TERMINAL AREA FORECASTS

San Antonio International Airport

5

5.0 INTRODUCTION

This chapter presents the projection of future aviation demand for San Antonio International Airport (SAT or Airport) through the fiscal year (FY) 2025, with FY 2008 serving as the base year for the analysis. The components that are being projected include passenger enplanements (air carrier and commuter) and operations for air carrier, commuter/air taxi, general aviation and military aircraft. This chapter presents the forecasting methodologies used, the data sources utilized, and the outcome of the forecasting process.

5.1 FORECAST METHODOLOGY

The Federal Aviation Administration's (FAA) Terminal Area Forecast (TAF) assumes an unconstrained demand for aviation services based upon local and national economic conditions as well as aviation industry trends. In other words, for purposes of estimating demand, the forecasts assume airport facilities and airspace can be provided to meet the demand.

Aviation activity forecasts for FAA-towered and Federal contract towered airports are developed using historical relationships between activity measures (passenger demand, operations, based aircraft) and local and national factors that influence aviation activity. Each estimate is examined for its reasonableness and consistency by comparisons with historical trends of airport activity. If forecasts deviate from their expected trend, then other statistical techniques are utilized to reforecast the series. Other methods may include use of regression analysis and the use of growth rates developed separately from the TAF.

5.2 DATA SOURCES

The projections of aviation demand relied on a wide range of information about SAT, the aviation industry, and the U.S. economy. The primary data sources utilized in the development of this study are described below.

Woods & Poole Economics, Inc.

Woods & Poole Economics, Inc. is an independent vendor and nationally recognized firm that provides expert economic and demographic analysis. Historical and forecast of socio-economic data including population, per capita income, and employment were provided by this resource.

Official Airline Guide

The official airline guide (OAG) provides information on scheduled airline service, historical aircraft seat configurations, frequency, and city-pairs (among other metrics).

City of San Antonio Aviation Department

Landing reports and airport traffic data was provided by the City of San Antonio Aviation Department electronically and via their website.

Federal Aviation Administration

- The number of operations at SAT for the baseline fiscal year (2008) was determined from two FAA data sets, the Air Traffic Activity Data System (ATADS) and the SAT Air Traffic Control Tower (ATCT) records. The ATADS, available online, contains the official national air traffic operations counts from the FAA air traffic control facilities. ATADS reports historical operations data by four cooperation categories: Air carrier, Air taxi/commuter, general aviation, and military. The SAT ATCT provided arrival and departure data from December 2007 to September 2008.
- Airport Master Record (Form 5010) provides information on based aircraft and fleet mix for the base year (2008).
- The 2008 TAF for SAT was downloaded from the FAA website. The TAF contains data on a federal fiscal year (12 months ended September 30) for enplanements (air carrier and regional), operations (air carrier, air taxi/commuter, general aviation and military), and based aircraft.

U.S. Department of Transportation

The U.S. Department of Transportation (DOT) Bureau of Transportation Statistics (BTS) is part of the Research and Innovative Technology Administration (RITA). DOT-BTS operates TranStats, an "e-government" initiative, which is designed to provide data for transportation researchers and analysts. TranStats provides monthly data reported by certificated U.S. and foreign air carriers on passengers, freight and mail transported. The TranStats data provides detailed information including departures (scheduled/actual), aircraft type, and available seats.

Planning Studies

- *Noise Exposure Map Report and Noise Compatibility Program Update for San Antonio International Airport*, Wyle Aviation Services, January 2009 (draft report).
- *Final Environmental Assessment for the Extension of Runway 3/21 and Lease of Residual Airport Property for Commercial Development*, Booz, Allen, Hamilton, September 2007.
- *San Antonio International Airport Master Plan Study*, Ricondo & Associates, Inc. January 1998.

5.3 AVIATION DEMAND FORECASTS

With a review of historical activity, an understanding of national aviation trends, a defined airport service area, and a review of trends in population and employment in the airport service area, the aviation demand forecasts were prepared. The most reliable approach to estimating future aviation demand is to use one or more analytical techniques. Various methods of forecasting aviation demand exist and are widely used throughout the industry. The primary statistical methods used include trend line, regression, and market share.[1] These FAA supported methods have been applied to develop the most accurate forecasts possible for SAT, and are discussed in detail below.

[1] Airport Cooperative Research Program, *Airport Aviation Activity Forecasting*, 2007.

5.3.1 Passenger Enplanements

The future level and characteristics of passenger enplanements (sum of originating and connecting passengers) at SAT will directly define airside, terminal, and landside facility needs. Passenger aircraft operations are determined by the level of passenger activity and aircraft fleet characteristic including average seating capacities and load factors. The FAA's TAF separates enplanements for air carriers and commuters. Air carrier enplanements include scheduled and non-scheduled domestic and international passengers on U.S. commercial and foreign flag carriers. Regional enplanements include airlines whose primary function is to provide passenger feed to mainline carriers. The total number of enplanements was forecasted first then subdivided into air carrier and commuter based on each of their historical percentages of the total. The various analytical techniques applied to forecast total enplanements are described below.

5.3.1.1Trend Line Analysis

Trend Line analysis examines historical growth trends in activity and applies these trends to current demand levels to produce projections of future activity. Trend line analysis assumes that activity, and the factors that have historically affected activity, will continue to influence demand levels at similar rates over an extended period of time. Linear trend projections are typically used to provide baseline forecasts that reflect stable market conditions. The three time periods selected are as follows:

- Five-year historical data from FY 2003 to FY 2008 to cover the recovery from the September 11, 2001 attacks on the aviation industry.
- Ten-year historical data from FY 1997 to FY 2007 to account for the boom of the aviation industry in the mid-90s, the recession that started in the late 90s and the aftermath of September 11.
- Twenty-year historical data from FY 1987 to FY 2007 to consider the impact of deregulation, the Persian Gulf War as well as all the factors noted in the previous two time series analyses.

As shown in **Table 5-1**, the trend analysis used different annual growth rates found in specific historical periods of the Airport and projected forward based on those historical trends. The average annual growth rate for the period from FY 1988 through FY 2008 is a 2.5 percent average annual growth rate. This growth rate was projected into the future with the result that passenger enplanements would grow to 6,293,181 enplanements by FY 2025. The lowest average annual growth rate analyzed was found between FY 1998 and FY 2008. The average annual growth rate during this period was 1.5 percent, resulting in a total of 5,790,781 passenger enplanements in FY 2025. The average annual growth rate for the last five years, FY 2003 to FY 2008, had the highest average annual growth rate of 5.8 percent. Projected forward, this average annual growth would result in 10,785,018 passenger enplanements in FY 2025.

Table 5-1. Total Enplanement Forecasts - Trend Analysis

		Enplanement Forecast		
Fiscal Year	Total Enplanements	20-Year Trend Analysis [1]	10-Year Trend Analysis [2]	5-Year Trend Analysis [3]
Historical				
1987	2,512,162			
1988	2,517,986			
1989	2,592,439			
1990	2,681,958			
1991	2,629,017			
1992	2,689,614			
1993	2,804,188			
1994	2,963,038			
1995	3,066,256			
1996	3,266,659			
1997	3,361,170			
1998	3,379,337			
1999	3,384,107			
2000	3,535,268			
2001	3,434,894			
2002	3,162,506			
2003	3,121,545			
2004	3,310,933			
2005	3,521,538			
2006	3,884,886			
2007	3,903,642			
2008	4,135,848			
Forecast				
2010		4,345,225	4,302,636	4,629,519
2015		4,916,223	4,750,458	6,137,114
2020		5,562,255	5,244,889	8,135,655
2025		6,293,181	5,790,781	10,785,018
Average Annual Growth Rates				
1998-2025		2.5%	2.0	5.8%

Notes:
1/ Based on average annual growth rate of 2.5 percent (1988-2008).
2/ Based on average annual growth rate of 1.5 percent (1998-2008).
3/ Based on average annual growth rate of 5.8 percent (2003-2008).

Sources: Federal Aviation Administration Terminal Area Forecast, Woods & Poole Economics, Inc., and PBS&J.

5.3.1.2 Regression Analysis

The demographic and economic elements of the surrounding community are among the principal factors in forecasting the levels of aviation activity at an airport. Population demographics, in addition to employment and earnings statistics, provide indications of the community's ability to support aviation activities and of the underlying level of demand for aviation services. Regression analysis refers to a technique for studying and comparing relationships between various socioeconomic independent variables (population, employment, per capita income, etc.) and dependent variables (enplanements, operations, based aircraft). The coefficient of determination (r^2) is a statistical measure showing the extent to which there is a relationship between the two variables. The closer the r^2 value is to 1.0, the higher the confidence level is that a change in the value of socioeconomic values would translate into a change in airport activity. As rule of thumb, an r^2 value over 0.95 carries a strong statistical correlation.

The historical and forecast of socioeconomic data were obtained from Woods & Poole, Inc. For the purpose of the regression analyses, the selected time frame is FY 2003 to FY 2008. The results of the various regression analyses are described below and shown in **Table 5-2**.

Population Regression – Using the primary SAT MSA population as the basis for the regression analysis, total Airport enplaned passengers are forecast to increase from 4,135,848 in FY 2008 to 7,176,611 in FY 2025 resulting in a compounded annual growth rate of 3.3 percent.

Employment Regression – Using employment as the basis for the regression analysis, total Airport enplaned passengers are forecast to increase from 4,135,848 in FY 2008 to 6,785,682 in FY 2025, resulting in a compounded annual growth rate of 3.0 percent.

Per Capita Personal Income (PCPI) Regression – Using PCPI as the basis for the regression analysis, total Airport enplaned passengers are forecast to increase from 4,135,848 in FY 2008 to 10,044,998 in FY 2025, resulting in a compounded annual growth rate of 5.4 percent.

Overall, the regression methodology resulted in high correlations between the independent socioeconomic variables and the dependent enplaned passenger variable over the past five years. In this analysis, the three socioeconomic variables of population, employment, and per capita personal income yielded r^2 values of 0.96, 0.98, and 0.98, respectively.

Table 5-2. Total Enplanements Forecasts – Regression Analysis

		Independent Variables		
Fiscal Year	Enplanements	Population	Employment	Per Capita Income
Historical				
1997	3,361,170			
1998	3,379,337			
1999	3,384,107			
2000	3,535,268			
2001	3,434,894			
2002	3,162,506			
2003	3,121,545			
2004	3,310,933			
2005	3,521,538			
2006	3,884,886			
2007	3,903,642			
2008	4,135,848			
Forecast		4,330,084	4,250,217	4,291,627
2010		4,503,704	4,389,991	4,494,336
2015		5,380,190	5,124,196	5,775,784
2020		6,273,337	5,921,059	7,561,702
2025		7,176,611	6,785,682	10,044,998
Average Annual Growth Rates				
2008-2025		3.3%	3.0%	5.4%
Coefficient of Determination (r^2)		0.96	0.98	0.98

Sources: Federal Aviation Administration Terminal Area Forecast, Woods & Poole Economics, Inc., and PBS&J.

5.3.1.3 Market Share Analysis

The market share analysis methodology is a top-down approach to examine the airport's historical share of the national, state, and regional market. This approach assumes the growth in activity at the airport to be proportionate to the activity of the nation, state, and region. Therefore, as market shares are held constant over the forecast period, the resulting increases in the activity occur based on the growth rates established in the FAA's Aerospace Forecasts and TAF. Once a market share projection is developed, it can then be reflected as an increase or decrease in the share of the national, state, and regional market for the airport. The results of the market share analysis are shown in **Table 5-3** and described below.

SAT and the U.S.: The historical Airport's share of enplaned passengers for the entire U.S. has remained a constant of .5 percent over the past 10 years with an increase to .6 percent in FY 2008. Applying the FY 2008 ratio, total enplanements are projected to reach 5,881,067 in FY 2025, an average annual growth rate of 2.1 percent. Increasing SAT's share of the U.S. to .65 percent, total enplanements are projected to reach 6,935,492 in FY 2025, an average annual rate of 3.1 percent.

Table 5-3. Market Share Enplanement Projections

Fiscal Year	Southwest Region	State of Texas	U.S. Total	SAT	SAT Share of Southwest Region [1] Constant Ratio	SAT Share of Southwest Region [1] Increasing Ratio	SAT Share of State of Texas [2] Constant Ratio	SAT Share of State of Texas [2] Increasing Ratio	SAT Share of U.S. [3] Constant Ratio	SAT Share of U.S. [3] Increasing Ratio
Historical										
1997	74,341,319	60,156,179	637,652,364	3,361,170						
1998	75,957,918	61,712,342	649,015,634	3,379,337						
1999	77,056,344	62,558,165	675,537,623	3,384,107						
2000	79,874,186	65,109,179	704,858,256	3,535,268						
2001	78,169,210	63,531,077	693,153,587	3,434,894						
2002	70,875,167	57,638,423	627,653,711	3,162,506						
2003	70,898,440	57,675,118	643,226,419	3,121,545						
2004	76,728,487	62,835,571	690,969,986	3,310,933						
2005	80,144,345	65,718,669	733,408,737	3,521,538						
2006	81,944,488	69,254,682	732,888,922	3,884,886						
2007	84,311,585	70,634,137	755,547,019	3,903,642						
2008	84,100,144	69,709,703	750,364,580	4,135,848						
Forecast										
2010	82,206,429	68,885,488	718,464,859		4,042,720	4,932,386	4,086,948	5,235,297	3,960,024	4,670,022
2015	94,598,071	79,397,453	823,022,344		4,652,111	5,675,884	4,710,618	6,034,206	4,536,322	5,349,645
2020	109,208,412	91,968,704	938,774,599		5,370,614	6,552,505	5,456,465	6,989,622	5,174,323	6,102,035
2025	123,640,328	104,174,375	1,066,998,754		6,080,342	7,418,420	6,180,623	7,917,253	5,881,067	6,935,492
Average Annual Growth Rate										
2003-2008	3.5%	3.9%	3.1%							
2008-2025	2.3%	2.4%	2.1%		2.3%	3.5%	2.4%	3.9%	2.1%	3.1%

Notes:
1/ Constant ratio of 4.9 percent (2008 ratio) and increasing 6.0 percent (2003-2008 ratio) for SAT/FAA Southwest region market share.
2/ Constant ratio of 5.9 percent (2008 ratio) and increasing 7.6 percent (2003-2008 ratio) for SAT/Texas market share.
3/ Constant ratio of 0.6 percent (2008 ratio) and increasing 0.65 percent (2003-2008 ratio) for SAT/U.S. market share.

Sources: FAA Terminal Area Forecast Summary Fiscal Years 2008-2025 and City of San Antonio Aviation Department.

SAT and the State of Texas: The historical Airport's share of enplaned passengers for the State of Texas has fluctuated over the past 10 years with a high of 5.9 percent in FY 2008. Applying the FY 2008 ratio, total enplanements are projected to reach 6,180,623 in FY 2025, an average annual growth rate of 2.4 percent. Increasing SAT's share of the Texas to 7.6 percent, total enplanements are projected to reach 7,917,253 in FY 2025, an average annual rate of 3.9 percent.

SAT and the Southwest Region: The historical Airport's share of enplaned passengers for the Southwest Region[2] has slightly fluctuated over the past 10 years with a high of 4.9 percent in FY 2008. Applying the FY 2008 ratio, total enplanements are projected to reach 6,080,342 in FY 2025, an average annual growth rate of 2.3 percent. Increasing SAT's share of the Southwest Region to 6.0 percent, total enplanements are projected to reach 7,418,420 in FY 2025, an average annual rate of 3.5 percent.

5.3.1.4 Comparison of Enplaned Passenger Forecasts

Enplaned passenger forecasts developed using each of the methodologies described above are presented in **Table 5-4**. For comparison purposes, enplaned passenger forecasts from the FAA's most recent FAA TAF is also included in Table 5-4.

5.3.1.5 Preferred Enplaned Passenger Forecasts

The forecasting analyses conducted in the previous sections provide multiple growth scenarios based on market share and regression methodologies. This section identifies a preferred enplaned passenger forecast to be used in further analysis of operational and peaking forecasting components. The assumptions and logic used in selecting the forecast must be appropriate, reasonable, and stand up to scrutiny from the public, the airlines, and the FAA. **Table 5-5** presents the preferred enplanement forecast for SAT. As shown, the forecasts derived from the market share methodology are considered the preferred total enplaned passenger forecasts for SAT. The preferred forecast reflects an overall compounded annual grow rate of 2.4 percent with total enplanements projected to reach 6,180,623 in FY 2025.

[2] The Southwest Region includes Arkansas, Louisiana, New Mexico, Oklahoma, and Texas.

Table 5-4. Comparison of Enplaned Passenger Forecasts

		Trend Analysis			Regression Analysis			Market Share Analysis						2008 TAF
								SAT Share of Southwest Region		SAT Share of State of Texas		SAT Share of U.S.		
Fiscal Year	Enplane-ments	20-Year Trend Analysis	10-Year Trend Analysis	5-Year Trend Analysis	Pop-ulation	Employ-ment	Per Capita Income	Constant Ratio	Increase Ratio	Constant Ratio	Increase Ratio	Constant Ratio	Increase Ratio	
Historical														
1998	3,379,337													
1999	3,384,107													
2000	3,535,268													
2001	3,434,894													
2002	3,162,506													
2003	3,121,545													
2004	3,310,933													
2005	3,521,538													
2006	3,884,886													
2007	3,903,642													
2008	4,135,848													
Forecast														
2010		4,345,225	4,302,636	4,629,519	4,503,704	4,389,991	$4,494,336	4,042,720	4,932,386	4,086,948	5,235,297	3,960,024	4,670,022	3,846,268
2015		4,916,223	4,750,458	6,137,114	5,380,190	5,124,196	$5,775,784	4,652,111	5,675,884	4,710,618	6,034,206	4,536,322	5,349,645	4,378,823
2020		5,562,255	5,244,889	8,135,655	6,273,337	5,921,059	$7,561,702	5,370,614	6,552,505	5,456,465	6,989,622	5,174,323	6,102,035	4,988,262
2025		6,293,181	5,790,781	10,785,018	7,176,611	6,785,682	$10,044,998	6,080,342	7,418,420	6,180,623	7,917,253	5,881,067	6,935,492	5,686,477
Average Annual Growth Rates														
2008-2025		2.5%	2.0%	5.8%	3.3%	3.0%	5.4%	2.3%	3.5%	2.4%	3.9%	2.1%	3.1%	2.1%

Sources: Federal Aviation Administration Terminal Area Forecast, Woods & Poole Economics, Inc., and PBS&J.

Table 5-5. Preferred Enplaned Passenger Forecast

Fiscal Year	Enplanements
Historical	
1998	3,379,337
1999	3,384,107
2000	3,535,268
2001	3,434,894
2002	3,162,506
2003	3,121,545
2004	3,310,933
2005	3,521,538
2006	3,884,886
2007	3,903,642
2008	4,135,848
Forecast	
2010	4,086,948
2015	4,710,618
2020	5,456,465
2025	6,180,623
Average Annual Growth Rates	
2008-2025	2.4%

Sources: Federal Aviation Administration Terminal Area Forecast and PBS&J, 2009.

5.3.2 Aircraft Operations Forecasts and Fleet Mix Projections

This section presents operations and fleet mix projections for air carrier, commuter/air taxi activity, general aviation, all-cargo, and military activity at SAT. Forecasts of aircraft operations for air carrier and commuter/air taxi categories were developed using the preferred enplaned passenger forecast presented earlier in conjunction with historical and expected trends in load factors and average aircraft seats-per departure.

5.3.2.1 Air Carrier Operations and Fleet Mix

According to the FAA, air carrier operations represent either take-offs or landings of commercial aircraft with seating capacity of more than 60 seats. Forecast of operations and fleet mix by air carrier operators are presented in **Table 5-6**. Air carrier enplanements are divided by a load factor to calculate the number of seats required to transport the forecasted passengers. The number of seats is divided by the expected number of seats-per departure to calculate the number of departures. The number of departures is multiplied by two to calculate total number of operations. The following points highlight the key assumptions that were used to derive the air carrier aircraft operations forecast for the Airport.

Seats-per-departure: The average number of seats-per-departure for the air carrier airlines was calculated to be approximately 126 in FY 2008. Current fleet plans for air carrier airlines nationwide indicate that their average number of seats-per-departure is anticipated to increase .1 per year. Applying this growth pattern to the SAT air carrier fleet, the average number of air carrier airline aircraft seats-per-departure at the Airport is projected to increase to 127.7 seats by FY 2025.

Table 5-6. Air Carrier Operations and Fleet Mix Forecast

Fleet Mix	Seats	FY 2008		FY 2010		FY 2015		FY 2020		FY 2025	
		Operations	Percent	Operations	Percent	Operations	Percent	Operations	Percent	Operations	Percent
A30B	250	36	0.0%	35	0.0%	40	0.0%	46	0.0%	52	0.0%
A318	100	1,246	1.4%	1,312	1.5%	1,601	1.6%	1,957	1.7%	2,326	1.8%
A319	145	6,050	6.8%	6,297	7.2%	7,804	7.8%	9,787	8.5%	12,920	10.0%
A320	150	1,868	2.1%	2,711	3.1%	3,802	3.8%	5,182	4.5%	7,752	6.0%
B712	106	890	1.0%	875	1.0%	1,000	1.0%	576	0.5%	0	0.0%
B721	131	62	0.1%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
B722	149	89	0.1%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
B732	115	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
B733	137	18,240	20.5%	17,490	20.0%	18,509	18.5%	17,272	15.0%	15,504	12.0%
B734	150	712	0.8%	437	0.5%	500	0.5%	576	0.5%	646	0.5%
B735	122	6,050	6.8%	5,947	6.8%	6,503	6.5%	6,909	6.0%	5,168	4.0%
B736	130	2	0.0%	2	0.0%	0	0.0%	0	0.0%	0	0.0%
B737	137	21,354	24.0%	20,989	24.0%	22,010	22.0%	21,878	19.0%	19,380	15.0%
B738	155	2,580	2.9%	3,061	3.5%	4,002	4.0%	6,909	6.0%	10,336	8.0%
B739	167	801	0.9%	875	1.0%	1,301	1.3%	5,757	5.0%	9,044	7.0%
B742	452	6	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
B752	175	623	0.7%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
B753	216	356	0.4%	437	0.5%	500	0.5%	461	0.4%	517	0.4%
B757	175	2	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
B762	216	3	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
B763	269	62	0.1%	61	0.1%	70	0.1%	81	0.1%	90	0.1%
B764	300	2	0.0%	0	0.0%	0	0.0%	2	0.0%	2	0.0%
B772	400	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
CRJ7	70	2	0.0%	87	0.1%	800	0.8%	2,303	2.0%	5,168	4.0%
CRJ9	90	7,919	8.9%	8,745	10.0%	11,005	11.0%	13,818	12.0%	18,088	14.0%
CVLT	60	801	0.9%	787	0.9%	900	0.9%	921	0.8%	646	0.5%
DC8	100	13	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
DC10	100	3	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
DC93	100	801	0.9%	787	0.9%	900	0.9%	576	0.5%	0	0.0%
DC94	110	89	0.1%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
DC95	125	89	0.1%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
E170	70	534	0.6%	700	0.8%	1,000	1.0%	1,727	1.5%	3,876	3.0%
E190	99	0	0.0%	87	0.1%	800	0.8%	2,303	2.0%	3,876	3.0%
MD11	323	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
MD80	136	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
MD81	136	89	0.1%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
MD82	150	12,012	13.5%	10,932	12.5%	12,006	12.0%	11,515	10.0%	10,336	8.0%
MD83	150	2,669	3.0%	2,624	3.0%	3,001	3.0%	3,454	3.0%	3,876	3.0%
MD87	170	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
MD88	148	3,292	3.7%	2,186	2.5%	2,001	2.0%	1,151	1.0%	0	0.0%
Total		88,976	100.00%	87,452	100.00%	100,046	100.00%	115,147	100.00%	129,199	100.00%
Enplanements		3,970,433		3,923,470		4,531,615		5,265,489		5,964,301	
Average Seats Per Departure		126.0		126.2		126.7		127.2		127.7	
Load Factor		71.0%		71.1%		71.5%		71.9%		72.3%	
Departures		44,488		43,726		50,023		57,574		64,600	
Operations		88,976		87,452		100,046		115,147		129,199	

Sources: SAT ATCT, BS T-100, Federal Aviation Administration Terminal Area Forecast and PBS&J, 2009.

Load Factor: Similar to the average number of aircraft seats-per-departure, the load factors for the Airport's air carrier airlines also varied over the past five years but remained relatively unchanged. The load factor for the air carrier airlines in FY 2008 was 71.0 percent. The FAA is projecting load factors for air carrier airlines to increase at an average annual rate of .12 percent. Therefore, air carrier load factors at SAT are anticipated to increase to 72.3 percent in FY 2025.

Fleet Mix: The aircraft fleet mix projection for the air carrier airlines is also presented in Table 5-6. As shown, the air carrier aircraft fleet mix at SAT is small and medium narrowbody aircraft primarily consisting of Boeing 737, Airbus 319, and McDonnell Douglas 80 (or their equivalent). Since the FAA categorizes aircraft operations performed by aircraft with 60 or more seats as air carrier operation, this category includes regional jets. The Canadair Regional Jet 700 and 900 and the Embraer 170 and 190 are currently being operated by regional air carriers such as GoJet, Skywest, and Mesa. Fleet mix projections include older 737-300/400/500s being retired over time and replaced with the newer 737 models (700/800/900). Projections also include an increase of larger sized regional jets as supported by national airline trends. It is expected that SAT will continue to see occasional non-scheduled operations of widebody aircraft.

5.3.2.2 Commuter/Air Taxi Aircraft Operations and Fleet Mix

Commuter Operations and Fleet Mix

According to the FAA, commuter operations include takeoffs and landings by aircraft with 60 or fewer seats that transport regional passengers on schedule commercial flights. Forecasts of commuter aircraft operations at the Airport are presented in **Table 5-7**. The forecasts were developed based on historical numbers of enplaned passengers, load factors, and average aircraft seats-per-departure at the Airport. The following points highlight the key assumptions that were used to derive the commuter operations forecast for the Airport:

Seats-per-departure: The average number of seats-per-departure for commuter aircraft was calculated to be approximately 48.5 in FY 2008. Current fleet plans for commuter aircraft nationwide indicate that their average number of seats-per-departure is anticipated to increase .1 per year. Applying this growth pattern to the SAT commuter fleet, the average number of commuter aircraft seats-per-departure at the Airport is projected to increase to 50 by FY 2025.

Load Factor: The load factors for the Airport's commuter aircraft was 76 percent in FY 2008. The FAA is projecting load factors for air carrier airlines to increase at an average annual rate of .12 percent. Therefore, air carrier load factors at SAT are anticipated to increase to 77.5 percent in FY 2025.

Fleet Mix: Aircraft fleet mix projections for commuter aircraft serving the Airport are presented in Table 5-7. As shown, the commuter fleet mix as SAT is regional jets versus turboprops. The fleet is projected to see a shift and growth to 70 and 100 seat regional jets, which change the classification to the air carrier category. It is also projected that the commuter fleet will continue to be 50 seat regional jets.

Table 5-7. Commuter Operations and Fleet Mix Forecast

		FY 2008		FY 2010		FY 2015		FY 2020		FY 2025	
Fleet Mix	**Seats**	**Operations**	**Percent**	**Operations**	**Percent**	**Operations**	**Percent**	**Operations**	**Percent**	**Operations**	**Percent**
CRJ1	50	745	8.3%	793	9.0%	902	9.5%	997	10.0%	1,340	12.0%
CRJ2	50	2,245	25.0%	2,203	25.0%	2,565	27.0%	2,992	30.0%	3,908	35.0%
E135	37	395	4.4%	353	4.0%	332	3.5%	199	2.0%	112	1.0%
E145	50	2,730	30.4%	2,820	32.0%	3,325	35.0%	3,790	38.0%	4,466	40.0%
E45X	45	2,874	32.0%	2,644	30.0%	2,375	25.0%	1,995	20.0%	1,340	12.0%
Total		8,980	100.00%	8,813	100.00%	9,499	100.00%	9,973	100.00%	11,165	100.00%
Enplanements		165,435		163,478		179,003		190,976		216,322	
Average Seats Per Departure		48.5		48.7		49.2		49.7		50.0	
Load Factor		76.0%		76.2%		76.6%		77.1%		77.5%	
Departures		4,490		4,406		4,750		4,986		5,583	
Operations		8,980		8,813		9,499		9,973		11,165	

Sources: SAT ATCT, BS T-100, Federal Aviation Administration Terminal Area Forecast and PBS&J, 2009.

Air Taxi Operations and Fleet Mix

Air taxi includes non-scheduled charter operators and air taxi operators which have not been included in categories previously presented. Air taxi operators are subject to the requirements of FAR part 135 and offer service to the general public for a fee. Air taxi operators are considered to be air carriers. At SAT, the category of air taxi includes nonscheduled cargo carriers (e.g., Ameriflight, Ameristar, and Martinaire) specialized cargo carriers (e.g. US Check and Quest Diagnostics) and air taxi operators (e.g., Executive Jet).

Given the "on-demand" nature of air taxi services, a conservative approach was adopted to determine the air taxi activity projection at SAT. As such, the air taxi growth rate developed by the FAA in its most recent TAF was adopted for this forecast. **Table 5-8** summarizes the air taxi activity projection for SAT. As shown, air taxi operations increase at an average annual growth rate of 1.4 percent from 21,874 operations in FY 2008 to 27,704 in FY 2025. **Table 5-9** provides a summary of the air taxi fleet mix. As shown, the largest percentage of the air taxi fleet is turbo-prop and GA corporate jet aircraft (e.g., Gulfstream V). It is forecasted that corporate jet aircraft will increase in terms of the percentage of the total air taxi operations.

Table 5-8. Air Taxi Operations Forecast

Fiscal Year	Air Taxi Operations
Base Year	
2008	21,874
Forecast	
2010	22,490
2015	24,109
2020	25,844
2025	27,704
Average Annual Growth Rate 2008-2025	1.4%

Sources: SAT ATCT, FAA Aerospace Forecast, Fiscal Years 2009 – 2025.

Table 5-9. Air Taxi Fleet Mix

Fleet Mix	FY 2008 Operations	FY 2008 Percent	FY 2010 Operations	FY 2010 Percent	FY 2015 Operations	FY 2015 Percent	FY 2020 Operations	FY 2020 Percent	FY 2025 Operations	FY 2025 Percent
Single Engine Piston	2,187	10.0%	2,175	10.0%	2,170	9.0%	2,068	8.0%	1,939	7.0%
Multi-Engine Piston	3,500	16.0%	3,598	16.0%	3,375	14.0%	3,101	12.0%	2,216	8.0%
Turbo Prop	8,312	38.0%	8,250	36.0%	8,197	34.0%	7,753	30.0%	6,926	25.0%
GA Corporate Jet	6,562	30.0%	7,117	32.0%	8,920	37.0%	10,338	40.0%	13,852	50.0%
Regional Jet	656	3.0%	675	3.0%	723	3.0%	1,292	5.0%	1,385	5.0%
Helicopter	656	3.0%	675	3.0%	723	3.0%	1,292	5.0%	1,385	5.0%
Total	21,874	100.0%	22,490	100.0%	24,109	100.0%	25,844	100.0%	27,704	100.0%

Sources: SAT ATCT and PBS&J, 2009.

5.3.2.3 All-Cargo Operations

Historical and forecast all-cargo aircraft operations at the Airport are presented in **Table 5-10.** As shown, all-cargo aircraft operations are forecast to increase from 6,480 in FY 2008 to 13,123 in FY 2030, representing a compounded annual growth rate of 4.4 percent during this period. **Table 5-11** provides the fleet mix for all-cargo aircraft.

Table 5-10. All-Cargo Operations Forecast

Fiscal Year	All-Cargo Tonnage	% of Total Cargo	All Cargo Operations	Tons Per Operation
Historical				
2003	48,576	37.8%	5,082	9.6
2004	50,059	37.9%	5,098	9.8
2005	51,057	40.0%	5,058	10.1
2006	53,590	37.5%	4,744	11.3
2007	53,139	37.8%	5,424	9.8
2008	60,823	43.0%	6,480	9.7
Forecast				
2010	62,432	40.0%	6,243	10.0
2015	79,943	40.0%	7,994	10.0
2020	102,406	40.0%	10,241	10.0
2025	131,232	40.0%	13,123	10.0
Average Annual Growth Rates				
2003-2008	4.6%		4.3%	
2008-2025	4.6%		4.4%	

Source: City of San Antonio Aviation Department, SAT ATCT, and PBS&J, 2009.

Table 5-11. All-Cargo Operations and Fleet Mix Forecast

	FY 2008		FY 2010		FY 2015		FY 2020		FY 2025	
Fleet Mix	**Operations**	**Percent**	**Operations**	**Percent**	**Operations**	**Percent**	**Operations**	**Percent**	**Operations**	**Percent**
A300	2	0.0%	31	0.5%	56	0.9%	94	1.5%	125	2.0%
A306	792	12.2%	812	13.0%	874	14.0%	936	15.0%	999	16.0%
A310	27	0.4%	50	0.8%	131	2.1%	200	3.2%	281	4.5%
B722	1,850	28.6%	1,748	28.0%	1,249	20.0%	936	15.0%	624	10.0%
B727	36	0.6%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
B752	2,016	31.1%	1,998	32.0%	2,123	34.0%	2,185	35.0%	2,247	36.0%
B753	2	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
B757	32	0.5%	31	0.5%	62	1.0%	94	1.5%	125	2.0%
B763	7	0.1%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
DC10	1,011	15.6%	999	16.0%	1,124	18.0%	1,155	18.5%	1,186	19.0%
DC8	88	1.4%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
DC87	346	5.3%	375	6.0%	437	7.0%	468	7.5%	499	8.0%
MD10	224	3.5%	200	3.2%	187	3.0%	175	2.8%	156	2.5%
MD11	44	0.7%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
DC11	3	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total	6,480	100.0%	6,243	100.0%	7,994	100.0%	10,241	100.0%	13,123	100.0%

Sources: SAT ATCT, BS T-100, Federal Aviation Administration Terminal Area Forecast and PBS&J, 2009.

5.3.2.4 General Aviation Operations and Fleet Mix

This section presents the forecast of general aviation based aircraft, operations, and fleet mix. General aviation represents all facets of civil aviation except activity by certificated route air carriers and air commuters.

Based Aircraft

Typically, the number of based aircraft is dependent on the local demand for aircraft storage facilities, the amenities provided by the airport, and the capacity of other airports in the vicinity with comparable facilities. A projection of GA aircraft that will be based at SAT is required for the proper planning of future airside and landside requirements, such as runway usage, aircraft parking apron, and the number of hangars needed. **Table 5-12** presents historical based aircraft at SAT. The historical based aircraft data was obtained primarily from the FAA's TAF. The FAA Airport Master Record Form 5010 (effective January 15, 2009) provided a total number of based aircraft for FY 2008; however, the reported data appeared to be inconsistent with historical based aircraft counts. *The National Plan of Integrated Airport Systems (NPIAS), 2009-2013* was reviewed and verified that the 2008 counts from the 5010 seemed to have been doubled and were adjusted accordingly. As shown, the number of based aircraft at the Airport fluctuated from a low of 194 in FY 1990 to a high of 293 in FY 2008.

Table 5-12. Historical General Aviation Operations Forecast

Fiscal Year	Based Aircraft
1990	194
1991	200
1992	200
1993	200
1994	234
1995	234
1996	234
1997	225
1998	225
1999	252
2000	252
2001	253
2002	277
2003	288
2004	263
2005	263
2006	257
2007	257
2008	293
Average Annual Growth Rates	
1990-2008	1.7%

Sources: Federal Aviation Administration Terminal Area Forecast Summary Fiscal Years 2008-2025 and the National Plan of Integrated Airport Systems (NPIAS), 2009-2013.

Table 5-13 provides the based aircraft forecast for SAT. Trend and regression analyses were performed but yielded inconsistent results. A market share analysis examined the Airport's historical share of the national, state, and regional market. The constant market share of SAT in the State of Texas was the preferred based aircraft forecast.

General Aviation Fleet Mix

Table 5-14 further examines based aircraft by fleet type. In FY 2008, single-engine aircraft accounted for 63.8 percent of the Airport's based aircraft; multi-engine piston accounted for 8.2 percent, turboprop aircraft accounted for 6.5 percent; jet aircraft accounted for 21.4 percent; and helicopters accounted for .005 percent. The Airport's based aircraft fleet mix was projected by examining historical trends, as well as using national data for general aviation aircraft.

General Aviation Operations

Forecasts of total operations were prepared using a ratio of aircraft operations to based aircraft (OPBA) from historical data. The OPBA is then applied to forecasts of based aircraft to develop estimates of future annual operations. This methodology is a common forecast technique because it directly links the aircraft to their average level of annual utilization at the Airport. This number is particularly useful in facility planning and is an important indicator in the aviation forecasting process.

As shown in **Table 5-15,** the historical OPBA has fluctuated from a high of 661 in FY 1998 to a low of 301 in FY 2008. For the purposes of projecting future aircraft operations at the airport, it was assumed that the average OPBA value range of 275 to 300 be applied to the projected number of based aircraft. The number of total operations is projected to increase from 88,193 in FY 2008 to 107,100 in FY 2025, representing an average annual growth rate of 1.1 percent.

General aviation operations are classified as either local or itinerant. As defined by the FAA, local operations are performed by aircraft that:

- operate in the local traffic pattern or within sight of the airport,
- are known to be departing for, or arriving from, flight in local practice areas located within a 20-mile radius of the airport, and
- execute simulated precision, non precision, and visual approaches or low passes at an airport (including touch-an-go operations).

Itinerant operations are those performed by aircraft with a specific origin or destination away from the airport. As shown in Table 5-15, the percentage of operations at the Airport performed by itinerant aircraft has held relatively constant. For the purposes of this analysis, the percentage distribution of itinerant and local share of the total operations was held constant into the future at 99.8 percent and 0.2 percent, respectively.

Table 5-13. Based Aircraft Forecasts – Market Share Analysis

Fiscal Year	Southwest Region	State of Texas	U.S. Total	SAT	SAT Share of Southwest Region		SAT Share of State of Texas		SAT Share of U.S.	
					Constant Ratio	Increasing Ratio [1]	Constant Ratio	Increasing Ratio [2]	Constant Ratio	Increasing Ratio [3]
Historical										
1998	20,427	11,601	176,302	225	1.1%		1.9%		0.1%	
1999	20,232	11,450	178,405	252	1.2%		2.2%		0.1%	
2000	21,025	12,130	182,128	252	1.2%		2.1%		0.1%	
2001	22,572	12,900	189,241	253	1.1%		2.0%		0.1%	
2002	23,078	13,162	191,097	277	1.2%		2.1%		0.1%	
2003	23,260	13,374	192,395	288	1.2%		2.2%		0.1%	
2004	23,910	13,779	195,444	263	1.1%		1.9%		0.1%	
2005	25,224	14,790	199,630	263	1.0%		1.8%		0.1%	
2006	24,549	14,004	199,616	257	1.0%		1.8%		0.1%	
2007	25,382	14,611	202,084	257	1.0%		1.8%		0.1%	
2008	25,639	14,763	203,534	293	1.1%		2.0%		0.1%	
Forecast										
2009	25,880	14,921	205,096		296	311	296	321	261	308
2010	26,133	15,085	206,709		299	314	299	325	263	310
2011	26,384	15,244	208,313		302	317	303	328	265	312
2012	26,672	15,430	210,193		305	320	306	332	267	315
2013	26,924	15,592	211,836		308	323	309	336	269	318
2014	27,192	15,776	213,551		311	326	313	340	272	320
2015	27,468	15,962	215,287		314	330	317	344	274	323
2016	27,791	16,151	217,284		318	334	321	348	276	326
2017	28,088	16,345	219,067		321	337	324	352	279	329
2018	28,370	16,525	220,973		324	341	328	356	281	331
2019	28,673	16,719	222,846		328	344	332	360	283	334
2020	28,943	16,904	224,632		331	347	335	364	286	337
2021	29,275	17,110	226,722		335	351	340	368	288	340
2022	29,590	17,311	228,780		338	355	344	373	291	343
2023	29,923	17,522	230,913		342	359	348	377	294	346
2024	30,270	17,741	233,050		346	363	352	382	296	350
2025	30,632	17,968	235,178		350	368	357	387	299	353
Average Annual Growth Rate 2008-2025	1.1%	1.2%	0.9%		1.1%	1.3%	1.2%	1.6%	0.1%	1.1%

Notes:
1/ Constant ratio of 1.1 percent (2008 ratio) and increasing 1.2 percent for SAT/FAA Southwest region market share.
2/ Constant ratio of 2.0 percent (2008 ratio) and increasing 2.2 percent for SAT/Texas market share.
3/ Constant ratio of 0.1 percent (2008 ratio) and increasing 0.15 percent for SAT/U.S. market share.

Sources: FAA Terminal Area Forecast Summary Fiscal Years 2009-2025.

Table 5-14. General Aviation Operations Fleet Mix

Fiscal Year	Single-Engine Piston	% of Total	Multi-Engine Piston	% of Total	Turbo-Prop	% of Total	Turbojets	% of Total	Helicopter	% of Total	Total
2008	56,253	63.8%	7,245	8.2%	5,764	6.5%	18,891	21.4%	40	0.0%	88,193
Forecast											
2010	51,802	63.0%	6,578	8.0%	5,262	6.4%	18,583	22.6%	37	0.0%	82,225
2015	54,049	62.0%	6,102	7.0%	5,318	6.1%	21,707	24.9%	39	0.0%	87,175
2020	61,305	61.0%	6,030	6.0%	5,879	5.9%	27,236	27.1%	45	0.0%	100,500
2025	64,260	60.0%	5,355	5.0%	5,998	5.6%	31,487	29.4%	48	0.0%	107,100
Average Annual Growth Rates											
2008-2028	0.8%		-1.8%		0.2%		3.1%		1.1%		1.1%

Sources: FAA Airport Master Record 5010, Noise Exposure Map Report and Noise Compatibility Program Update for San Antonio International Airport, January 2009, FAA SAT ATCT.

Table 5-15. General Aviation Operations Forecast

				Operations			
Fiscal Year	Total Operations	Based Aircraft	OPBA	Itinerant	Share	Local	Share
Historical							
1997	121,617	225	541	115,727	95.2%	5,890	4.8%
1998	148,685	225	661	141,491	95.2%	7,194	4.8%
1999	120,945	252	480	113,227	93.6%	7,718	6.4%
2000	125,468	252	498	116,758	93.1%	8,710	6.9%
2001	109,030	253	431	103,168	94.6%	5,862	5.4%
2002	110,346	277	398	103,978	94.2%	6,368	5.8%
2003	113,909	288	396	108,135	94.9%	5,774	5.1%
2004	104,678	263	398	99,322	94.9%	5,356	5.1%
2005	90,558	263	344	84,251	93.0%	6,307	7.0%
2006	89,317	257	348	83,036	93.0%	6,281	7.0%
2007	83,258	257	324	80,474	96.7%	2,784	3.3%
2008	88,193	293	301	88,010	99.8%	183	0.2%
Forecast							
2010	82,225	299	275	82,061	99.8%	164	0.2%
2015	87,175	317	275	87,001	99.8%	174	0.2%
2020	100,500	335	300	100,299	99.8%	201	0.2%
2025	107,100	357	300	106,886	99.8%	214	0.2%

Sources: FAA Airport Master Record 5010, Noise Exposure Map Report and Noise Compatibility Program Update for San Antonio International Airport, January 2009, FAA SAT ATCT.

5.3.2.5 Military Operations

Military operations are difficult to forecast at any airfield, including military bases, because they rely so heavily on each year's available budget and the status of events on a regional or worldwide basis. The FAA forecast the total military operations to be constant when updating forecasts annually. For the purposes of this analysis, it is forecast that military operations at the Airport will be held constant at the FY 2008 level of 4,114 operations. **Table 5-16** provides the military fleet mix.

Table 5-16. Military Operations Fleet Mix for 2008

	FY 2008	
Fleet Mix	**Operations**	**Percent**
C-130	1,646	40.0%
Apache Helicopter	1,440	35.0%
C-21 Business Jet	103	2.5%
T-38 Military Jet	103	2.5%
T-34 Piston-Engine Prop	823	20.0%
Total	4,115	100.0%

Sources: Noise Exposure Map Report and Noise Compatibility Program Update for San Antonio International Airport, January 2009 and FAA SAT ATCT.

5.3.3 Passenger Enplanements and Aircraft Operations Summary

Table 5-17 summarizes historical and forecast enplanements and aircraft operations for SAT. These forecasts will serve as the basis for updated the FY 2009 FAA TAF.

Table 5-17. SAT Terminal Area Forecast Summary

	ENPLANEMENTS			AIRCRAFT OPERATIONS									BASED AIRCRAFT
				Itinerant Operations					Local Operations				
Fiscal Year	Air Carrier	Commuter	Total	Air Carrier	Air Taxi & Commuter	General Aviation	Military	Total	Civil	Military	Total	Total Operations	Total
1998	3,353,325	26,012	3,379,337	80,671	40,775	141,491	9,058	271,995	7,194	1,406	8,600	280,595	225
1999	3,381,891	2,216	3,384,107	80,532	37,643	113,227	10,310	241,712	7,718	1,608	9,326	251,038	252
2000	3,527,149	8,119	3,535,268	81,332	37,367	116,758	10,353	245,810	8,710	1,102	9,812	255,622	252
2001	3,424,256	10,638	3,434,894	74,947	38,989	103,168	10,289	227,393	5,862	1,168	7,030	234,423	253
2002	3,079,324	83,182	3,162,506	67,374	45,970	103,978	11,105	228,427	6,368	1,394	7,762	236,189	277
2003	2,984,157	137,388	3,121,545	66,360	53,813	108,135	13,483	241,791	5,774	1,146	6,920	248,711	288
2004	2,973,917	337,016	3,310,933	81,663	40,199	99,322	10,951	232,135	5,356	832	6,188	238,323	263
2005	3,135,255	386,283	3,521,538	92,710	26,348	84,251	5,775	209,084	6,307	941	7,248	216,332	263
2006	3,398,177	486,709	3,884,886	101,636	18,963	83,036	4,289	207,924	6,281	743	7,024	214,948	257
2007	3,442,456	461,186	3,903,642	104,293	21,844	80,474	4,279	210,890	2,784	328	3,112	214,002	257
2008	3,970,433	165,435	4,135,868	98,955	30,854	88,010	4,115	221,934	183	40	223	222,157	293
2009	3,167,733	131,989	3,299,722	96,289	21,519	81,237	4,115	203,160	162	40	202	203,362	296
2010	3,923,470	163,478	4,086,948	93,695	31,303	82,060	4,115	211,173	164	40	204	211,377	299
2011	4,038,191	166,470	4,204,661	96,403	31,751	83,158	4,115	215,426	166	40	206	215,632	303
2012	4,156,266	169,516	4,325,782	99,189	32,205	83,981	4,115	219,489	168	40	208	219,697	306
2013	4,277,794	172,618	4,450,412	102,055	32,665	84,805	4,115	223,641	169	40	209	223,850	309
2014	4,402,875	175,777	4,578,652	105,005	33,132	85,902	4,115	228,154	172	40	212	228,366	313
2015	4,531,615	179,003	4,710,618	108,040	33,608	87,000	4,115	232,763	174	40	214	232,977	317
2016	4,669,712	181,330	4,851,042	111,303	34,038	88,098	4,115	237,554	176	40	216	237,770	321
2017	4,812,018	183,687	4,995,705	114,664	34,474	88,921	4,115	242,174	178	40	218	242,392	324
2018	4,958,661	186,075	5,144,736	118,127	34,915	90,019	4,115	247,176	180	40	220	247,396	328
2019	5,109,772	188,494	5,298,266	121,694	35,362	91,117	4,115	252,288	182	40	222	252,510	332
2020	5,265,489	190,976	5,456,465	125,388	35,817	100,299	4,115	265,619	201	40	241	265,860	335
2021	5,398,373	195,789	5,594,162	128,610	36,408	101,796	4,115	270,929	204	40	244	271,173	340
2022	5,534,610	200,722	5,735,332	131,916	37,009	102,993	4,115	276,032	206	40	246	276,278	344
2023	5,674,286	205,781	5,880,067	135,306	37,619	104,191	4,115	281,231	208	40	248	281,479	348
2024	5,817,487	210,966	6,028,453	138,783	38,240	105,388	4,115	286,526	211	40	251	286,777	352
2025	5,964,301	216,322	6,180,623	142,322	38,869	106,885	4,115	292,191	214	40	254	292,445	357
Annual Average Growth Rate													
2008-2025	2.4%	1.6%	2.4%	2.2%	1.4%	1.1%	0.0%	1.6%	0.9%	0.0%	0.8%	1.6%	1.2%

Sources: 2008 FAA Terminal Area Forecast and PBS&J, 2009.

RUNWAY CAPACITY ANALYSIS

San Antonio International Airport

6

6.0 INTRODUCTION

The evaluation of runway capacity is critical for identifying the point at which the existing airfield configuration at San Antonio International Airport (SAT or Airport) can no longer accommodate current and future operational demands. The analysis is particularly important in terms of assessing the adequacy of Runway 12L-30R only handling General Aviation (GA) operations.

The generally accepted methodology for calculating airfield capacity is based on the Federal Aviation Administration's (FAA) Advisory Circular (AC) 150/5060-5, *Airport Capacity and Delay*. For verification purposes, computer modeling and simulation was utilized to validate manual calculations of hourly capacity. The results of the evaluation are presented below.

6.1 CAPACITY ANALYSIS

Runway capacity is a measure of the number of aircraft that can operate on an airport's runways in a given timeframe. Capacity is most often expressed in hourly or annual measures. Hourly capacities are calculated for visual flight rules (VFR) and instrument flight rules (IFR) in order to identify any peak-period issues. Annual service volume (ASV) is calculated to measure an airport's ability to process existing and future demand levels.

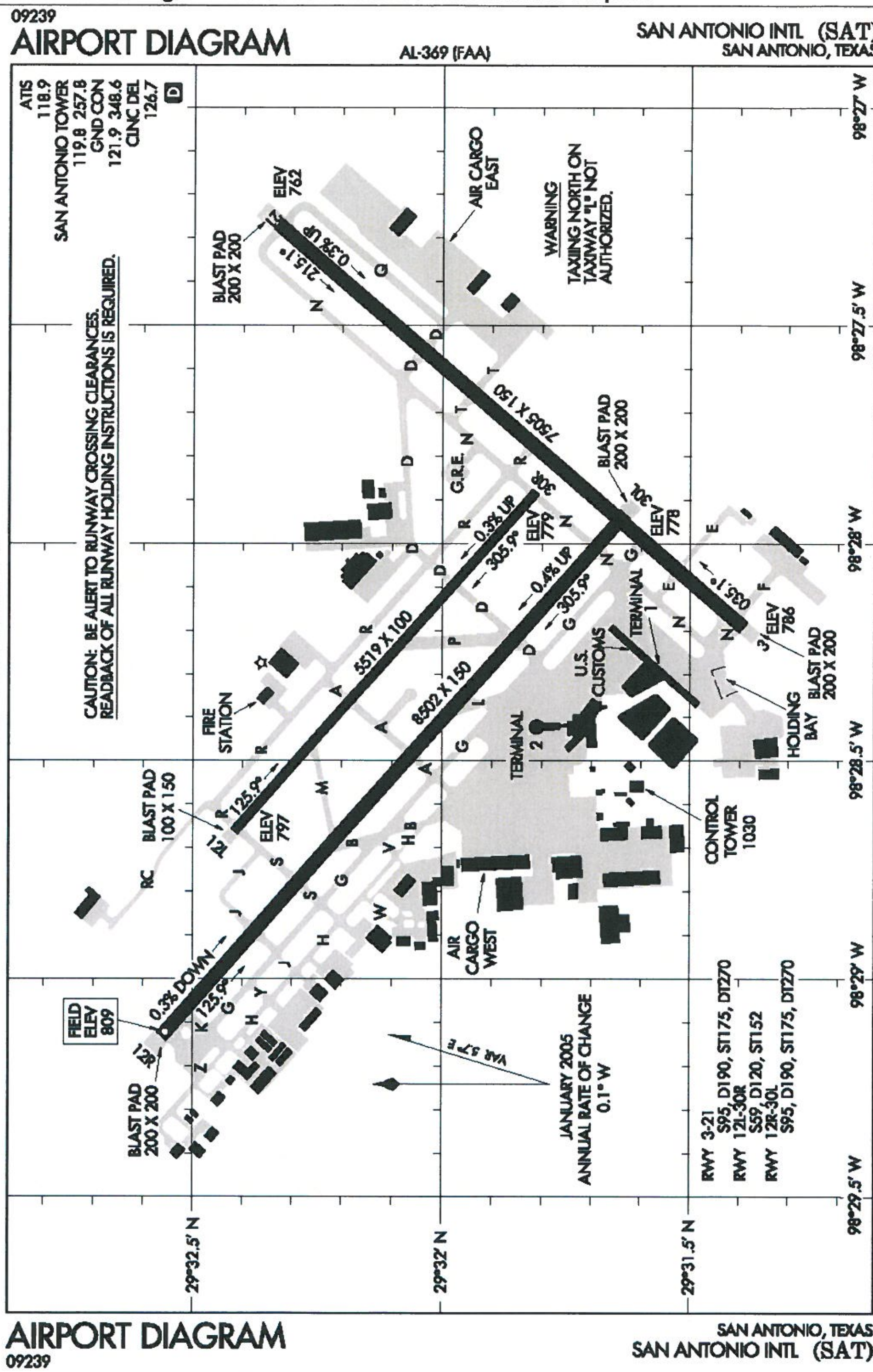
The major components of an airfield system to be considered when determining capacity include runway orientation and configuration, runway length, and runway exit locations. Additionally, the capacity of a given system is affected by operational characteristics such as fleet mix, climatology, and Air Traffic Control Tower (ATCT) procedures. Each of these components has been examined as part of the airside capacity analysis and is described in the following sections.

6.1.1 Runway Orientation and Utilization

SAT has three existing runways, as depicted in **Figure 6-1**. Runways 12R-30L and 12L-30R both have a northwest-southeast alignment, while Runway 3-21 is oriented northeast to southwest. The use and orientation of these runways was estimated to determine the capacity of the airfield, which is the sum of capacities determined for each operation (takeoff and landing). Each operation is defined by its direction, often influenced by wind, available instrument approaches, noise abatement procedures, airspace restrictions, and/or other operating parameters. The runway use configurations used for capacity calculations considered runway orientations of all runways at SAT. The operations evaluated five scenarios and included the utilization of runways in both visual flight rules VFR and IFR conditions.

- Scenario 1 (VFR) – involves commercial and GA arrivals and departures to/from Runways 12L and 12R and departures from Runway 3. Runway 12L only handles GA arrivals and departures.
- Scenario 2 (VFR) - involves commercial and GA arrivals and departures to/from Runways 30L and 30R. Runway 30R only handles GA arrivals and departures.

Figure 6-1. Existing Airfield at San Antonio International Airport



Source: Federal Aviation Administration (FAA) National Aeronautical Charting Office (NACO), November, 2009.

- Scenario 3 (VFR) – involves commercial and GA arrivals and departures to/from Runway 21.
- Scenario 4 (VFR) – involves commercial and GA arrivals and departures to/from Runway 3
- Scenario 5 (IFR) - involves the utilization of a single runway due to the existing instrument operations and wind conditions at SAT.

Runway utilization factors for this study were derived from the final *Noise Exposure Map Report and Noise Compatibility Program Update for San Antonio International Airport*, completed by Wyle Aviation Services in May 2009. The runway utilization information derived from this document and applied to the above mentioned scenarios is presented in **Figure 6-2**.

6.1.2 Aircraft Mix Index

The FAA developed a classification system for aircraft, based on size, weight, and performance. **Table 6-1** illustrates this classification as it is presented in FAA AC 150/5060-5, *Airport Capacity and Delay*. This classification is used to develop an aircraft mix, which is the relative percentage of operations conducted by each of the four classes of aircraft (A, B, C, and D). The aircraft mix is used to calculate a "mix index," which is used in airfield capacity studies. The FAA defines the mix index as a mathematical expression, representing the percent of Class C aircraft, plus three times the percent of Class D aircraft; written as % (C+3D).

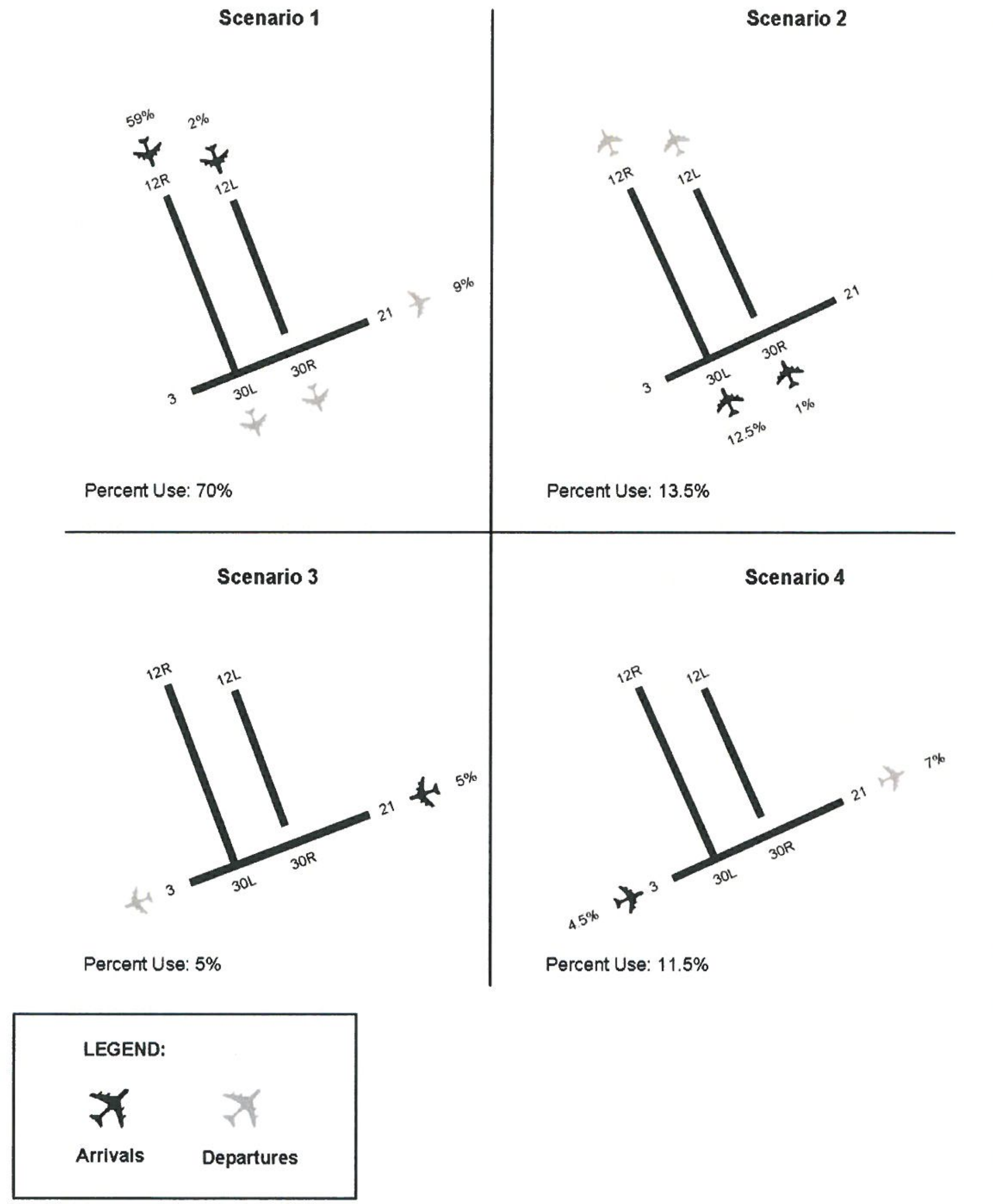
The current facilities at SAT can accommodate aircraft within all four aircraft classes. The analysis of Fiscal Year 2008 (base year) operations obtained from the SAT ATCT determined that operations would be divided amongst the four classes as listed in Table 6-1. Utilizing this information, the base year mix index at SAT for purposes of airfield capacity calculations, is 74.4 (C + 3D = 69.6 + 4.8 = 74.4).

Table 6-1. FAA Aircraft Classifications

Aircraft Class	Max. Cert. Takeoff Weight (lb)	Number of Engines	Wake Turbulence Classification	SAT Percentages
A	12,500 or less	Single	Small (S)	25.6
B		Multi		3.2
C	12,500 – 300,000	Multi	Large (L)	69.6
D	Over 300,000	Multi	Heavy (H)	1.6

Sources: FAA AC 150/5060-5, Airport Capacity and Delay and Noise Exposure Map Report and Noise Compatibility Program Update for San Antonio International Airport, completed by Wyle Aviation Services in May 2009 and PBS&J, 2009.

Figure 6-2. Runway Utilization



Sources: Noise Exposure Map Report and Noise Compatibility Program Update for San Antonio International Airport, completed by Wyle Aviation Services in May 2009 and PBS&J, 2009.

6.1.3 Percent Arrivals

The percent of arrivals is the ratio of arrivals to total operations. It is logical to assume that the total annual arrivals will equal total departures, and that average daily arrivals will equal average daily departures. Therefore, the ratio of arrivals used in the capacity calculations for SAT was 50 percent.

6.1.4 Percent Touch-and-Go

The percentage of touch-and-go operations is an integral part of the FAA's airfield capacity computation method. The touch-and-go percentage is the ratio of landings with an immediate takeoff; two total operations. This type of operation is typically associated with flight training. The number of touch-and-go operations normally decreases as air carrier operations increase, the demand for service and number of total operations approach runway capacity, and/or weather conditions deteriorate. Touch-and-go operations are assumed to be between zero and 50 percent of total operations, as the FAA considers any number greater than 50 percent to qualify an airport for the highest touch-and-go index in capacity calculations. Given the nature of high scheduled commercial service activity at SAT, a touch-and-go factor range of 1 to 10 percent was selected.

6.1.5 Taxiway Exit Factors

Taxiway entrance and exit locations are an important factor in determining the capacity of an airport's runway system. Runway capacities are highest when full-length, parallel taxiways, ample runway entrance and exit taxiways, and no active runway crossings are available. FAA AC 150/5060-5, *Airport Capacity and Delay* identifies the criteria for determining taxiway exit factors at an airport. The criteria for exit factors are generally based on the mix index and the distance the taxiways are from the runway threshold and other taxiways. Because the mix index for the Airport was calculated to be 74.4, only exit taxiways that are between 3,500 and 6,500 feet from the threshold, spaced at least 750 apart, were considered, and contributed to the taxiway exit factor. Taxiways that met these parameters were considered in completing the capacity calculations for all directions and all conditions. An average number of compatible exits are computed when multiple runway layout configurations are utilized, and the maximum factor available is 1.0.

6.1.6 Runway Instrumentation

The capacity calculations for SAT include all active runways on the airfield. For planning purposes, calculations assume that instrument landing system (ILS) approach capabilities are provided only on Runways 12R, 30L, and 3.

6.1.7 Weather Influences

Weather data obtained from the National Climatic Data Center (NCDC), compiled in the *San Antonio International Airport Master Plan*, prepared by Ricondo & Associates in 1998, identified that IFR conditions (ceilings greater than or equal to 200 but less than 1,000 feet, and/or visibility greater than or equal to one-half mile, but less than three miles) occur 12.2 percent of the time. SAT's ATCT indicated that periods of marginal VFR (MVFR) occurs approximately 30 percent of the time due to low cloud ceilings. MVFR conditions occur when the cloud ceiling is between 1,000 feet and 3,000 feet.

SAT contains a Category-II (CAT-II) Instrument Landing System (ILS) approach to Runway 12R, and CAT-I ILS approaches to Runways 3, 12R, and 30L. Those approaches provide for landings in IFR conditions with ceilings as low as 200 feet AGL and visibility as low as one-half mile on all ILS capable runways. The CAT-II ILS provides approach minima of 100 foot ceilings and lateral visibility as low as 1,200 feet runway visual range (RVR). As such, SAT would be considered closed to landing aircraft when meteorological conditions were worse than those previously mentioned. If the SAT is being operated in MVFR, aircraft on an instrument approach to Runway 12R or 30L may "side-step" over to 12L or 30R respectively, once they break out of the clouds.

6.2 AIRFIELD CAPACITY CALCULATIONS

Manual capacity calculations were conducted based on the guidance and procedures in FAA AC 150/5060-5, *Airport Capacity and Delay* to predict the Airport's overall capacity, both hourly and annually. Hourly capacity and ASV calculations were manually calculated for both assumptions of IFR weather predictions (30 percent and 12.2 percent).

6.2.1 Hourly Capacity

Hourly capacities were analyzed for the five runway use scenarios and the results are summarized in **Table 6-2**. This table also compares the peak hour demand at SAT to the hourly capacities (VFR only). As shown, SAT does not have adequate hourly capacity to accommodate existing peak hour demand. The following equation presents the step-by-step method that was used to calculate the hourly capacities.

Hourly Capacity Base (C) x Touch & Go Factor (T) x Exit Factor (E) = Hourly Capacity*

Table 6-2. Hourly Capacity Results

Runway Configuration	Hourly VFR Capacity	Hourly IFR Capacity	2008 Peak Hour Demand
Scenario 1 Runways 12L, 12R, and 3	77		62
Scenario 2 Runways 30L, 30R	56		62
Scenario 3 Runway 21	54		62
Scenario 4 Runway 3	54		62
Scenario 5 (IFR) One Runway Only		50	n/a

Sources: SAT ATCT and PBS&J, 2009.

6.2.2 Annual Service Volume

The ASV is the maximum number of annual operations that can occur at SAT before an assumed maximum operational delay value is encountered. The ASV is calculated based on the existing runway configuration, aircraft mix, and the parameters and assumptions identified herein, and incorporates the hourly capacities previously discussed.

To calculate an airfield's ASV, the percentage of occurrence of different runway operation configurations and their associated hourly capacities must be specified.

These percentages, along with ASV weighting factors (derived from the capacity estimate), are used to compute a weighted hourly capacity. Two additional factors – the ratio of annual demand to average daily demand in the peak month of the year (referred to as the D factor) and the ratio of average daily demand to average peak hour demand for the peak month of the year (referred to as the H factor) – are then used to calculate the ASV. **Tables 6-3 and 6-4** show the ASV calculations for SAT based on different IFR percentages. The following equation presents the step-by-step method that was used to calculate the ASV.

Weighted Hourly Capacity (Cw) x Annual Daily Demand (D) x Daily Hourly Demand (H) = ASV

The ASV for existing conditions at SAT was calculated to be 196,938 operations, assuming that IMC occurs 12.2 percent of the time (based from 1998 Master Plan). The ASV was calculated to be 189,366 operations, assuming that IMC occurs 30 percent of the time (based on SAT ATCT).

According to the FAA, the following guidelines should be used to determine necessary steps as demand reaches designated levels:

- 60 percent of ASV: Threshold at which planning for capacity improvements should begin.
- 80 percent of ASV: Threshold at which planning for improvements should be complete and construction should begin.
- 100 percent of ASV: Airport has reached the total number of annual operations (demand) the Airport can accommodate, and capacity-enhancing improvements should be made to avoid extensive delays.

Tables 6-5 and **6-6** summarize and **Figures 6-3 and 6-4** illustrate the preferred aviation demand forecast for SAT and its relation to the ASV calculations for the two assumed IFR/VFR weather ratios. As can be seen from both tables, planning efforts to mitigate capacity improvements are an immediate need. Capacity-enhancing improvements typically include, but are not limited to, runway utilization modification, runway extensions, additional runway instrumentation, and/or taxiway improvements.

Table 6-3. Airfield Hourly Capacity and Annual Service Volume Calculations (12.2% IFR)

Airfield Configuration	Scenario 1		Scenario 2		Scenario 3	Scenario 4	Scenario 5
FAA AC 150/5060-5 Rwy Configuration	Figure 3-28 (Rwys 12L & 3)	Figure 3-3 (Rwy 12L)	Figure 3-3 (Rwy 12R or 30L)	Figure 3-3 (Rwy 12L or 30R)	Figure 3-3 (Rwy 21)	Figure 3-3 (Rwy 3)	Figure 3-43 (1 IFR Rwy)
Configuration Utilization During VFR	68.00%	2.00%	12.50%	1.00%	5.00%	11.50%	0.00%
Configuration Utilization During IFR	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Percent VFR	87.80%						
Percent IFR	12.20%						
Percent of Aircraft in Each Mix Category (See Table 6-2) A	25.6	50	25.6	50	25.6	25.6	25.6
B	3.2	50	3.2	50	3.2	3.2	3.2
C	69.6	0	69.6	0	69.6	69.6	69.6
D	1.6	0	1.6	0	1.6	1.6	1.6
Aircraft Mix Index	74.4	0.0	74.4	0.0	74.4	74.4	74.4
Hourly Capacity Base (C^*)	77	104	59	104	57	57	55
Touch & Go Factor (T)	1.03	1.04	1.04	1.04	1.04	1.04	1.00
Exit Factor (E)	0.97	0.94	0.91	0.94	0.91	0.91	0.91
Hourly Capacity $(C) = C^* \times T \times E$	77	102	56	102	54	54	50
Scenario % of Max Capacity	15	1	20	1	–	–	–
Scenario Weighted Capacity	77		56		54	54	50
% of Maximum Capacity	100%		73%		70%	70%	65%
Weighting Factor (W)	1		15		15	15	20
% (P) Use of Rwy Config.	61.46%		11.85%		4.39%	10.10%	12.20%
Weighted Hourly Capacity (Cw)	55.09						
Annual Demand	222,157						
Avg. Daily Demand Durring Peak Month	649						
Avg. Daily Demand	609						
Avg. Peak Hour Demand During the Peak Month	58						
Demand Ratios Daily (D)	342.10						
Demand Ratios Hourly (H)	10.45						
ASV FORMULA	Cw x D x H						
ASV CALCULATION	196,938						

Sources: FAA AC 150/5060-5, Airport Capacity and Delay and PBS&J, 2009.

Table 6-4. Airfield Hourly Capacity and Annual Service Volume Calculations (30% IFR)

Airfield Configuration	Scenario 1		Scenario 2		Scenario 3	Scenario 4	Scenario 5
FAA AC 150/5060-5 Rwy Configuration	Figure 3-28 (Rwys 12L & 3)	Figure 3-3 (Rwy 12L)	Figure 3-3 (Rwy 12R or 30L)	Figure 3-3 (Rwy 12L or 30R)	Figure 3-3 (Rwy 21)	Figure 3-3 (Rwy 3)	Figure 3-43 (1 IFR Rwy)
Configuration Utilization During VFR	68.00%	2.00%	12.50%	1.00%	5.00%	11.50%	0.00%
Configuration Utilization During IFR	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Percent VFR	70.00%						
Percent IFR	30.00%						
Percent of Aircraft in Each Mix Category (See Table 6-2) A	25.6	50	25.6	50	25.6	25.6	25.6
B	3.2	50	3.2	50	3.2	3.2	3.2
C	69.6	0	69.6	0	69.6	69.6	69.6
D	1.6	0	1.6	0	1.6	1.6	1.6
Aircraft Mix Index	74.4	0.0	74.4	0.0	74.4	74.4	74.4
Hourly Capacity Base (C*)	77	104	59	104	57	57	55
Touch & Go Factor (T)	1.03	1.04	1.04	1.04	1.04	1.04	1.00
Exit Factor (E)	0.97	0.94	0.91	0.94	0.91	0.91	0.91
Hourly Capacity (C) = C* x T x E	77	102	56	102	54	54	50
Scenario % of Max Capacity	15	1	20	1	--	--	--
Scenario Weighted Capacity	77		56		54	54	50
% of Maximum Capacity	100%		73%		70%	70%	65%
Weighting Factor (W)	1		15		15	15	20
% (P) Use of Rwy Config.	49.00%		9.45%		3.50%	8.05%	30.00%
Weighted Hourly Capacity (Cw)	52.97						
Annual Demand	222,157						
Avg. Daily Demand Durring Peak Month	649						
Avg. Daily Demand	609						
Avg. Peak Hour Demand During the Peak Month	58						
Demand Ratios Daily (D)	342.10						
Demand Ratios Hourly (H)	10.45						
ASV FORMULA	Cw x D x H						
ASV CALCULATION	189,366						

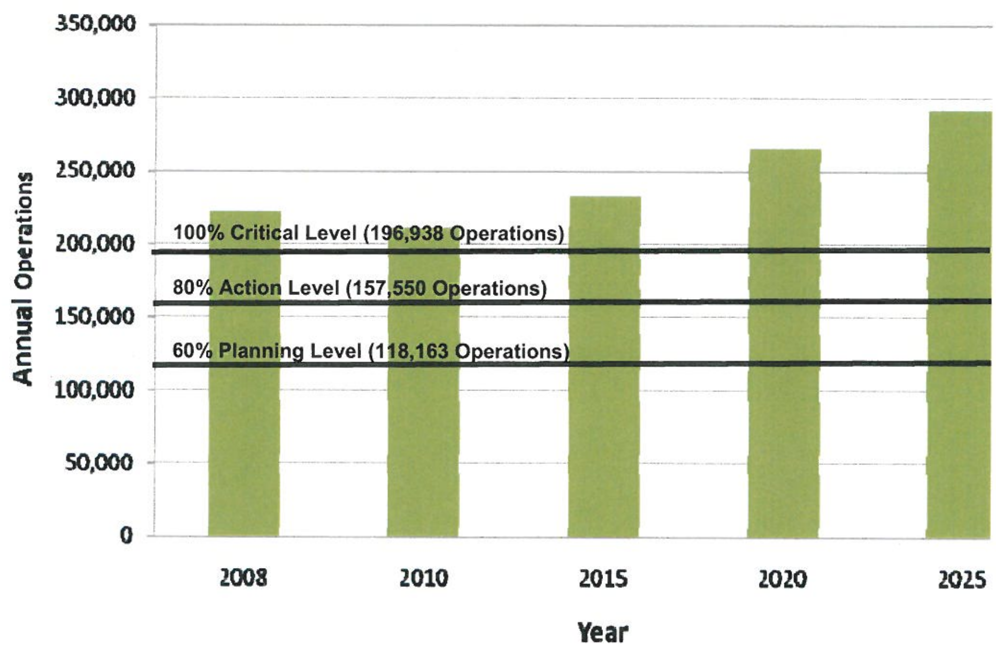
Sources: FAA AC 150/5060-5, Airport Capacity and Delay and PBS&J, 2009.

Table 6-5. Annual Service Volume vs. Annual Demand 12.2 Percent IFR

Fiscal Year	Annual Operations	Annual Service Volume	Percent of Annual Service Volume
2008	222,157	196,938	112.8%
2010	211,377	196,938	107.3%
2015	232,977	196,938	118.3%
2020	265,860	196,938	135.0%
2025	292,445	196,938	148.5%

Sources: FAA AC 150/5060-5, Airport Capacity and Delay and PBS&J, 2009.

Figure 6-3. Existing Demand vs. Capacity 12.2 Percent IFR



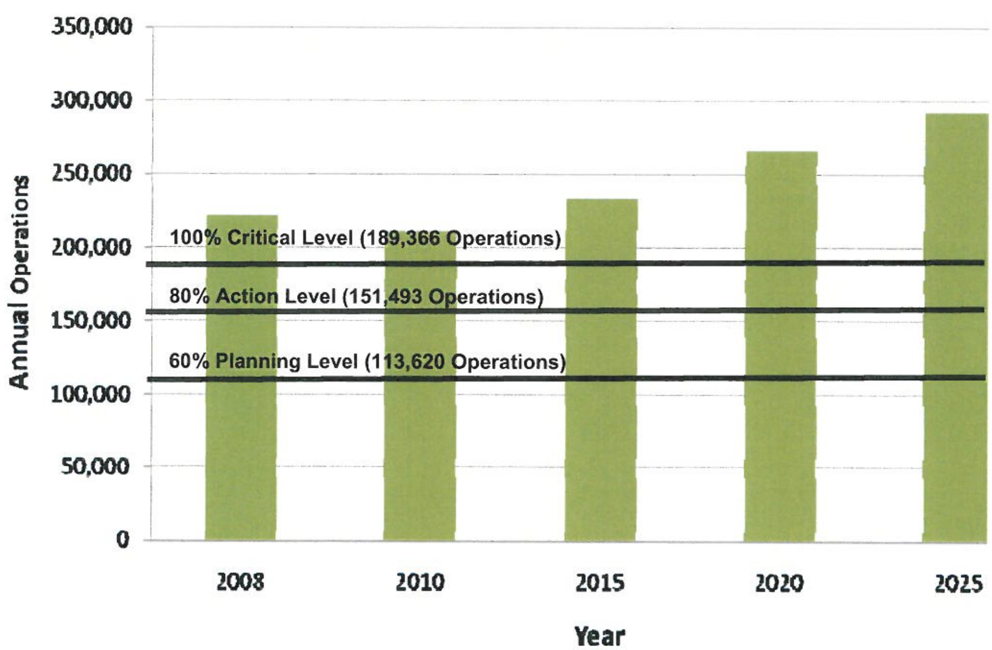
Sources: FAA AC 150/5060-5, Airport Capacity and Delay and PBS&J, 2009.

Table 6-6. Annual Service Volume vs. Annual Demand 30 Percent IFR

Fiscal Year	Annual Operations	Annual Service Volume	Percent of Annual Service Volume
2008	222,157	189,366	117.3%
2010	211,377	189,366	111.6%
2015	232,977	189,366	123.0%
2020	265,860	189,366	140.3%
2025	292,445	189,366	154.4%

Sources: FAA AC 150/5060-5, Airport Capacity and Delay and PBS&J, 2009.

Figure 6-4. Existing Demand vs. Capacity 30 Percent IFR



Sources: FAA AC 150/5060-5, Airport Capacity and Delay and PBS&J, 2009.

6.3 AIRPORT CAPACITY AND DELAY COMPUTER SIMULATIONS

This section summarizes the future fleet mix, the exiting airfield layout, and modeling assumptions as they pertain specifically to the airport capacity analysis of SAT. This information is based on the following sources:

- Data collected onsite at the Federal FAA SAT ATCT on January 27-29, 2009
- Discussions between SAT ATCT, SAT Aviation Department, PBS&J, and TransSolutions
- TransSolutions' experience in aviation operations and simulation modeling

The objectives of the simulation study were to quantify the runway capacity during visual meteorological conditions with the 2025 fleet mix for the following operating scenarios:

- Runway 12L, 12R, and 3
- Runway 30L and 30R
- Runway 3

To accomplish these objectives, TransSolutions developed simulation models of the existing SAT airfield shown in Figure 6-1 using SIMMOD Plus!®. SIMMOD is the FAA's Airport and Airspace Capacity Model that tracks individual aircraft movements throughout the airspace and on the airfield, accurately capturing the interactions between aircraft to assess measures of throughput and aircraft delay.

Arriving aircraft movements were modeled through final approach, landing, exiting the runway, and taxiing to their respective ramp. Since this study focused on runway capacity (and not gate/ramp capacity), aircraft movements on the ramp were not modeled in detail. Departing aircraft movements were modeled from taxi to the departure queue, take-off, and initial departure heading while transiting the airspace.

To estimate capacity, several hours of flights are generated in the model with each hour representing the FY 2025 forecast fleet mix as shown in **Table 6-7**. Resulting aircraft delays are not considered; rather, the analysis focuses on the actual number of aircraft that can be accommodated on the runways.

Table 6-7. FY 2025 Fleet Mix

Aircraft Class	Weight Range (lbs)	2025 Fleet Mix
A	12,500 or less	20%
B	12,500 or less	17%
C	12,500–300,00	62%
D	300,00 or over	1%
Total	--	100%

Source: PBS&J, 2009.

The reported hourly capacity represents the throughput that may occur consistently for several hours. Conditions may exist that permit slightly higher throughput; however those maximum numbers cannot be maintained for any length of time and should not be considered for general planning purposes.

6.3.1 General Runway Operations and Airspace Separations Overview

The arrivals airspace was modeled for approximately 10 nautical miles (nm) from final approach until touchdown. The departure airspace was modeled from initial departure heading approximately 5-10 miles into the airspace to capture the initial departure headings of the aircraft. Aircraft are required to maintain separation from other aircraft in order to maintain a safe environment, adhering to the following standard separations described in this section:

- Terminal area separations
- Runway interdependency separations
- Wake turbulence separations

Since SAT operates 70 percent of the time under VMC (as provided by the SAT ATCT), only VMC was modeled. General aircraft separations that apply to all scenarios are presented in this section, with separations specific to each configuration detailed in subsequent sections.

6.3.1.1 Terminal Area Separations

Radar separations require at least three nm between aircraft until the aircraft pilots are permitted to fly visual approaches when within close proximity of the airport. Once visual approaches are permitted, 1.9 nm separation is modeled to approximate the minimum distance between aircraft at touchdown.

For all SAT runways, jet departures maintain runway heading immediately after departure. Propeller aircraft departures fly a heading that diverges from the runway heading by 15°.

6.3.1.2 Standard FAA Separations

The following standard FAA separations were maintained for all scenarios.

- Consecutive departures from the same runway, when either of the aircraft is a jet, require 6,000 feet separation between aircraft; also, the first aircraft must be airborne prior to the next departure being released.
- Consecutive small GA departures from the same runway require 3,000 feet separation and the first aircraft must be airborne for the next departure to be released.

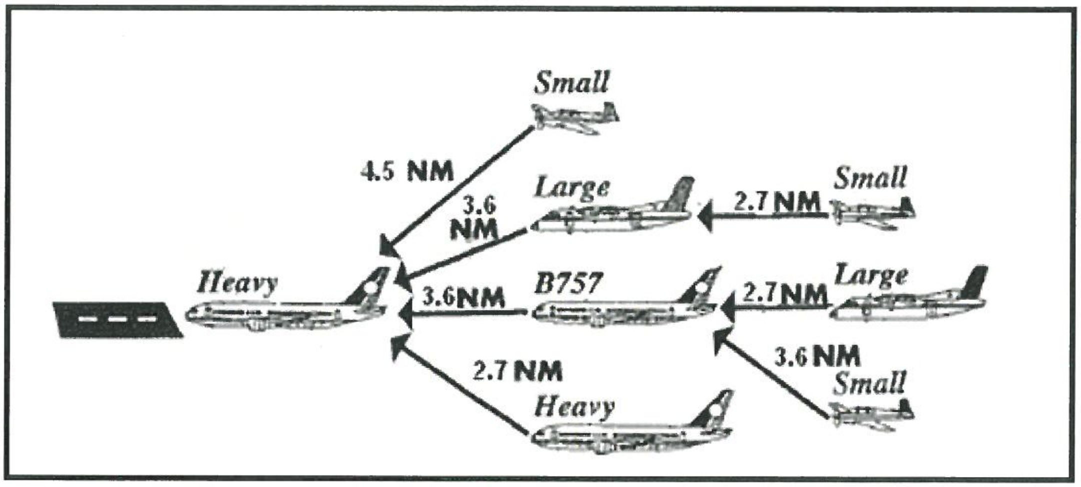
6.3.1.3 Wake Turbulence Separations

Standard wake turbulence separations were maintained based on the leading and trailing aircraft category as shown in **Figure 6-5**. These VMC wake turbulence separations, which are approximately 25 percent less than the wake turbulence separations published by the FAA, are based on data collected by MITRE and account for the pilot's ability to remain above the leading aircraft's glide slope when maintaining visual separation.

The aircraft categories adhere to standard FAA weight classes:

- Small aircraft have a maximum takeoff weight of 41,000 pounds or less, such as Beech 1900, King Air, Cessna Citation, Learjets
- Large aircraft have a maximum takeoff weight of more than 41,000 pounds up to 255,000 pounds, such as Boeing 737, MD-80, CRJ's (regional jets)
- Heavy aircraft have a maximum takeoff weight of more than 255,000 pounds, such as Boeing 767, C-5

Figure 6-5. Wake Turbulence Separations in Visual Conditions



Source: MITRE.

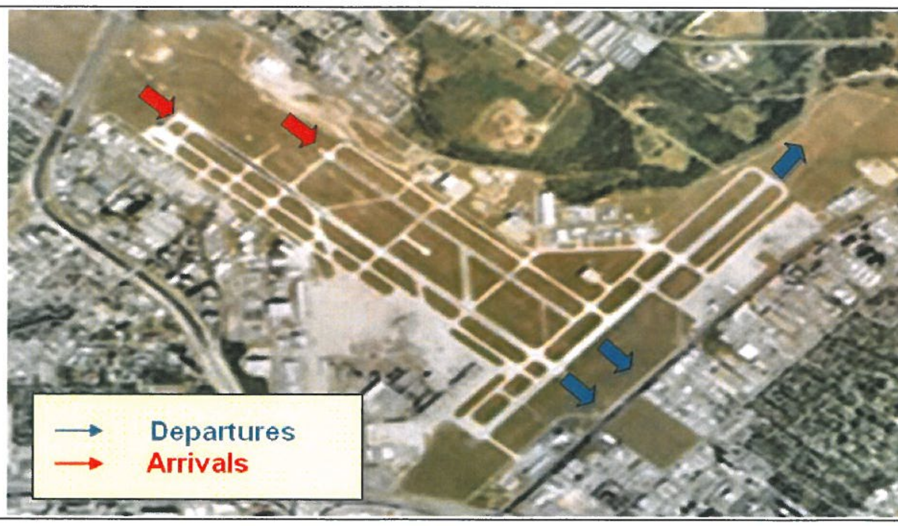
Since air traffic controllers and pilots cannot keep aircraft separations exactly at the distances specified above, arrival separations were distributed between 0.87 and 1.67 times the distance specified in Figure 6-5 while departures were distributed between 0.87 and 1.5 times these distance separations.

6.3.2 Scenario - Active Runways 12L, 12R and 3

As depicted in **Figure 6-6**, the following operations will be used to assess the airfield capacity when Runways 12L, 12R, and 3 are in use:

- Commercial and GA arrivals and departures on Runway 12R
- GA arrivals and departures on Runway 12L
- Commercial and GA departures on Runway 3

Figure 6-6. Arrival and Departure Operations for Active Runways 12L, 12R and 3



Source: TransSolutions, 2009.

6.3.2.1 Same Runway Separations

Consecutive arrivals to Runway 12R require a 5 nm separation in order for departures to be released between arrivals; otherwise a 3 nm separation between consecutive arrivals is maintained. Consecutive arrivals to Runway 12L require a 3 nm separation. Due to the location of runway exits on Runway 3, consecutive arrivals to Runway 3 require a 5-7 nm separation in order for departures to be released between arrivals. Aircraft departing from a runway will be held if a jet arrival to the same runway is within 3 nm of landing or if a prop arrival is within 2 nm of landing.

6.3.2.2 Separations between Runways 12R and 12L with Runway 3

The departure end of Runway 12R intersects with Runway 3. Land and hold short operations are not authorized between Runway 12R and 3. However, wake turbulence separation between Runways 12R and 3 operations is not required. Aircraft departing from Runway 3 must be past the intersection of Runway 12R before a departure from Runway 12R can be released. Aircraft departing from Runway 3 must be past the extended centerline of Runway 12L before a departure from Runway 12L can be released. Arrivals to Runways 12R or 12L must more than 1 nm from landing for a departure from Runway 3 to be released. Departures from Runway 3 can be cleared for departure before an arrival to Runway 12R exits the runway as long as the arrival to 12R is slowing and will not roll to the intersection of the two runways.

6.3.2.3 Separations between Runway 12R with Runway 12L

Due to the runways being spaced only 900 feet apart, simultaneous departures from Runways 12R and 12L are not allowed. However, simultaneous jet departures from Runway 12R and GA propeller departures from Runway 12L are allowed as long as diverging headings are maintained. Simultaneous arrivals to Runways 12R and 12L are allowed as long as aircraft do not overtake one another on final approach. Arrivals to one runway are independent of departures from the other runway. Departures from Runway 12L must wait 2 minutes after a Heavy/757 departure from Runway 12R.

6.3.2.4 Capacity Results

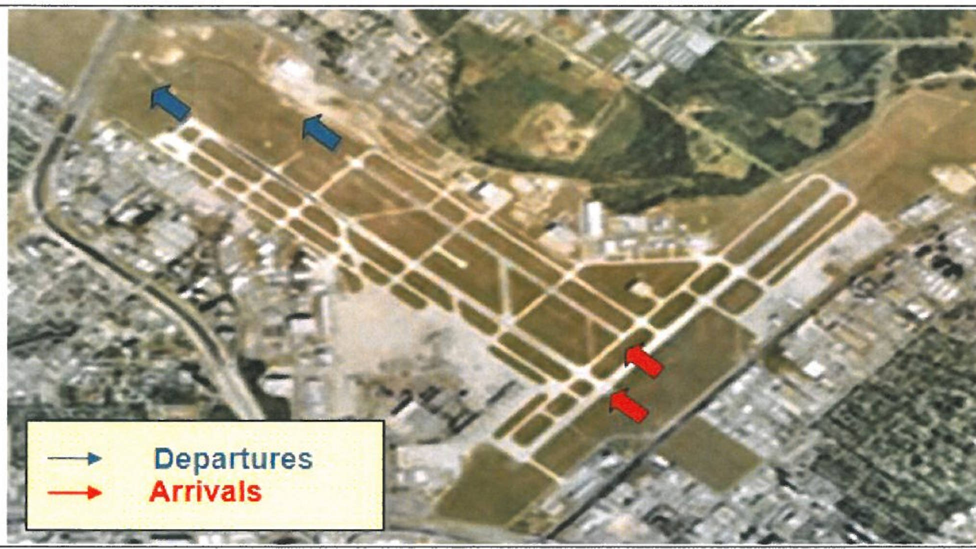
Analyzing the results of the simulation model of operations on Runway 12L, Runway 12R and Runway 3, the sustainable hourly capacity is approximately 60 operations per hour with the forecasted 2025 fleet mix. This configuration has slightly greater departure throughput than arrival throughput. In this configuration, the capacity is restricted by operations at nearby Randolph Air Force Base (RND) due to the extended runway centerlines intersecting approximately six miles off the departure end of Runway 3.

6.3.3 Scenario - Active Runways 30L and 30R

As depicted in **Figure 6-7**, the following operations will be used to assess the airfield capacity when Runways 30L and 30R are in use:

- Commercial and GA arrivals and departures on Runway 30L
- GA arrivals and departures on Runway 30R

Figure 6-7. Arrival and Departure Operations for Active Runways 30L and 30R



Source: TransSolutions, 2009.

6.3.3.1 Same Runway Operations

Consecutive arrivals to Runway 30L require a 5 nm separation in order for departures to be released between arrivals; otherwise a 3 nm separation between consecutive arrivals is maintained. Consecutive arrivals to Runway 30R require a 3 nm separation. Aircraft departing from a runway will be held if a jet arrival to the same runway is within 3 nm of landing or if a prop arrival is within 2 nm of landing.

6.3.3.2 Separations between Runways 30L and 30RL

Due to the runways being spaced only 900 feet apart, simultaneous departures from Runways 30L and 30R are not allowed. However, simultaneous jet departures from Runway 30L and GA propeller departures from Runway 30R are allowed as long as diverging headings are maintained. Simultaneous arrivals to Runways 30L and 30R are permitted as long as aircraft do not overtake one another on final approach. Arrivals to one runway are independent of departures from the other runway. Departures from Runway 30R must wait 2 minutes after a Heavy/757 departure from Runway 30L.

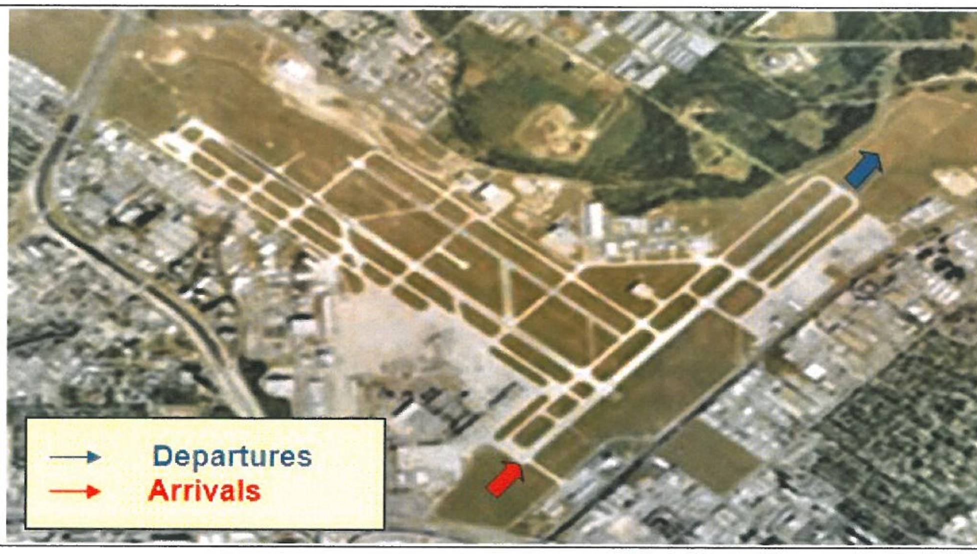
6.3.3.3 Capacity Results

Analyzing the results of the simulation model of operations on Runway 30R and Runway 30L, the sustainable hourly capacity is approximately 50 operations per hour with the forecasted 2025 fleet mix. Throughput in this configuration is comprised of an equal number of arrivals and departures.

6.3.4 Scenario - Active Runway 3

Figure 6-8 shows the types of operations for this configuration, with all arrivals on Runway 3 and all departures on Runway 3.

Figure 6-8. Arrival and Departure Operations for Active Runway 3



Source: TransSolutions, 2009.

6.3.4.1 Separations

Due to the location of runway exits on Runway 3, consecutive arrivals require a 5-7 nm separation in order for departures to be released between arrivals. If no departures are waiting, the spacing between consecutive arrivals can be reduced to 3 nm. Aircraft departing from Runway 3 will be held if a jet arrival is within 3 nm of landing or if a prop arrival is within 2 nm of landing.

6.3.4.2 Capacity Results

Analyzing the results of the simulation model of all operations on Runway 3 only, the maximum hourly capacity is approximately 45 operations per hour with the forecasted 2025 fleet mix. Throughput in this configuration is comprised of an equal number of arrivals and departures. The capacity is restricted by operations at nearby Randolph Air Force Base (RND) due to the extended runway centerlines intersecting a few miles off the departure end of Runway 3. Note that without a full parallel taxiway, cargo departures must cross Runway 3 to Taxiway N to depart Runway 3.

6.4 AIRPORT CAPACITY SUMMARY

Based on the simulation analyses conducted for SAT in visual conditions with the forecasted 2025 fleet mix, the resulting hourly throughputs are summarized in **Table 6-8**. The airspace restrictions due to close proximity of other airfields, specifically Randolph Air Force Base (RND), limit the ability of SAT to achieve higher throughputs. The table also provides a comparison of the manual capacity calculations applied above using the FAA AC 150-5060-5, *Airport Capacity and Delay*. In both cases, the analyses indicate that the existing SAT airfield will need to improve in order to handle current and future operational demands. An alternative solution to enhance capacity is identified and discussed in the next section of this study.

Table 6-8. Sustainable Hourly Capacity in VMC

Airfield Layout and Flow	SIMMOD Hourly Capacity	Manual Hourly Capacity – 30% IFR
Runway 12L, 12R, and 03	60	77
Runway 30L and 30R	50	56
Runway 03	45	54

Sources: TransSolutions and PBS&J, 2009.

6.5 RECOMMENDED CAPACITY ENHANCEMENT

From the capacity results it is apparent that the existing airfield at SAT needs to be improved in order to handle operational demands. Runway 12L-30R is limited to general aviation operations and aircraft less than 59,000 pounds. Therefore, the runway is underutilized. The upgrade of Runway 12L-30R would allow for increased utilization and subsequently increased capacity. The SAT ATCT was contacted regarding an estimate of usage increase and capacity. As noted, the avoidance of runway crossings and decrease in taxi times and the ability to use Runway 12L-30R for departures, the overall usage would be estimated between 20 to 25 percent versus the 3 percent today. The 1998 master plan recommended that Runway 12L-30R be extended to 8,250 feet, widened to 150 feet, and equipped to accommodate commercial aircraft under VFR and IFR conditions. The purpose of this section is to provide support and justification in extending and upgrading Runway 12L-30R.

6.5.1 Critical Aircraft and Airport Reference Code

The planning and design of an airport is typically based on the airport's role and the critical aircraft that are planned to use it. Guidance for the planning and design of the airfield are based on FAA guidance that aims to maximize airport safety, economy, efficiency, and longevity.

The FAA requires that a "critical aircraft" be identified for the design of airports. Many factors are analyzed before selecting the critical aircraft including geometric dimensions of aircraft, forecasted aviation demand at the airport, and projected growth in the surrounding communities. In order for a particular aircraft to be considered by the FAA as a potential critical aircraft, the existing and/or forecasted operations must exceed 500 per year. Once all aircraft with the 500 annual operations are identified, the most geometrically demanding one is chosen as the critical aircraft. In some cases where several aircraft with similar requirements are present, a profile of the most demanding aircraft is developed in order to identify the appropriate FAA design requirements.

Once a critical aircraft is established, a corresponding Airport Reference Code (ARC) is assigned to the airport. The ARC is used by the FAA to establish minimum geometric criteria for the safe operation of aircraft. The ARC has two components relating to the airport design aircraft (i.e., critical airplane). The first component, depicted by a letter (e.g., A, B, C, etc.) is the aircraft approach category and relates to aircraft approach speed (operational characteristic). The second component, depicted by a Roman numeral (e.g., I, II, III, etc.), is the airplane design group and relates to the wingspan (physical characteristic). The aircraft approach category and airplane design group classifications are presented in **Table 6-9.**

Table 6-9. Airport Reference Code Breakdown

Aircraft Approach Category	
Category	**Approach Speed (knots)**
A	Less than 91
B	91-120
C	121-140
D	141-165
E	166 or greater

Airplane Design Group	
Design Group	**Wingspan (feet)**
I	Less than 49
II	49 but less than 79
III	79 but less than 118
IV	118 but less than 171
V	171 but less than 214
VI	214 but less than 262

Source: FAA AC 150/5300-13, Airport Design.

According to the January 2009 Existing Airport Layout Plan dated January, 2009, the ARC for SAT is D-IV with the Boeing 767 as the critical design aircraft. However, Runway 12L-30R has an ARC of B-III.

A review of the type of aircraft currently using and expected to use SAT was performed in order to verify the critical aircraft and associated ARC. **Table 6-10** presents a summarized breakdown of the type of operations by ARC for SAT based on data obtained from the SAT ATCT for FY 2008. From the table, it is evident that the airport is utilized by a wide range of aircraft. The largest aircraft to use the airport include the MD-11 and D-10 (D-IV) and the Boeing 747 and 777 (D-V). Based upon the data, aircraft in the D-IV accounted for more than 700 annual operations in fiscal year 2008. Therefore, the Boeing 767 and ARC of D-IV presents an accurate categorization of the critical aircraft and ARC for the airport and specifically to Runways 12R-30L and 3-21. However, as Runway 12L-30R handles only general aviation operations, the GA and Air Taxi fleet mix shown in Table 6-10 substantiates an ARC of C-III for this runway as the C-III aircraft currently have more than 2,000 annual operations.

Table 6-10. Aircraft Fleet Mix and Airport Reference Code for San Antonio International Airport

	FY 2008		FY 2010		FY 2015		FY 2020		FY 2025	
Airport Reference Code	Operations	Percentage	Operations	Percentage	Operations	Percentage	Operations	Percentage	Operations	Percentage
Air Carrier										
C-II	802	0.9%	875	1.0%	1,701	1.7%	3,224	2.8%	5,814	4.5%
C-III	84,057	94.5%	82,119	93.9%	92,443	92.4%	98,681	85.7%	103,747	80.3%
C-IV	1,097	1.2%	533	0.6%	610	0.6%	587	0.5%	659	0.5%
D-III	3,381	3.8%	3,935	4.4%	5,302	6.0%	12,666	14.2%	19,380	21.8%
D-IV	2	0.0%	0	0.0%	0	0.0%	2	0.0%	2	0.0%
D-V	6	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Cargo										
C-III	1,887	29.1%	1,748	28.0%	1,249	15.6%	936	9.1%	624	4.8%
C-IV	2,878	44.4%	2,922	46.8%	3,246	40.6%	3,509	34.3%	3,777	28.8%
D-IV	705	10.9%	574	9.2%	624	7.8%	643	6.3%	656	5.0%
Commuter										
C-II	8,980	100%	8,813	100%	9,499	100%	9,973	100%	11,165	100%
Air Taxi										
A-I	3,217	14.7%	3,198	14.2%	3,186	13.2%	3,028	11.7%	2,796	10.1%
A-II	3,594	16.4%	3,567	15.9%	3,544	14.7%	3,352	13.0%	2,995	10.8%
B-I	5,020	22.9%	5,170	23.0%	5,129	21.3%	5,014	19.4%	4,417	15.9%
B-II	6,666	30.5%	6,949	30.9%	7,911	32.8%	8,811	34.1%	10,438	37.7%
B-III	82	0.4%	84	0.4%	91	0.4%	95	0.4%	104	0.4%
C-I	676	3.1%	730	3.2%	903	3.7%	1,089	4.2%	1,427	5.2%
C-II	746	3.4%	805	3.6%	997	4.1%	1,202	4.7%	1,575	5.7%
C-III	358	1.6%	386	1.7%	478	2.0%	577	2.2%	756	2.7%
D-I	704	3.2%	760	3.4%	941	3.9%	1,134	4.4%	1,486	5.4%
D-II	154	0.7%	166	0.7%	206	0.9%	248	1.0%	325	1.2%
Helicopter	657	3.0%	675	3.0%	723	3.0%	1,292	5.0%	1,385	5.0%
General Aviation										
A-I	57,073	64.7%	52,342	63.7%	54,551	62.6%	61,847	61.5%	64,687	60.4%
A-II	664	0.8%	606	0.7%	612	0.7%	676	0.7%	689	0.6%
B-I	12,131	13.8%	11,470	13.9%	11,945	13.7%	13,497	13.4%	14,121	13.2%
B-II	12,873	14.6%	12,406	15.1%	13,816	15.8%	16,686	16.6%	18,638	17.4%
B-III	163	0.2%	162	0.2%	187	0.2%	233	0.2%	268	0.2%
B-IV	38	0.0%	38	0.0%	38	0.0%	38	0.0%	38	0.0%
C-I	1,780	2.0%	1,767	2.1%	2,062	2.4%	2,584	2.6%	2,986	2.8%
C-II	1,463	1.7%	1,452	1.8%	1,694	1.9%	2,125	2.1%	2,456	2.3%
C-III	1,724	2.0%	1,712	2.1%	1,981	2.3%	2,457	2.4%	2,823	2.6%
C-IV	96	0.1%	88	0.1%	89	0.1%	97	0.1%	99	0.1%
D-II	146	0.2%	145	0.2%	169	0.2%	212	0.2%	245	0.2%
D-V	3	0.0%	3	0.0%	3	0.0%	3	0.0%	3	0.0%
Helicopter	40	0.0%	37	0.0%	39	0.0%	45	0.0%	48	0.0%
Military										
C-130	1,646	40.0%	1,646	40.0%	1,646	40.0%	1,646	40.0%	1,646	40.0%
Apache Helicopter	1,440	35.0%	1,440	35.0%	1,440	35.0%	1,440	35.0%	1,440	35.0%
C-21 Business Jet	103	2.5%	103	2.5%	103	2.5%	103	2.5%	103	2.5%
T-38 Military Jet	103	2.5%	103	2.5%	103	2.5%	103	2.5%	103	2.5%
T-34 Piston-Engine Prop	823	20.0%	823	20.0%	823	20.0%	823	20.0%	823	20.0%

Sources: SAT ATCT and PBS&J, 2009.