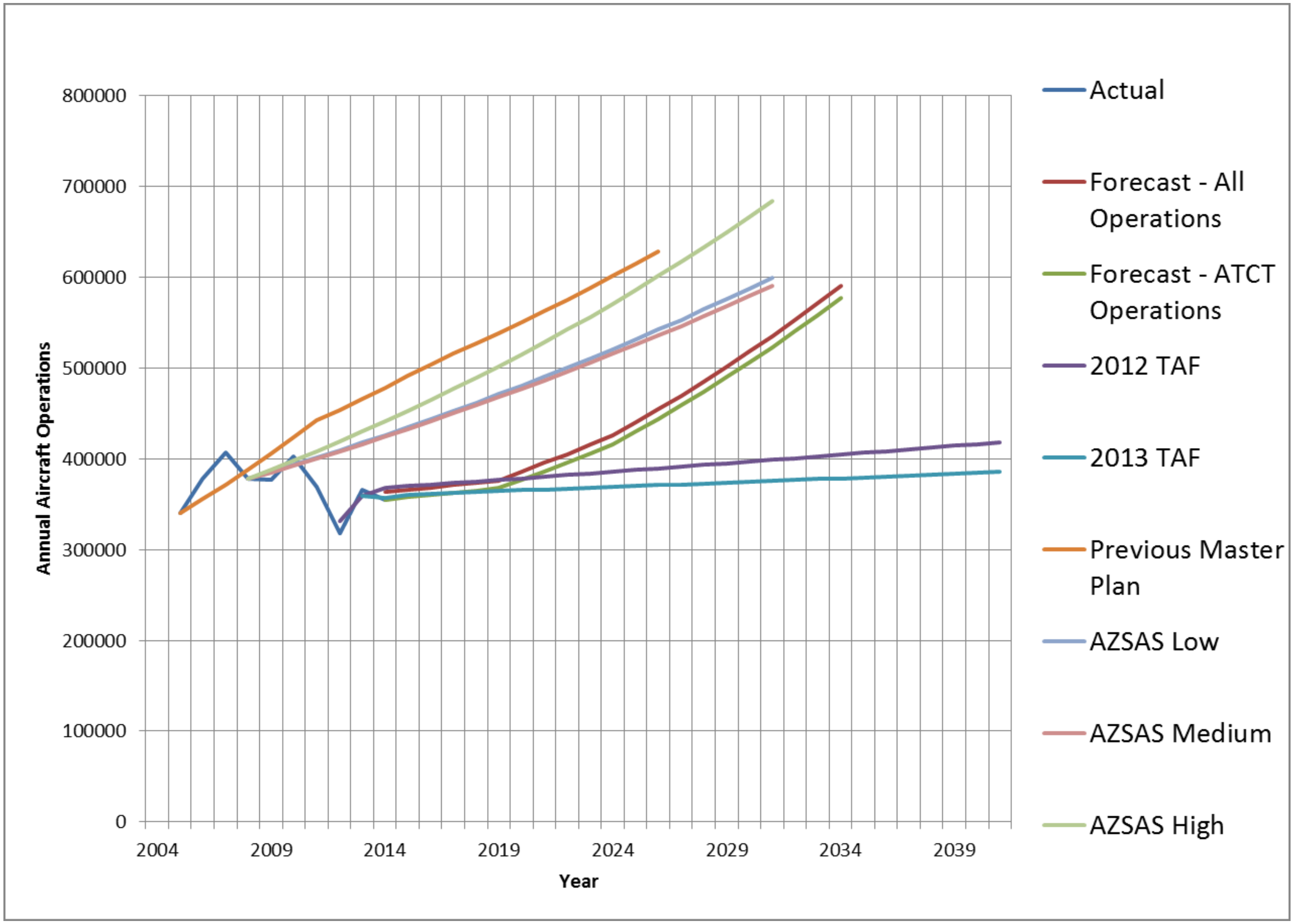
For all classes of airports, forecasts for total enplanements, based aircraft, and total operations are considered consistent with the TAF if they meet the following criterion:

- Forecasts differ by less than 10% in the 5-year forecast period, and 15% in the 10-year forecast period
- If the forecast is not consistent with the TAF, differences must be resolved if the forecast is to be used in FAA decision-making.[5]

Using this criterion, the Master Plan based aircraft forecast is consistent with the TAF. The forecast of commercial operations (air carrier plus air taxi) differs by more than 15% in 2023, mainly because the TAF assumes operations in this category will remain constant. It should be noted that commercial operations at DVT are minimal and by themselves will likely not generate any new facility requirements. They are therefore unlikely to be needed for any FAA decision-making. The Master Plan and TAF projections of total operations are very similar in 2018 and differ by less than 13% in 2023, and therefore meet the criterion for consistency.

[5] FAA, Review and Approval of Aviation Forecasts, June 2008.

Figure 2-4: Comparison of DVT Aircraft Operations Forecasts



Sources: City of Phoenix Aviation Department airport records, FAA 2012 and 2013 Terminal Area Forecasts, 2007 Phoenix Deer Valley Master Plan Update

TAF = FAA Terminal Area Forecast
AZSAS = Arizona State Airports System Plan Forecast

Table 2-18: Comparison of Previous Operations Forecasts

Year	Actual	Forecast – All Operations	Forecast – ATCT Operations	2012 TAF	2013 TAF	Previous Master Plan	AZSAS Low	AZSAS Medium	AZSAS High
2004	340,437					**340,437**			
2005	377,841					355,578			
2006	406,507					371,391			
2007	378,349					387,909	**377,696**	**377,696**	**377,696**
2008	376,634					405,160	385,359	385,101	387,567
2009	402,335					423,180	393,178	392,651	397,696
2010	368,747					**442,000**	401,156	400,348	408,090
2011	317,443			331,377		453,758	409,295	408,197	418,756
2012	365,432			358,731	358,731	465,828	**417,600**	**416,200**	**429,700**
2013	354,995	**363,352**	**354,995**	367,939	356,350	478,219	426,051	424,354	440,919
2014		365,866	357,452	369,655	360,502	490,941	434,673	432,668	452,430
2015		368,398	359,926	371,380	361,417	**504,000**	443,469	441,145	464,242
2016		370,948	362,416	373,117	362,334	515,209	452,444	449,788	476,363
2017		373,515	364,925	374,865	363,254	526,667	**461,600**	**458,600**	**488,800**
2018		**376,100**	**367,450**	376,623	364,177	538,380	470,957	467,581	501,570
2019		385,522	376,656	378,392	365,102	550,354	480,505	476,737	514,674
2020		395,181	386,092	380,173	366,030	562,594	490,245	486,073	528,120
2021		405,082	395,765	381,964	366,960	575,106	500,183	495,591	541,918
2022		415,230	405,680	383,766	367,893	587,897	510,323	505,296	556,076
2023		**425,633**	**415,843**	385,580	368,828	600,971	520,668	515,191	570,604
2024		439,779	429,664	387,405	369,765	614,337	531,223	525,280	585,511
2025		454,395	443,944	389,240	370,705	**628,000**	541,992	535,567	600,808
2026		469,497	458,699	391,087	371,648		552,979	546,054	616,505
2027		485,101	473,944	392,945	372,593		564,189	556,748	632,611
2028		501,224	489,696	394,814	373,542		575,626	567,650	649,139
2029		517,882	505,971	396,694	374,493		587,295	578,766	666,098
2030		535,094	522,787	398,588	375,446		**599,200**	**590,100**	**683,500**
2031		552,878	540,162	400,493	376,403				
2032		571,253	558,115	402,409	377,362				
2033		**590,239**	**576,664**	404,338	378,324				
2034				406,278	379,289				
2035				408,230	380,256				
2036				410,195	381,226				
2037				412,171	382,199				
2038				414,159	383,175				
2039				416,160	384,153				
2040				418,174	385,135				
Average Annual Growth Rate									
		2.5%	2.5%	0.8%	0.3%	3.0%	2.0%	2.0%	2.6%

Sources: City of Phoenix Aviation Department airport records, FAA 2012 and 2013 Terminal Area Forecasts, 2007 Phoenix Deer Valley Master Plan Update

TAF = FAA Terminal Area Forecast
AZSAS = Arizona State Airports System Plan Forecast

Table 2-19: Comparison of Master Plan Forecast and FAA's 2013 Terminal Area Forecast

	Year	Master Plan Forecast	2013 TAF	Master Plan / TAF (% Difference)
Passenger Enplanements	2013	0	0	-
Base Year	2018	0	0	-
Base Year + 5 Years	2023	0	0	-
Base Year + 10 Years	2028	0	0	-
Base Year + 15 Years	2013	0	0	-
Commercial Operations				
Base Year	2013	4,535	4,468	1.5%
Base Year + 5 Years	2018	4,729	4,468	5.8%
Base Year + 10 Years	2023	5,340	4,468	19.5%
Base Year + 15 Years	2028	6,291	4,468	40.8%
Total Operations				
Base Year	2013	354,995	356,350	-0.4%
Base Year + 5 Years	2018	367,450	364,177	0.9%
Base Year + 10 Years	2023	415,843	368,828	12.7%
Base Year + 15 Years	2028	489,695	373,542	31.1%
Based Aircraft				
Base Year	2013	1033	1014	1.9%
Base Year + 5 Years	2018	1167	1124	3.8%
Base Year + 10 Years	2023	1329	1249	6.4%
Base Year + 15 Years	2028	1538	1389	10.7%

Sources: Tables 2-11, 2-16, FAA, and HNTB Analysis

Notes: TAF data is on a U.S. Government fiscal year basis (October through September).
Airport operations forecasts are from 6 am – midnight, consistent with FAA ATCT counts.

As noted earlier, there is a significant difference between the Master Plan and TAF total operations forecasts towards the end of the forecast period. There are several reasons for the higher growth rates in the Master Plan baseline Forecast:

- The Master Plan aircraft utilization assumptions are more consistent with the national utilization projections in the FAA's most recent Aerospace Forecast but the TAF projects operations per based aircraft to decline from 351 in 2013 to 245 in 2033. Given the amount of training activity at DVT and the need of the flight schools to fully utilize their aircraft, this decrease in operations per based aircraft is considered unlikely.
- The Phoenix MSA has and is projected to continue to grow more rapidly than the United States average. Since 1990, population in the Phoenix MSA grew

at an average annual rate of 3.0% compared to the overall U.S. annual growth rate of 1.0%. According to the ADOA, population in the Phoenix MSA is projected to grow 1.9% per year compared to their projection of 0.7% per year for the entire U.S. Income forecasts show a similar divergence. According to W&P, real income in the Phoenix MSA is expected to grow 3.5% per year compared to 2.4% per year in the entire U.S.

- Aircraft operations at DVT have paralleled economic trends. Due to the events of September 11, 2001, the spike in fuel costs, and the recession, overall general aviation operations at U.S. towered airports have decreased at a rate of 3.3% per year since 2000. In comparison, over the same period of time operations at DVT have only decreased an average of 0.3% per year, outperforming U.S. operations by 3.0% per year.
- DVT's share of overall Phoenix towered airport operations (general aviation, military, non-scheduled air taxi) has increased from 22.5% in 2000 to 26.0% in 2013. This indicates that in addition to serving a rapidly growing area, DVT is serving an increasing share of this area.
- A large number of DVT's operations are training operations for flight schools serving Asian airlines. The need for these pilots is expected to continue to increase, as both Boeing and Airbus project rapid passenger growth in the Asia/Pacific region (6.3% per year for Boeing and 5.8% per year for Airbus).
- The forecast of operations projected under the TAF for DVT is unusually low and uses a lower growth rate (0.3%) than the national general aviation forecast (0.5%), despite historical trends and the anticipation that the Phoenix area will grow more rapidly than the overall U.S.

As a result of the above factors, the draft baseline forecast of operations is considered more appropriate than the TAF operations forecast for use in planning for facility requirements in the Master Plan.

2.10 Forecast Scenarios

The assumptions used in developing the Master Plan Forecast are likely to vary over the forecast period, and the variations could be material. One way to explore the impact of these variations is to develop alternative scenarios in which the impact on the Forecast of a variation in a critical assumption is evaluated. The baseline Forecast provides the basis for determining what additional facilities or policies will be required at DVT through 2033. The Aviation Department must be able to respond to a range of contingencies that could occur, taking into account political and economic changes, technological changes, and changes in the business plans of individual tenants. The recommended development program must be flexible enough to accommodate these contingencies.

To address these potential changes, four alternative forecast scenarios were selected by the Aviation Department in consultation with stakeholders. Much of the background information used to develop the scenarios is provided in previous sections. The four scenarios differ from the baseline Forecast summarized in Section 2.9 and include:

- Scenario 1: Addition of a New Flight School
- Scenario 2: High Economic Growth Combined with the Loss of an Existing Flight School
- Scenario 3: Low Economic Growth and High Fuel Cost
- Scenario 4: Loss of an Existing Flight School

Table 2-20 and **Tables B-1 through B-4** in **Appendix B** summarize the results of the scenarios. More detailed discussion of the assumptions and results associated with each scenario follow.

Scenario 1: This scenario is a high growth scenario that assumes that a third flight school begins operating at DVT sometime between 2018 and 2023. It was assumed that the based aircraft and operations associated with the new flight school would be similar to those associated with the second largest flight school currently operating at DVT. All other assumptions, such as economic growth and fuel costs, are the same as in the baseline Forecast.

As shown in **Table 2-20** and in **Table B-1**, the scenario results in slightly more based aircraft at DVT when compared to the baseline case. The main difference, however, is in aircraft operations since flight schools tend to fly their aircraft many times per day. Under Scenario 1, total operations at DVT are projected to increase from 363,352 in 2013 to 704,549 by 2033, an average annual increase of 3.4%. The main increase would be among single engine and twin engine piston-powered operations.

Scenario 2: This scenario assumes higher economic growth than in the baseline Forecast. It is also assumed that the additional operations associated with the higher economic growth would increase congestion and thereby induce one of the existing flight schools to relocate to a less busy airport sometime between 2018 and 2023. For the purpose of this scenario, it was assumed that the second largest flight school at DVT would leave DVT. The high economic growth is based on the High ADOA population forecast (see **Table 2-4**).

As shown in **Tables 2-20 and B-2**, Scenario 2 results in slightly more based aircraft than the baseline Forecast, but fewer aircraft operations. Flight schools tend to have very high aircraft utilization rates. The additional economic growth is sufficient to generate enough based aircraft to offset the relatively small number of aircraft lost with the flight school. However, the additional economic growth is not sufficient to offset the relatively large loss in aircraft operations associated with the loss of the flight school. Although total operations are less than in the baseline Forecast, the number of operations by high performance aircraft (jets and turboprops) is greater (see **Table B-2**).

Scenario 3: Scenario 3 is a conservative scenario that assumes lower economic growth and higher fuel costs than in the baseline case. The low economic growth is based on the low ADOA population forecast (**Table 2-4**) and high fuel cost is based on the High DOE fuel price case (**Table 2-7**). High fuel costs often trigger recessions and are therefore frequently associated with them. Examples include recessions in 1974, 1980, 1991, and 2008.

Scenario 3 results in lower based aircraft and aircraft operations totals for DVT when compared to the baseline Forecast, as shown in **Tables 2-20 and B-3**. Based aircraft are projected to grow from 1,033 in 2013 to 1,458 in 2033, an average annual growth rate of 1.7%. Annual aircraft operations are projected to increase from 363,352 in 2013 to 483,417, an average annual increase of 1.4%. Piston and turbine aircraft operations would all decline when compared to the baseline Forecast.

Scenario 4: Like Scenario 2, Scenario 4 assumes the loss of one of the flight training schools. However, unlike Scenario 2, it also assumes no increase in economic growth above the baseline Forecast. For the purpose of this scenario, it was assumed that the second largest flight school at DVT would leave DVT sometime between 2018 and 2023.

Since flight schools account for a much greater share of aircraft operations than based aircraft, Scenario 4 has a significantly greater impact on the operations forecast than the based aircraft forecast. As shown in **Table 2-20**, the average annual growth rate for the based aircraft forecast is 2.6%, slightly lower than the 2.8% associated with the baseline Forecast. However, the average annual growth rate for the operations forecast is 1.4%, much lower than the 2.5% associated with the baseline Forecast.

Table 2-20: Comparison of Baseline Forecast and Forecast Scenarios

	2013	2018	2023	2028	2033	Average Annual Growth Rate
Based Aircraft						
Baseline	1,033	1,167	1,329	1,538	1,780	2.8%
Scenario 1: New Flight School	1,033	1,167	1,377	1,652	1,844	2.9%
Scenario 2: High Growth & Loss of Flight School	1,033	1,188	1,328	1,502	1,839	2.9%
Scenario 3: Low Economic Growth & High Fuel Cost	1,033	1,021	1,143	1,291	1,458	1.7%
Scenario 4: Loss of Flight School	1,033	1,167	1,281	1,422	1,716	2.6%
Annual Operations (24-hour)						
Baseline	363,352	376,100	425,633	501,090	590,239	2.5%
Scenario 1: New Flight School	363,352	376,100	510,076	599,344	704,549	3.4%
Scenario 2: High Growth & Loss of Flight School	363,352	383,073	353,027	424,237	510,145	1.7%
Scenario 3: Low Economic Growth & High Fuel Cost	363,352	328,912	365,810	420,417	483,417	1.4%
Scenario 4: Loss of Flight School	363,352	376,100	341,190	402,832	475,929	1.4%

Sources: Tables 2-16, B-1, B-2, B-3, and B-4