# GREENVILLE-SPARTANBURG INTERNATIONAL AIRPORT

2040 WINGSPAN
A VISION FOR THE FUTURE

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AIRPORT MASTER PLAN UPDATE
CHAPTER 3: AVIATION FORECASTS

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# 3. Aviation Forecasts

## 3.1. INTRODUCTION

The purpose of aviation forecasting is to outline future growth of significant areas of activity over a 20-year period at Greenville-Spartanburg International Airport (GSP or the Airport). The Federal Aviation Administration (FAA) requires that all airport planning efforts be based upon an approved forecast methodology as the resulting analysis assists in determining the facility requirements for meeting future demand.

The key elements of this chapter include:

- Forecast Influencing Factors
- Socioeconomic Trends
- Passenger Enplanements
- Air Cargo
- Aircraft Operations
- Based Aircraft
- Forecast Summary
- Future Design Aircraft
- Long Range Planning

Key metrics of the aviation forecasts and their focus at GSP include the following:

Annual Passenger Enplanements – The number of people boarding aircraft at GSP each year, which is used to identify the need for future passenger terminal area space, parking facilities, and airport access. In the dynamic commercial aviation industry forecasting passenger enplanements requires a broad view of trends and influencing factors as opposed to looking at past relationships through regression analysis. These growth-influencing factors range from socioeconomic patterns to air service analyses.

Aircraft Operations – The number of takeoffs and landings at GSP each year, which is used to determine the necessary capacity of the airfield and aircraft operating area. A takeoff and landing is each counted individually as one operation.

Based Aircraft by Type – The number and type of general aviation aircraft maintained at the airport on a permanent basis, which is used to identify the space requirements of future facilities.

Air Cargo Activity – The weight, in pounds, of air freight and air express shipments to/from GSP annually, which is used to determine the size of future cargo facilities.

General Aviation Operations – The estimated number of general aviation takeoffs and landings at GSP, which used to determine the necessary capacity of the airfield and GA support facilities.

The forecast efforts will carefully consider the uses and applications for which the forecast demand will be applied. An emphasis has been placed on activity indicators that drive facility planning such as peak hour enplanements, air cargo and general aviation demand.

## 3.2. FORECAST INFLUENCING FACTORS

The forecast analysis for the GSP master plan reflects a snapshot in time based on historical trends and industry data from the year 2017. Influencing factors presented in this section identify considerations and areas of uncertainty that provide additional context for the GSP forecast. Changing variables and guaranteed uncertainty are underlying reason for the dynamic master plan approach which includes the scenario based forecasts and Dynamic Analysis Tool that combine to enhance the utility of the forecast as the industry evolves.

### 3.2.1. Service Area

As defined in Chapter 2 – *Inventory*, the Airport Service Area (ASA) encompasses all areas within a 60-minute drive of GSP. The Airport is the only commercial service airport within the ASA with Asheville Regional (AVL), Charlotte/Douglas International (CLT), and Hartsfield – Jackson Atlanta International Airport over an hour drive away. Several general aviation (GA) airports are located near GSP that act as both reliever and public use airports.

The general aviation service area is generally defined as a 30 nautical miles (nm) ring centered on GSP. There are four airports within this area of which GSP is the sole commercial service airport. Two of the four airports have ILS services and Donaldson Field Airport (GHY) provides the next largest runway in the area at 8,000 feet.

For both commercial and general aviation, changes in facilities or activity at other airports in the service area have the potential to affect demand and activity levels at GSP both positively and negatively.

Considerations for the local economy are based on existing conditions and past performance. Analysis and speculation regarding possible future economic performance is not part of this master plan. However, any significant future changes in the local economic performance, for better or for worse, would warrant a cursory review of the forecast inputs and assumptions.

### 3.2.2. Aviation Industry

The airline industry is evolving rapidly to maintain sustained profitability as the economy continues to improve. There have been a number of airline mergers reducing overall system capacity and affecting individual market competition. These mergers have created more efficient airlines with increased load factors and profits, primarily resulting from reduced competition and unbundled products driving new ancillary revenues for things such as checked baggage and seat assignments.

The decreases in fuel price across the country have also facilitated record profits for most US airlines in 2015. As of August 2017, this trend has plateaued and airlines may be susceptible to the pressure of rising fuel costs once again. Recovery of the economy has led to steady increases in leisure and business travel while the airlines have continued slow growth in seating capacity. The net result between the economy, airline mergers and the growth of ancillary services and fees is fewer flight options nationwide, moderately higher ticket costs to the passengers, and stronger

airline profits. The bulk of the traffic growth has been occurring at large-hub airports where competition is at its greatest.

Some specific aviation industry influencers include:

*Pilot Supply* – In recent years the industry has begun to see impacts associated with a reduced number of pilots entering the aviation industry. Reduced pay, with the onset of regional jet flying in the 2000's, and regulatory changes requiring 1500 hours for first officers have added to an already increasingly expensive training process. These are compounding factors that will likely increase the severity of this issue in the coming years. Some industry groups also predict a similar shortage in qualified aircraft mechanics as well. Limited pilot supply is a contributing factor to the recent aircraft upgauging trend.

*NextGen* – For the past 10 years, the FAA has been incrementally implementing new technology with the broader goal of modernizing the nation's air traffic control system. Some of the key objectives involve improving the safety and efficiency of airspace in and around high-volume airport regions such as Atlanta, New York and Washington. These improvements may not have a noticeable impact on GSP's operational efficiency; however, it may reduce delays to hub airports and provide the opportunity for additional schedule frequencies resulting in an improved passenger experience.

*Fuel Prices* – Over the past 10 years the aviation industry has demonstrated its sensitivity to fuel prices and their impact on operational cost and ultimately aviation demand. On average, fuel represents approximately one-third of the cost of commercial aviation activity. Thus, during spikes in fuel prices like in 2008, the impacts to both supply and demand are tremendous. Advancements in fuel technology will help reduce industry sensitivity to fuel although it will likely continue to be a key influencer for activity for some time.

*Aircraft Technology* – Over the past 20 years there have been significant advances and innovations to aviation and aircraft technology. With global positioning system (GPS) technology, unmanned aerial systems (UAS) and single pilot operations for complex aircraft systems, the next 20 years will likely yield numerous additional advances in technology that could impact various airline business models. Monitoring and maintaining an awareness of technology enhancements and potential applications for GSP will help ensure the airport is always well-positioned to respond to a changing industry.

## 3.3. SOCIOECONOMIC TRENDS

This section presents social and economic factors to better understand how each, either separately or in combination with other factors, relates to and influences aviation activity. Key indicators such as population, employment, and personal income per capita were analyzed for areas identified as significant for aviation forecasting. The United States, the Southeastern United States, The State of South Carolina (SC), the GSP Catchment Area, the Greenville-Spartanburg-Anderson Economic Area, the Greenville-Spartanburg-Anderson, SC Combined Statistical Area (CSA) and The Counties of Greenville and Spartanburg were each examined as part of this forecast and are defined as follows:

- *United States of America:* United States of America

- *Southeast*: The States of Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia
- *South Carolina*: The State of South Carolina
- *The GSP Catchment Area*: The Counties of Buncombe, Burke, Cherokee, Clay, Cleveland, Graham, Haywood, Henderson, Jackson, McDowell, Macon, Madison, Mitchell, Polk, Rutherford, Swain, Transylvania, and Yancy in North Carolina, as well as Abbeville, Anderson, Cherokee, Greenville, Greenwood, Laurens, McCormick, Newberry, Oconee, Pickens, Richland, Saluda, Spartanburg, and Union Counties in South Carolina
- *The Economic Area*: Polk County, NC and Abbeville, Anderson, Cherokee, Greenville, Greenwood, Laurens, McCormick, Oconee, Pickens, Spartanburg, and Union Counties, SC as defined by the Bureau of Economic Analysis, 2007
- *CSA*: Abbeville, Anderson, Cherokee, Greenville, Greenwood, Laurens, Oconee, Pickens, Spartanburg, and Union Counties, SC
- *Greenville, SC*: The County of Greenville, SC
- *Spartanburg, SC*: The County of Spartanburg, SC

### 3.3.1. Population

Population is often a strong indicator of the potential for activity and growth at an airport as the higher the population growth, the more likely growth in operations and enplanements at an airport will be more stable. Population in the Southeast United States is forecast to increase more rapidly than the U.S. average over the next 25 years. The groupings of this and various other geographic sectors are shown in Table 3-1.

Table 3-1: Historical and Forecast Percentages of Growth in Population

| Year Range | United States | SE | South Carolina | GSP Catchment Area | Economic Area | CSA | Greenville County | Spartanburg County |
|---|---|---|---|---|---|---|---|---|
| 1969-2015 | 1.02% | 1.40% | 1.41% | 1.19% | 1.26% | 1.27% | 1.61% | 1.20% |
| 2016-2041 | 0.87% | 1.07% | 1.16% | 0.81% | 0.85% | 0.88% | 1.21% | 0.77% |

*Note: SE = Southeast*

*Source: Woods and Poole Economics, 2017*

Greenville County population growth outpaced the other sectors between the years 1969 and 2015 with an average annual growth rate of 1.61 percent. The State of Carolina came in second with an average annual growth rate of 1.41 percent, followed closely by the Southeast with 1.40 percent. The United States Population experienced the slowest average annual rate of growth of all the sectors analyzed, with an average annual growth rate (AAGR) of 1.02 percent.

The rate of growth over all the areas is anticipated to be less within the next 25 years than it previously was. Greenville County is expected to have a higher rate of average annual growth, at 1.21 percent, than all the sectors examined. South Carolina and the Southeast are also expected to continue to outperform the national average with 1.16 and 1.07 percent AAGR respectively.

### 3.3.2. Employment

Between the years of 1969 and 2015, Greenville County outperformed every other sector with an average annual growth rate in employment of 2.28 percent AAGR. This was followed by the Southeast sector with 1.94 percent AAGR and South Carolina with 1.78 percent AAGR as shown in Table 3-2. The sector with the lowest average annual rate of growth was the GSP Catchment Area at 1.54 percent AAGR, which was only marginally better than Spartanburg County with 1.55 percent AAGR in employment.

Although periodic business cycles, such as the 2008-2009 recession, have interrupted and changed the growth trajectory, the nation's employment is generally expected to rise over the next 25 years with steady job gains. The rate of growth between 2016 and 2041 is predicted to be less than that of the previous 46 years, but it is anticipated to be steady. Greenville County is forecast to continue to lead the sectors with 1.46 percent AAGR. South Carolina is projected to follow with 1.4 percent AAGR and the Southeast with 1.34 percent AAGR. The lowest performing sector is anticipated to be Spartanburg County with 1.08 percent AAGR for employment.

Table 3-2: Historical and Forecast Percentages of Total Employment

| Year Range | United States | SE | South Carolina | GSP Catchment Area | Economic Area | CSA | Greenville County | Spartanburg County |
|---|---|---|---|---|---|---|---|---|
| 1969-2015 | 1.61% | 1.94% | 1.78% | 1.54% | 1.60% | 1.61% | 2.28% | 1.55% |
| 2016-2041 | 1.22% | 1.34% | 1.40% | 1.13% | 1.17% | 1.17% | 1.46% | 1.08% |

*Note: SE = Southeast*
*Source: Woods and Poole Economics, 2017*

### 3.3.3. Per Capita Personal Income

Per capita personal income (PCPI) has also been found to be a good indicator of potential growth at an airport, as increases in income can yield a greater ability and desire to travel among the population within the area. The percentages of average annual growth in PCPI are shown for each of the sectors in Table 3-3.

Table 3-3: Historical and Forecast Total Percentages of PCPI

| Year Range | United States | SE | South Carolina | GSP Catchment Area | Economic Area | CSA | Greenville County | Spartanburg County |
|---|---|---|---|---|---|---|---|---|
| 1969-2015 | 5.59% | 5.77% | 5.83% | 5.71% | 5.64% | 5.69% | 5.74% | 5.75% |
| 2016-2041 | 4.45% | 4.50% | 4.56% | 4.39% | 4.33% | 4.37% | 4.37% | 4.35% |

*Note: SE = Southeast*
*Source: Woods and Poole Economics, 2017*

The average annual rate of growth for per capita personal income, in current dollars, were higher than those for population and employment and more closely grouped both historically and in the forecasts. Between the years 1969 and 2015, the highest rate of growth for per capita personal income was experienced by South Carolina with 5.83 percent AAGR. This was followed by the Southeast with 5.77 percent AAGR and Spartanburg County with 5.74 percent AAGR. Greenville

came in at a close fourth with 5.74 percent AAGR. The lowest average annual rate of growth in per capita personal income was experienced by the United States with an average annual rate of growth for personal income per capita of 5.59 percent AAGR.

The highest performing sector for average annual growth rate for per capita personal income between the years 2016 and 2041 is predicted to be South Carolina at 4.56 percent AAGR. The Southeast and the United States are forecast to be second and third of those sectors studied with 4.50 and 4.45 percent AAGR respectively. The sector forecast to have the lowest average annual rate of growth in per capita personal income between the years 2016 and 2014 is the Economic Area with an average of 4.33 percent AAGR growth in personal income per capita.

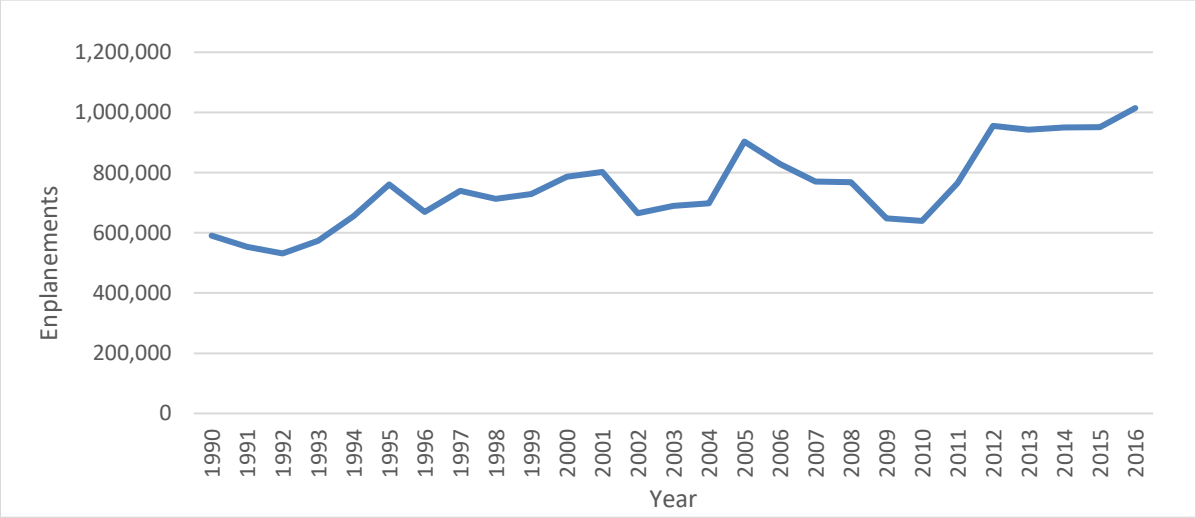
## 3.4. PASSENGER ENPLANEMENTS

Passenger enplanements are a key measure in the forecasting efforts for commercial service airports. The enplanements forecast focuses on the total annual enplanements as well as the peak hour characteristics of busier traffic periods. The results of these forecasts are particularly useful in the assessment of the passenger terminal building and associated facilities such as auto parking lots. Beyond that, the types and quantities of growth extend beyond the terminal area itself to impact elements such as roadways and transportation networks, helping to ensure that they are adequately sized for future demand.

### 3.4.1. Historical Activity

The historical data for passenger enplanements presented in **Figure 3-1** and **Table 3-4** depicts stable and consistent growth, not only over the past 10 years, but also over the past 25 years. This consistent growth in the shadow of growing airline hubs, three recessions, 9/11 and three airline mergers is a testament to the resilience of the overall GSP market.

Figure 3-1: Historical Passenger Enplanements




*Source: GSP Airport Records, 2017*

Table 3-4: Historical Passenger Enplanements

| Year | Passenger Enplanements |
|---|---|
| 1990 | 590,279 |
| 1991 | 554,026 |
| 1992 | 531,593 |
| 1993 | 573,878 |
| 1994 | 655,135 |
| 1995 | 760,918 |
| 1996 | 669,825 |
| 1997 | 739,584 |
| 1998 | 712,733 |
| 1999 | 728,735 |
| 2000 | 786,087 |
| 2001 | 802,132 |
| 2002 | 665,458 |
| 2003 | 690,038 |
| 2004 | 697,698 |
| 2005 | 903,503 |
| 2006 | 828,639 |
| 2007 | 770,406 |
| 2008 | 768,162 |
| 2009 | 648,657 |
| 2010 | 639,646 |
| 2011 | 764,626 |
| 2012 | 955,821 |
| 2013 | 942,465 |
| 2014 | 950,205 |
| 2015 | 951,148 |
| 2016 | 1,014,485 |
| 2017 | 1,074,508 |

*Source: GSP Airport Records, 2017*

### 3.4.2. Existing Forecasts

Several forecasts of activity already exist and were reviewed as part of the preliminary forecast efforts.

*FAA TAF* – The FAA Terminal Area Forecast (TAF) is a high-level forecast developed by FAA headquarters using macro-level inputs of national and regional data with the airport specific forecast being the result of broad-based forecast applications. While generally understood not to be a detailed reflection of local market demand, the TAF is considered by the FAA to be the basis from which a detailed forecast will be measured. The FAA TAF depicts a compound annual growth rate (CAGR) of 1.46% for GSP between 2016 and 2037.

*FAA Aerospace Forecast* – The National Aerospace Forecast is issued annually by the FAA and contains guidance on a variety of industry segments, including passenger traffic. This forecast projects a 1.7 percent CAGR for air carrier passengers identified in the 2017-2037 FAA Aerospace Forecast.

*2010 Terminal Area Study* – The forecasts developed as part of the *2010 GSP Terminal Area Study* were extrapolated to coincide with the forecast horizons for the master plan. Both the baseline forecast and low cost carrier (LCC) scenarios were extrapolated; it should be noted that the LCC scenario assumes nine flights via Southwest in 2017, compared to the current level of three.

The existing GSP forecasts are displayed in Table 3-5.

Table 3-5: Existing GSP Forecasts

| Year | TAF | FAA Aerospace | 2010 Terminal Study Base | 2010 Terminal Study LCC |
|---|---|---|---|---|
| Existing (2016) | 990,512 | 1,014,610 | 763,800 | 873,200 |
| 2022 | 1,077,708 | 1,122,600 | 831,800 | 1,202,002 |
| 2027 | 1,163,109 | 1,221,320 | 940,600 | 1,466,400 |
| 2037 | 1,348,414 | 1,445,570 | 1,213,600 | 1,902,000 |
| CAGR | 1.48% | 1.70% | 2.55% | 2.74% |

*Source: FAA.gov, August 2017, GSP Terminal Area Study, October 2010*

### 3.4.3. Forecast Methodologies

In addition to existing forecasts, several methodologies were explored to create additional forecasts for consideration using socioeconomic adjustments, service area dynamics and historical growth rates.

*Population Adjusted Aerospace Forecast* – The economic area for GSP has outperformed national average growth rates for population growth by approximately 24 percent. This forecast adds 24 percent to the aerospace forecasts growth rate for a CAGR of 2.61 percent.

*Peer Airport Growth* – One methodology included a review of airports similar to GSP and their historical performance and associated TAF forecasts. The analysis looked at airports with similar enplanement levels to GSP that were also within a two-hour drive of a large hub airport. Airports identified include; Birmingham, AL, Grand Rapids, MI, Harrisburg, PA and Lexington, KY. Of these airports, only Grand Rapids had higher historical growth in the 10 and 25-year periods with GSP outperforming the rest of its peers. The TAF however, identifies higher growth rates for each of the peer airports projecting GSP to underperform despite the strong track record for historical growth that GSP has experienced.

The peer average growth rate for these airports identified in the TAF is 1.91 percent CAGR; this methodology continues the overage in which GSP has outperformed peer airports relative to the peer group average TAF forecast resulting in a projected growth rate of approximately 2.26 percent CAGR.

*Market Share* – The market share forecast methodology considered GSP's position in the regional airport market relative to Asheville (AVL) and Columbia (CAE). Atlanta and Charlotte were excluded from the analysis as the passenger volumes at both of the large airports would dwarf the region thereby eliminating any statistical observations. GSP's market share is currently approximately 50.95 percent relative to AVL and CAE, increasing at a rate of 1.2 percent CAGR. The base growth for the combined three airport region uses the 1.7 percent CAGR from the FAA Aerospace Forecast. The effective resulting growth rate is 1.63 percent CAGR for GSP.

*Population Adjusted Market Share* – The population adjusted market share is similar to the previous market share methodology however, it contains a socioeconomic adjustment for population as the broader region outperforms national trends for population growth. The effective resulting growth rate is 2.58 percent CAGR for GSP.

*Historical 25 Year Growth* – This forecast methodology uses the 25-year historical compounded annual growth rate (CAGR) for GSP of 2.0 percent CAGR. This growth rate accounts for the effects of 9/11, three economic recessions and multiple airline mergers.

*Post 9/11 Growth* – This forecast methodology uses the post 9/11 historical CAGR for GSP of 2.78 percent CAGR. This growth rate accounts for the post 9/11 recession, the great recession of 2008-2010 and multiple airline mergers.

The resulting methodologies contain 2037 enplanement levels ranging from 1,423,577 to 1,805,596 with growth rates ranging from 1.63 percent CAGR to 2.78 percent CAGR as displayed in Table 3-6. These various methodologies are also consistent with the existing forecast ranges identified in the previous section.

Table 3-6: Forecast Enplanements by Methodology

| | Pop. Adj. FAA Aerospace | Peer TAF Airport Growth | Adj. TAF Peer Airport Forecast | Market Share | Pop. Adj. Mkt. Shr. | Historical 25 yr. | Historical Post 9/11 |
|---|---|---|---|---|---|---|---|
| Existing | 1,014,610 | 1,014,610 | 1,014,610 | 1,014,619 | 1,014,610 | 1,014,610 | 1,014,610 |
| 2022 | 1,184,233 | 1,123,925 | 1,160,203 | 1,105,520 | 1,176,471 | 1,142,616 | 1,196,054 |
| 2027 | 1,347,056 | 1,223,965 | 1,297,367 | 1,202,739 | 1,338,227 | 1,261,540 | 1,371,810 |
| 2037 | 1,742,941 | 1,451,552 | 1,622,261 | 1,423,577 | 1,731,517 | 1,537,810 | 1,804,596 |
| CAGR | 2.61% | 1.72% | 2.26% | 1.63% | 2.58% | 2.00% | 2.78% |

*Source: McFarland Johnson Analysis, 2017*

### 3.4.4. Air Service Analysis

Following a review of the previous forecast methodologies that involved various growth rates, an independent analysis was conducted regarding historical and projected scheduled air service levels to further inform the enplanements forecast. For this analysis, schedule data was analyzed for a peak day (Thursday) during the peak month (August) for 2007, 2012 and 2017. These peak characteristics were normalized to reflect an annual number (peaking characteristics are detailed later in the chapter).

Several industry trends were prominent in the review of air service changes over the past 10 years at GSP:

*Airline and Hub Consolidation* – In 2007, GSP was served by each of the major legacy carriers of the time including Continental, Northwest, and US Airways, each of which have since been acquired. As a result of these mergers, several airline hubs have been eliminated or scaled down, with the subsequent effect of GSP no longer having service to cities like Cincinnati, Cleveland and Memphis.

*Low Cost Airline Growth* – Low cost and less than daily service was still in its infancy in 2007 when GSP had twice-weekly service on Allegiant to two destinations in Florida. Service has since grown to additional destinations with weekly frequencies, a trend noticeable at many airports comparable to GSP. The previous 10 years has also seen the introduction of service by Southwest Airlines. Southwest expanded to several markets comparable to GSP, both organically, and also as result of their acquisition of AirTran Airways. The historical airline schedules also clearly show Southwest's shift from a network of focus cities to larger concentrations similar to that of a network airline hub, while not operating as such (no time-coordinated connections).

*Aircraft Upgauging* – From 2007 to 2017, GSP had nearly 18 percent fewer average scheduled daily departures while transporting over 35 percent more passengers. Industry wide, and especially at small and medium sized airports, regional jets and turboprops with 50 seats or less are being consolidated into larger regional aircraft. In most cases, these larger aircraft come at the expense of frequency. GSP markets that have benefitted from the larger aircraft are primarily the larger, busier airports such as Atlanta, Charlotte, Chicago and Dallas.

Historical scheduled air service activity is detailed in Table 3-7.

Table 3-7: Historical Air Service Activity

| Airline | Destination | 2007 | | 2012 | | 2017 | |
|---|---|---|---|---|---|---|---|
| | | Peak Daily | Seats | Peak Daily | Seats | Peak Daily | Seats |
| American | CLT | 8 | 387 | 8 | 374 | 8 | 478 |
| (US) | DFW | 4 | 200 | 3 | 150 | 3 | 228 |
| | ORD | 3 | 150 | | | 3 | 150 |
| | DCA | 3 | 150 | 3 | 150 | 2 | 139 |
| | PHL* | 3 | 150 | 3 | 150 | 4 | 200 |
| | LGA | 2 | 100 | | | | |
| | TOTAL | 23 | 1137 | 17 | 824 | 20 | 1195 |
| Delta | ATL | 8 | 610 | 10 | 818 | 8 | 1013 |
| (NW) | DTW | 3 | 150 | 4 | 200 | 4 | 245 |
| | CVG | 5 | 224 | 1 | 50 | | |
| | NYC* | 2 | 100 | 2 | 100 | 2 | 145 |
| | MCO | 1 | 50 | | | | |
| | MEM | 3 | 150 | | | | |
| | TOTAL | 22 | 1284 | 17 | 1168 | 14 | 1403 |
| Southwest | ATL | | | | | 3 | 429 |
| | BWI | | | 2 | 274 | | |
| | MDW | | | 2 | 280 | | |
| | HOU | | | 1 | 137 | | |
| | BNA | | | 1 | 137 | | |
| | MCO | | | 1 | 143 | | |
| | TOTAL | | | 7 | 971 | 3 | 429 |
| United | EWR* | 3 | 150 | 3 | 150 | 3 | 150 |
| (CO) | IAH | 3 | 137 | 2 | 100 | 1 | 50 |
| | IAD | 3 | 150 | 3 | 150 | 3 | 150 |
| | CLE | 2 | 100 | 1 | 50 | | |
| | ORD | 3 | 150 | 3 | 150 | 4 | 252 |
| | TOTAL | 14 | 687 | 12 | 600 | 11 | 602 |
| Allegiant | SFB | 0.3 | 45 | 0.3 | 45 | 0.3 | 53.1 |
| (AVG DLY) | PIE | 0.3 | 45 | 0.3 | 45 | 0.3 | 53.1 |
| | PGD | | | 0.15 | 22.5 | 0.15 | 26.55 |
| | FLL | | | 0.3 | 45 | 0.3 | 53.1 |
| | TOTAL | 0.6 | 90 | 1.05 | 157.5 | 1.05 | 185.85 |
| GSP TOTAL | | 59.6 | 3198 | 54.05 | 3720.5 | 49.05 | 3814.85 |
| Monthly Seats | | 1,755 | 94,181 | 1,592 | 109,569 | 1,445 | 112,347 |
| Monthly Enplanements (9.5% of Annual) | | | 72,519 | | 89,846 | | 99,989 |
| Annual TOTAL Enplanements | | 18,476 | 763,363 | 16,756 | 945,751 | 15,206 | 1,052,517 |

*Source: GSP Airport Records, McFarland Johnson Analysis, 2017*

Industry trend applications used in the future air service analysis include:

*New Airlines and Routes* – Industry consolidation has reduced the number of airlines in the domestic market, as a result GSP is served by each of the major network carriers, one low-cost carrier and one ultra-low-cost carrier (ULCC). The timing of introduction of service cannot be predicted and therefore the introduction of a new airline was excluded from this analysis, however derivative forecast scenarios will consider new entrant airline service.

Long-term it is anticipated that congested airports in New York (EWR/LGA/JFK) and Philadelphia will not see additional frequencies, with growth coming from the use of larger aircraft. While no new hubs are anticipated, there are several existing hubs and focus cities that could theoretically be supported from GSP later in the planning period such as Boston, Denver, and Miami, each of which are included in the air service enplanement analysis.

International service is not considered in the air service analysis though it is included in a derivative forecast scenario.

*Low Cost Airline Growth* – Current trends for LCCs and ULCCs are expected to continue, with additional destinations and weekly frequencies for ULCC service and new service to large focus cities for Southwest such as Baltimore, Houston and Orlando.

*Aircraft Upgauging* – Similar to the service patterns at GSP from 2007 to 2017, it is anticipated that the remaining 50-seat regional jets will be replaced by larger two-class regional jets in addition to some mainline aircraft on multiple frequencies. The air service model identifies Charlotte, Chicago and New York as having the most notable aircraft upgauges over the 20-year planning horizon.

This independent, air service based methodology produced forecast enplanements generally consistent with the previously identified methods, being slightly greater with a 2037 enplanement level of 1,870,165 and a growth rate of 3.15 percent CAGR.

Projected scheduled air service activity used in the air service forecast methodology is detailed in Table 3-8.

Table 3-8: Projected Air Service Activity

| Airline | Destination | 2022 | | 2027 | | 2037 | |
|---|---|---|---|---|---|---|---|
| | | Peak Daily | Daily Seats | Peak Daily | Daily Seats | Peak Daily | Daily Seats |
| American | CLT | 7 | 532 | 7 | 588 | 7 | 700 |
| (US) | DFW | 2 | 264 | 3 | 340 | 3 | 368 |
| | ORD | 3 | 228 | 3 | 228 | 3 | 284 |
| | DCA | 2 | 152 | 2 | 152 | 3 | 228 |
| | PHL* | 3 | 228 | 3 | 228 | 3 | 284 |
| | MIA | 1 | 50 | 1 | 76 | 1 | 76 |
| | TOTAL | 18 | 1454 | 19 | 1612 | 20 | 1940 |
| Delta | ATL | 8 | 1192 | 8 | 1280 | 8 | 1280 |
| (NW) | DTW | 4 | 304 | 4 | 338 | 4 | 372 |
| | NYC* | 2 | 152 | 2 | 186 | 2 | 220 |
| | BOS | | | 1 | 76 | 1 | 76 |
| | TOTAL | 14 | 1648 | 15 | 1880 | 15 | 1948 |
| Southwest | ATL | 4 | 572 | 4 | 572 | 4 | 572 |
| | BWI | 2 | 286 | 2 | 286 | 2 | 286 |
| | HOU | | | | | 1 | 143 |
| | MCO | | | 1 | 143 | 1 | 143 |
| | TOTAL | 6 | 858 | 7 | 1001 | 8 | 1144 |
| United | EWR* | 3 | 176 | 3 | 228 | 3 | 284 |
| (CO) | IAH | 1 | 76 | 2 | 152 | 3 | 228 |
| | IAD | 2 | 100 | 2 | 100 | 2 | 152 |
| | ORD | 4 | 252 | 4 | 304 | 4 | 304 |
| | DEN | | | | | 1 | 76 |
| | TOTAL | 10 | 604 | 11 | 784 | 13 | 1044 |
| Allegiant | SFB | 0.4 | 70.8 | 0.4 | 70.8 | 0.5 | 88.5 |
| (AVG DLY) | PIE | 0.4 | 70.8 | 0.4 | 70.8 | 0.4 | 70.8 |
| | PGD | 0.3 | 53.1 | 0.4 | 70.8 | 0.4 | 70.8 |
| | FLL | 0.3 | 53.1 | 0.3 | 53.1 | 0.4 | 70.8 |
| | VPS | 0.3 | 53.1 | 0.3 | 53.1 | 0.3 | 53.1 |
| | LAS | | | 0.3 | 53.1 | 0.3 | 53.1 |
| | TOTAL | 1.7 | 300.9 | 2.1 | 371.7 | 2.3 | 407.1 |
| Other (New or Incumbent) | | | | | | | |
| | TOTAL | 2 | 110 | 3 | 186 | 5 | 220 |
| GSP TOTAL | | 51.7 | 4974.9 | 57.1 | 5834.7 | 63.3 | 6703.1 |
| Monthly Seats | | 1,523 | 146,511 | 1,682 | 171,832 | 1,864 | 197,406 |
| Monthly Enplanements (90% Load Factor) | | | 130,395 | | 154,649 | | 177,666 |
| Annual TOTAL Deps/Enpl. | | 16,027 | 1,372,575 | 17,701 | 1,627,881 | 19,623 | 1,870,165 |

*Source: GSP Airport Records, McFarland Johnson Analysis, 2017*

### 3.4.5. Selected Forecast

The resilience of the GSP passenger market is demonstrated when comparing historical growth and socioeconomic characteristics. The market has demonstrated consistent growth in the face of strong expansion at large competitive environments at Atlanta and Charlotte, industry changing events such as 9/11, and a reduction in service by Southwest Airlines. Historically GSP has outperformed not only regional market airports and peer airports, but also national averages. The FAA TAF projects under-performance in each of these categories and as such was not selected for use in this master plan.

The sustained growth, socioeconomic-outperformance, and region-leading air service all comprise the key factors that will drive long term growth at GSP. The selected enplanement forecast for GSP is a blended average of all of the previously mentioned enplanement forecasts with a CAGR of 2.46 percent. While the air service scenario was not individually selected, it is anticipated that many of the assumptions and considerations will also be true in the selected baseline master plan forecast. Selected forecast enplanement levels are displayed in Table 3-9.

Table 3-9: Baseline Enplanement Forecast

| Year | Enplanements |
|---|---|
| Existing (2016) | 1,014,611 |
| 2022 | 1,182,700 |
| 2027 | 1,333,823 |
| 2037 | 1,648,052 |
| CAGR | 2.46% |

*Source: McFarland Johnson, September 2017*

### 3.4.6. Derivative Forecast Scenarios

The following sections outline additional derivative forecasts scenarios that have been developed to address potential market conditions that are reasonably foreseeable but not able to be specifically quantified based on service announcements or contracts. These forecast scenarios will be additive or subtractive to the selected baseline forecast and will be used for facility planning only.

*New ULCC Service –* Compared to network airlines or even LCCs, the ULCC model favors less than daily service and varying schedules. This scenario considers the introduction of a new ULCC providing an average of 10-weekly frequencies to multiple destinations on aircraft in the 150 to 175 seat range. An additional weekly frequency is added in each subsequent year of the forecast for this scenario.

*New LCC Service –* Unlike the various schedules of the ULCC model, the LCC model tends to favor large focus cities as opposed to point-to-point or hub-and-spoke models. This scenario considers the introduction of new LCC service to one or two large focus cities with an average of three daily departures on aircraft in the 100 to 120 seat range.

*New International Service* – Many medium sized airports such as Buffalo, Columbus and Providence have seen the introduction of international service over the past several years and there is potential opportunity for this trend to continue for small-hub airports such as GSP. This scenario will consider the demand and facility impacts associated with the introduction of twice weekly international service to markets such as Cancun on aircraft in the 150 to 175 seat range.

Table 3-10 displays the additional service levels of the three derivative scenarios associated with new service at GSP.

Table 3-10: New Service Derivative Scenarios

| Year | New ULCC | | New LCC | | New International | |
|---|---|---|---|---|---|---|
| | Operations | Enplanements | Operations | Enplanements | Operations | Enplanements |
| 1 | 1,040 | 74,880 | 1,976 | 83,980 | 104 | 7,488 |
| 5 | 1,456 | 104,832 | 2,080 | 89,838 | 208 | 14,976 |
| 10 | 1,976 | 142,272 | 2,184 | 97,738 | 260 | 18,720 |
| 20 | 3,016 | 217,152 | 2,288 | 115,684 | 312 | 22,464 |

*Source: McFarland Johnson, 2017*

*Market Interruption* – While long term growth is anticipated for GSP, there is a potential for a temporary market interruption due to factors unrelated to the local GSP passenger market. Examples of a market interruption include airline network changes (loss of service or bankruptcy), enhanced low-fare competition at CLT, or a 9/11-like national event. This scenario includes a 10 percent drop in passenger demand/traffic with a 5-year recovery period (2 percent annually).

The enumerative value of this impact (10%) would be directly related to the respective year in which the affect would take place.

*Enhanced Aircraft Upgauging* – While the general trend of aircraft upgauging is contained in the general assumptions of the selected baseline forecast, this scenario will consider upgauging above anticipated levels and the impacts associated with larger aircraft and reduced frequencies. This scenario displayed in Table 3-11 maintains the forecast level of enplanements, however at reduced frequencies due to larger aircraft.

Table 3-11: Enhanced Aircraft Upgauging Scenario

| Year | Change in Annual Operations |
|---|---|
| 1 | 0 |
| 5 | -2,000 |
| 10 | -4,000 |
| 20 | -10,000 |

*Source: McFarland Johnson, 2017*

### 3.4.7. Peak Hour Enplanements/Peaking Characteristics

When divided equally over the year and throughout the day, annual enplanement numbers will not accurately identify specific facility needs. To accurately identify airport requirements for facility planning, peaking characteristics are broken down into the following elements:

***Peak Month*** – The GSP passenger market is more balanced on an annual basis compared to similar sized airports. Between peak summer travel, fall leaf season, holidays and spring break, there are no dramatic peaks in activity. Airport records indicate that August is the most above average period with approximately 9.5 percent of the annual total enplanements (equal distribution equates to 8.3 percent).

***Average Day Peak Month*** – The average day of the peak month (ADPM) is the industry standard measure used in planning and analyzing an airport's peaking characteristics. In the case of GSP, August is the peak month, with July and October also being above average, therefore the peak month activity is divided by 31 days.

***Peak Hour*** – Peak hour enplanements is the critical metric when planning for passenger terminal facilities. At small and medium sized airports, the peak hour is typically associated with the morning originating activity. Flight schedule data indicates that the peak hour for GSP is around the 6 o'clock hour in the morning and represents up to 20 percent of the daily departing seats. Adjacent hours of 5am and 7am are also busy. A normal distribution of a 14-hour day (accounting for single direction of activity) is just over seven percent meaning the 20 percent peak hour for GSP reflects a notable peaking characteristic to be applied when addressing facility requirements.

Peak enplanement characteristics for GSP are displayed in **Table 3-12**.

Table 3-12: Peak Enplanement Characteristics

| | Existing | 2022 | 2027 | 2037 |
|---|---|---|---|---|
| Enplanements | 1,014,611 | 1,182,700 | 1,333,823 | 1,648,052 |
| Peak Month | 96,388 | 112,356 | 126,713 | 156,565 |
| Average Day Peak Month | 3,109 | 3,624 | 4,088 | 5,050 |
| Peak Hour | 622 | 725 | 818 | 1,010 |

*Source: McFarland Johnson, 2017*

## 3.5. AIR CARGO

While enplanements, operations and based aircraft are typically viewed as the key forecast metrics for an airport, for GSP, air cargo is another important forecast metric. The FAA TAF does not have a provision for air cargo for comparison. This forecast considers all-cargo carrier activity only and does not include airline belly cargo activity.

Air cargo activity can be measured in two forms:

***Landed Weight*** – Landed weight includes both the freight/cargo as well as the weight of the aircraft itself. The FAA uses landed weight when reporting statistics for all-cargo carriers.

***Pounds/Tonnage*** – Most airports report cargo activity in either pounds or tonnage for mail/express/freight (some report each category separately). This activity is reported as both enplaned and deplaned activity and the aircraft weight is not included in these totals.

The cargo forecast for GSP uses the total (both directions) weight for combined cargo activities (mail/express/freight) in pounds.

The network cargo carriers (UPS and FedEx) have regional processing facilities (cargo equivalent of a focus city) at nearby airports with a FedEx facility at Greensboro (GSO) and a UPS facility at Columbia (CAE). As a result, the majority of GSP cargo involves mail/express/freight destined for or originating from the local Greenville/Spartanburg area. The amount of cargo activity at GSP, despite these processing facilities at other airports, underscores the strength of the local market for air cargo.

Historical demand for air cargo has been strong with a growth rate at nearly four times the national average over the past five years. Historical landed weight and overall pounds for GSP along with growth rates is displayed in Table 3-13.

Table 3-13: Historical Cargo Demand

| Year | Landed Weight | Pounds |
|---|---|---|
| 2002 | 154,923,100 | 41,806,000 |
| 2003 | 146,468,200 | 41,747,017 |
| 2004 | 151,162,700 | 45,720,706 |
| 2005 | 158,942,800 | 45,989,732 |
| 2006 | 158,795,700 | 52,274,546 |
| 2007 | 165,788,304 | 55,414,531 |
| 2008 | 169,776,120 | 51,966,318 |
| 2009 | 133,654,250 | 38,507,819 |
| 2010 | 152,218,275 | 48,654,867 |
| 2011 | 191,294,860 | 52,991,146 |
| 2012 | 203,367,812 | 54,607,566 |
| 2013 | 213,414,150 | 56,761,250 |
| 2014 | 249,117,397 | 58,574,065 |
| 2015 | 222,392,195 | 56,575,883 |
| 2016 | 247,817,497 | 63,807,773 |
| 2017E | | 89,999,195 |
| 5 yr. (2012-2016) | 5.07% | 3.97% |
| 10 yr. (2007-2016) | 4.57% | 1.58% |
| 15 yr. (2002-2016) | 3.41% | 3.07% |

*Note: E = Estimated*

*Source: GSP Airport Records, 2017*

The current year statistics do not include the full resulting activity associated with the introduction of scheduled service by Senator Logistics Freight Forwarding, LLC (Senator), which is estimated to add over 26,000,000 pounds to the annual totals with potential for some additional service in the near term. Growth for 2017 and 2018 is expected to significantly exceed historical rates.

The methodologies reviewed for air cargo include the following:

*Historical Growth Trends* – Historical growth rates for the five, 10 and 15-year time periods were used to project future activity levels. Both the five and 15-year trends are over three percent which is over three times national averages for the same period. The 10-year growth rate is lower as this

period includes the Great Recession of 2008-2009, which had a significant impact on air cargo activities nationwide.

*FAA Aerospace Forecast* – The FAA Aerospace Forecast contains guidance for air cargo in the form of Revenue Ton Miles (RTM) projections for both domestic and international cargo. While RTMs are not the metric used in this forecast or by the Airport, the growth rate is still applicable for use. The FAA Aerospace Forecast identifies a growth rate of 1.7 percent for domestic, and 3.2 percent for international. At GSP, all of the Senator activity is between GSP and Germany and is not reflected in the historical growth rates as the service commenced in late 2016.

The FAA Aerospace Forecast applications used in this master plan include a blend of the domestic and international rates with a growth rate of 2.45 percent CAGR and also a scenario that adjusts the domestic growth for GSP's performance against the national average with an effective growth rate of 4.58 percent CAGR. A third FAA Aerospace Forecast scenario is a blend of both methodologies which is the selected air cargo forecast used as the baseline analysis for this master plan. Forecast air cargo activity (bi-directional pounds) is displayed in Table 3-14.

Table 3-14: Forecast Air Cargo Activity

| Year | Historical 5 yr | Historical 10 yr | Historical 15 yr | FAA Aero RTM | FAA Aero Adjusted | FAA Aero Blend (Selected) |
|---|---|---|---|---|---|---|
| 2016 | 63,807,773 | 63,807,773 | 63,807,773 | 63,807,773 | 63,807,773 | 63,807,773 |
| 2022 | 109,339,943 | 97,337,383 | 104,688,748 | 101,577,715 | 112,585,332 | 107,081,523 |
| 2027 | 132,837,002 | 105,273,899 | 121,775,910 | 114,645,827 | 140,839,670 | 127,742,749 |
| 2037 | 196,064,743 | 123,141,034 | 164,772,278 | 146,042,036 | 220,399,891 | 183,220,963 |
| CAGR | 5.49% | 3.18% | 4.62% | 4.02% | 6.08% | 5.15% |

*Source: GSP Airport Records, FAA Aerospace Forecast, McFarland Johnson Analysis, 2017*

While the growth rates are higher than the recent historical averages, it is important to note that they include the recent 26,000,000 pounds in additional activity associated with Senator and do not include speculative expansion proposals for the near term.

## 3.6. AIRCRAFT OPERATIONS

The FAA defines an aircraft operation as a takeoff or a landing and categorizes the operations by aircraft type and purpose. These categories include commercial (all airline operations at the passenger terminal), general aviation (both recreational and corporate), and military. The forecasting of these operations by category is used in the planning of terminal buildings, runways, taxiways and other airport infrastructure.

Growth elements affecting operations at GSP are expected to generally follow national trends related to aviation fleets. The growth rates used in the most recent FAA National Aerospace Forecast for 2017-2037 result in an operational forecast that is in close proximity to the FAA TAF. The air carrier operations totals (discussed later in this section) were also compared to the previously discussed air service scenario, with which it was highly consistent. Based on these strong consistencies with existing forecasts and independent methodologies, this master plan will use the TAF for the selected aircraft operations forecast.

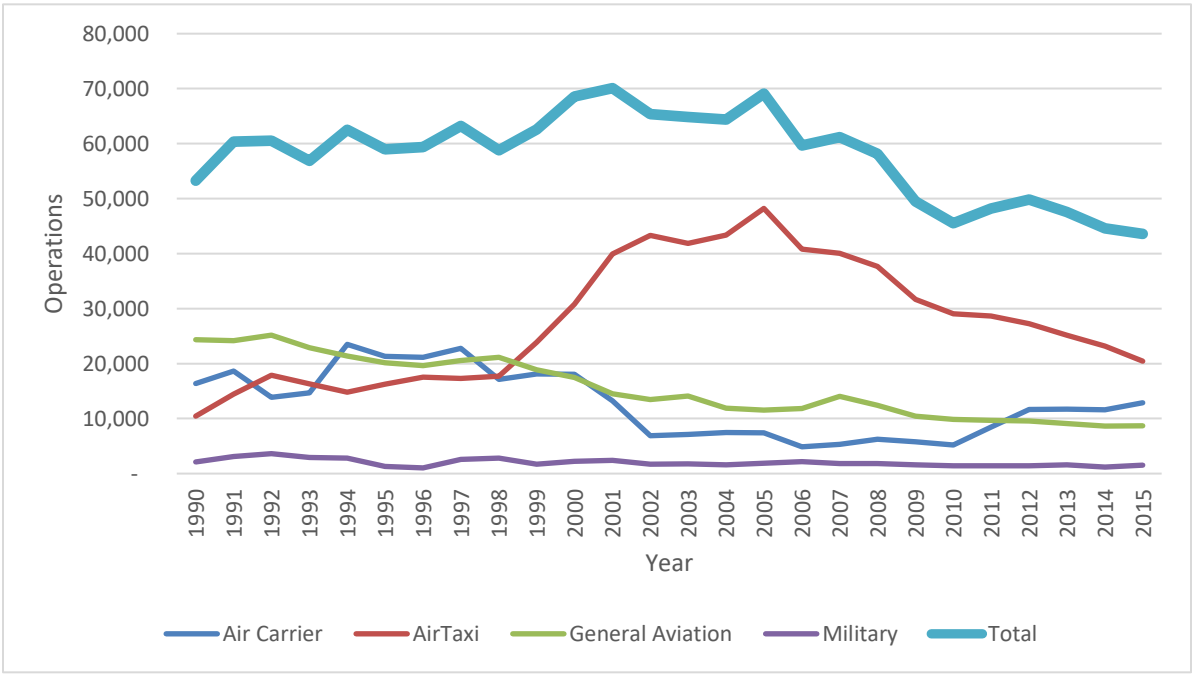
Growth in the total number of aircraft operations over the 20-year forecast period is approximately 1.23 percent CAGR.

Total general aviation operations are projected to increase at an average annual rate of 0.31 percent CAGR during the forecast period. Air taxi operations are projected to decrease at a negative average annual rate of 5.98 percent CAGR. The growth elements discussed for each operation type below include both local and airline industry factors that could impact aircraft operations at GSP.

### 3.6.1. Historical Activity

The historical data for aircraft operations, shown in **Figure 3-2** and **Table 3-15**, depicts trends for each operational type. Air carrier operations have fluctuated in the last 25 years with the initial growth of air service followed by a reduction in airlines at GSP. However, in the last 10 years, air service operations have slowly increased year over year. Air taxi operations peaked in 2005 at 48,221 and have followed a steady negative trend since. Total general aviation operations have seen a consistent decline historically, with both local and itinerant operations following negative trends, and military operations have remained consistently low over the last 25 years. Overall, the decline in total operations that has been seen historically has plateaued in recent years, with positive trends on the forecast horizon.

Figure 3-2: Historical Aircraft Operations




*Source: FAA TAF, 2017*

Table 3-15: Historical Aircraft Operations

| Year | Air Carrier | Air Taxi | General Aviation | Military | Total |
|---|---|---|---|---|---|
| 1990 | 16,356 | 10,440 | 24,357 | 2,100 | 53,253 |
| 1991 | 18,647 | 14,432 | 24,192 | 3,117 | 60,388 |
| 1992 | 13,868 | 17,899 | 25,172 | 3,622 | 60,561 |
| 1993 | 14,686 | 16,337 | 22,893 | 2,939 | 56,855 |
| 1994 | 23,497 | 14,809 | 21,398 | 2,822 | 62,526 |
| 1995 | 21,330 | 16,231 | 20,141 | 1,276 | 58,978 |
| 1996 | 21,164 | 17,532 | 19,644 | 1,031 | 59,371 |
| 1997 | 22,784 | 17,284 | 20,571 | 2,570 | 63,209 |
| 1998 | 17,136 | 17,682 | 21,157 | 2,838 | 58,813 |
| 1999 | 18,145 | 23,866 | 18,872 | 1,694 | 62,577 |
| 2000 | 18,076 | 30,783 | 17,469 | 2,213 | 68,541 |
| 2001 | 13,221 | 39,939 | 14,525 | 2,407 | 70,092 |
| 2002 | 6,902 | 43,309 | 13,469 | 1,709 | 65,389 |
| 2003 | 7,130 | 41,862 | 14,081 | 1,753 | 64,826 |
| 2004 | 7,455 | 43,379 | 11,914 | 1,611 | 64,359 |
| 2005 | 7,410 | 48,221 | 11,545 | 1,909 | 69,085 |
| 2006 | 4,868 | 40,810 | 11,829 | 2,162 | 59,669 |
| 2007 | 5,311 | 40,055 | 14,035 | 1,801 | 61,202 |
| 2008 | 6,248 | 37,689 | 12,389 | 1,834 | 58,160 |
| 2009 | 5,761 | 31,674 | 10,439 | 1,592 | 49,466 |
| 2010 | 5,187 | 29,067 | 9,862 | 1,398 | 45,514 |
| 2011 | 8,460 | 28,646 | 9,686 | 1,418 | 48,210 |
| 2012 | 11,636 | 27,260 | 9,537 | 1,402 | 49,835 |
| 2013 | 11,742 | 25,159 | 9,073 | 1,609 | 47,583 |
| 2014 | 11,599 | 23,197 | 8,633 | 1,176 | 44,605 |
| 2015 | 12,892 | 20,440 | 8,708 | 1,544 | 43,584 |

*Source: FAA TAF, 2017*

### 3.6.2. Growth Elements

*Air Carrier/Taxi* – Industry consolidation has reduced the number of airlines and hubs resulting in fewer nonstop routes than what were once available in the market. New airlines and new markets could be introduced over time, however the timing of introduction of service cannot be predicted and therefore the introduction of a new airline was excluded from this analysis. However, derivative forecast scenarios will consider activity from new airlines.

Trends for LCCs and ULCCs are expected to continue into the future, with additional destinations and weekly frequencies for ULCC service and new service to large focus cities for Southwest such as Baltimore, Houston and Orlando.

Similar to the service patterns at GSP from 2007 to 2017, it is anticipated that the remaining 50-seat regional jets will be replaced by larger two-class regional jets in addition to some mainline

aircraft used to replace multiple frequencies. Larger aircraft in place of greater frequency will maintain or even boost enplanements however it will slow overall operational growth.

*General Aviation* – At the time of this analysis, the airport has recently become the owner and operator of the FBO at the airport. For many years, general aviation has been only a minor presence on the airfield and with the new management structure, the overall goal is to enhance the general aviation presence at GSP. Presently there are only several months of data which are not sufficient in number to analyze and formulate reliable trends. A review of general aviation activity at GSP relative to industry trends should occur at a later time once multiple years of data are available. The facility requirements and alternatives chapters of this master plan will identify and reserve facilities for enhanced general aviation growth based on GSP's mission and goals for FBO growth.

*Military* – The growth of military operations is largely dependent on the security interests of the nation. Military aircraft are constantly relocated throughout the aviation system. Threats to the United States and disaster relief efforts may impact the amount of military operations at and around the Airport.

### 3.6.3. Air Carrier and Air Taxi

Air Carrier operations are those conducted by aircraft with 60 or greater passenger seats. Air Taxi operations include regional and commuter activity and commercial applications within general aviation such as Part 135 charter activity. Historically, the air taxi category has made facility planning difficult because it includes both airline and general aviation operations, however with the rapid retirement in 50-seat regional jet and smaller, nearly all airline operations in future years will be classified as air carrier. This transition between the two categories is reflected in the FAA TAF. As a result, the remaining Air Taxi operations will be considered as part of general aviation in facility planning.

Before endorsing the TAF operations forecast for the master plan, the air carrier operations were compared with the air service forecast methodology presented previously. The air service scenario depicts approximately 39,246 airline operations, while the TAF depicts 41,066 by 2037, a difference of 1,820 which equates to less than three departures per day.

### 3.6.4. General Aviation Operations

Annual itinerant aircraft operations, those flights originating or terminating 50 miles or greater from GSP, declined by 14.89 percent annually between 2011 and 2016. Itinerant GA operations are forecasted to slightly increase over the next 20 years. Though GSP's historic trend of GA itinerant operations has followed a negative growth rate, 2017 marked a return to positive growth, increasing operations of this type by 0.32 percent CAGR. It is expected from this point forward that itinerant GA operations at GSP will grow in line with the national forecast outlined in the TAF.

Defined as operations originating or terminating within 50 miles of GSP including traffic pattern operation, local GA activity has seen variations in growth over the last 10 years. Local GA operations at GSP are projected to show zero growth which is line with the FAA TAF.

### 3.6.5. Military Operations

With constant changes in national security and relief needs, military operations tend to fluctuate over time. At GSP, local and itinerant military operations have followed this characteristic trend over the last 10 years. In 2016, total military operations stabilized at 2,483 total and it is forecasted that GSP will maintain this plateau of operations for the next 20 years. The FAA TAF reports zero growth in military operations at GSP. However, it is anticipated that occasional local and itinerant military operations will occur as they have in the past with the C-130 conducting the majority of these.

Table 3-16 shows the forecasted annual operations by type.

Table 3-16: Annual Operations Forecast by Type

| Year | Air Carrier | Air Taxi | General Aviation | | | Military | | | Total Ops. |
|---|---|---|---|---|---|---|---|---|---|
| | | | Itinerant | Local | Total | Itinerant | Local | Total | |
| 2017 | 20,242 | 14,071 | 7,171 | 350 | 7,521 | 1,715 | 768 | 2,483 | 44,317 |
| 2022 | 32,491 | 3,957 | 7,281 | 350 | 7,631 | 1,715 | 768 | 2,483 | 46,562 |
| 2027 | 35,445 | 3,808 | 7,393 | 350 | 7,743 | 1,715 | 768 | 2,483 | 49,479 |
| 2037 | 41,066 | 4,363 | 7,623 | 350 | 7,973 | 1,715 | 768 | 2,483 | 55,885 |
| CAGR | 3.79% | -5.98% | 0.32% | 0.00% | 0.31% | 0.00% | 0.00% | 0.00% | 1.23% |

*Source: FAA Terminal Area Forecast, 2017*

### 3.6.6. Aircraft Fleet Mix

As eluded to previously in Section 3.2, both commercial and general aviation aircraft are getting progressively more fuel efficient with improved engines and aerodynamic design. Engine technology will yield quieter, more fuel-efficient engines, while aircraft design may slightly change the aircraft shape, primarily in the form of increased wingspans. Table 3-17 contains a representative sample of the existing and anticipated future fleet mix for GSP. It is important to note that aircraft not yet in the market place, such as a large passenger turboprop or a new generation of regional jets is not reflected as they are not in the current manufacturer marketplace but have the potential to exist inside the 20-year horizon.

Table 3-17: Aircraft Fleet Mix

| Category | Existing (2017) | Future (2037) |
|---|---|---|
| Commercial Service (Air Carrier) | Embraer 145 | Embraer 175 |
| | Bombardier CRJ-900 | C-Series CS 110/130 |
| | McDonnell Douglas MD-88 | Boeing 737 Max-8 |
| | Boeing 767-300F (Cargo) | Boeing 747-8F (Cargo) |
| | 61.6% | 73.5% |
| General Aviation Itinerant (Including Air Taxi) | Falcon 2000 LXS | Pilatus PC-12 |
| | Cessna Citation 525 | Embraer Phenom 300 |
| | Beech Baron | Dassault Falcon 5X |
| | Hawker 850 | Gulfstream G500 |
| | 32% | 21.5% |
| General Aviation Local | Cessna 208 Caravan | Beech Super King Air 350 |
| | Cessna Skyhawk (172) | Diamond DA-42 |
| | 0.8% | 0.6% |
| Other | C-130 (Military) | C-130J (Military) |
| | 5.6%% | 4.4% |

*Source: McFarland Johnson, 2017*

### 3.6.7. Peaking Characteristics – Aircraft Operations

Like the peaking characteristics used for passenger enplanements, annual operations numbers when divided equally over the year and throughout the day will not accurately identify capacity constraints or facility needs during busier periods. To accurately identify airport requirements for facility planning, peaking characteristics are broken down into the following elements:

***Peak Month*** – The GSP passenger market is more balanced on an annual basis compared to similar sized airports. Like passenger enplanements, there is no significant peak in activity on an annual basis for commercial activity. With general aviation factored in for the overall airport operational counts, recreational activity is elevated in the summer and fall months. A review of air traffic records resulted in a peak month of approximately 9.4 percent, for consistency purposes, the same peak month metric of 9.5 percent will be used for operations (equal distribution equates to 8.3 percent).

***Average Day Peak Month*** – The average day of the peak month (ADPM) is the industry standard measure used when planning and analyzing the airport's peaking characteristics. In the case of GSP, August is the peak month, with July and October also being above average, therefore the peak month activity is divided by 31 days.

***Peak Hour*** – Peak hour operations is a critical metric when planning for airfield capacity. Traditionally the operational peak hour typically represents between 12 percent and 17 percent of the daily operations total. The busiest hour based on existing (October 2017) flight schedules is 13 operations (arrivals and departures) and airline operations account for 80% of total operations. The resulting 16 existing peak hour operations represents 12 percent of the daily total,

which is within the generally accepted planning range and will be applied to future year peak hour levels.

Peak operational characteristics for GSP are displayed in Table 3-18.

Table 3-18: Peak Hour Operations

| | Existing | 2022 | 2027 | 2037 |
|---|---|---|---|---|
| Operations | 44,632 | 46,562 | 49,479 | 55,885 |
| Peak Month | 4,240 | 4,423 | 4,701 | 5,309 |
| Average Day Peak Month | 137 | 143 | 152 | 171 |
| Peak Hour | 16 | 17 | 19 | 21 |

*Source: McFarland Johnson, 2017*

## 3.7. BASED AIRCRAFT

Forecasting the number and type of based aircraft is critical to planning future GA facilities, especially for the type and size of hangars and aircraft movement and parking areas. The growth elements below discuss the factors that influence the number of based aircraft at GSP

### 3.7.1 Growth Elements

As with operations, growth elements effecting based aircraft at GSP are expected to generally follow national trends related to general aviation fleets. The growth rates used in this forecast represent those in the most recent FAA Aerospace Forecast for 2017 to 2037. As shown in Table 3-19, piston aircraft are forecasted to follow a negative growth rate over the next 20 years while turbine aircraft will grow positively throughout the planning period. This trend is consistent with previous statements regarding fuel efficiency and aircraft technologies.

***Piston*** – Locally, there are multiple general aviation airports that provide FBO services within GSP's ASA. Donaldson Field, Greenville Downtown, and Spartanburg Downtown Memorial Airport are each within a 30-minute drive of the Airport and totaled 329 based aircraft in 2015. The appeal and availability of GA-specific airports negatively impacts the number of based piston engine aircraft at GSP. Nationally, as the economic advantage of aircraft leasing, renting and fractional ownership becomes more popular, the number of newly purchased piston engine aircraft is decreasing in most regions. It is forecast that GSP will follow a negative trend for single and multi-engine based aircraft at a rate of -0.9 percent CAGR and -0.5 percent CAGR respectively.

***Turbine*** – As the full owner and operator of the FBO, GSP has elevated the services available to based and transient aircraft. With this, and the national forecast for based turbine aircraft following a positive trend, it is forecasted that turbo propeller and turbo jet aircraft will increase at a rate of 2.3 percent CAGR and 1.9 percent CAGR throughout the planning period.

Table 3-19: Based Aircraft Forecast

| Year | Piston | | | Turbine | | | Total Based Aircraft |
|---|---|---|---|---|---|---|---|
| | Single | Multi | Total | Turbo Prop | Turbo Jet | Total | |
| 2017 | 5 | 6 | 11 | 4 | 11 | 15 | 26 |
| 2022 | 5 | 6 | 11 | 4 | 13 | 17 | 28 |
| 2027 | 4 | 6 | 10 | 5 | 14 | 19 | 29 |
| 2037 | 4 | 6 | 10 | 5 | 16 | 21 | 31 |
| CAGR | -0.9% | -0.5% | -0.8% | 1.4% | 2.3% | 1.9% | 1.1% |

*Source: FAA National Aerospace Forecast 2017-2037*

## 3.8. FORECAST SUMMARY

Table 3-20 presents a summary of the aviation demand forecasts developed for GSP. These forecasts are considered reasonable and achievable and will be used throughout the Master Plan Update in the development of facility requirements and the identification of alternatives.

Table 3-20 Aviation Demand Forecast Summary

| | FORECAST | | | |
|---|---|---|---|---|
| | Existing | 2022 | 2027 | 2037 |
| **Enplanements** | | | | |
| Air Carriers | 1,014,611 | 1,182,700 | 1,333,823 | 1,648,052 |
| Peak Hour | 622 | 725 | 818 | 1,010 |
| **Aircraft Operations** | | | | |
| Air Carrier/Airline | 20,242 | 32,491 | 35,445 | 41,066 |
| Peak Hour | 21 | 22 | 23 | 27 |
| General Aviation | | | | |
| GA Itinerant* | 7,171 | 11,238 | 11,201 | 11,986 |
| GA Local | 350 | 350 | 350 | 350 |
| Military | 2,483 | 2,483 | 2,483 | 2,483 |
| **Based Aircraft** | | | | |
| Single | 5 | 5 | 4 | 4 |
| Multi | 6 | 6 | 6 | 6 |
| Turbo Prop | 4 | 4 | 5 | 5 |
| Turbo Jet | 11 | 13 | 14 | 16 |

*Note: GA Itinerant Operations include air taxi*

*Source: McFarland Johnson 2017*

### 3.8.1. Comparison with FAA Terminal Area Forecast

To confirm validity, master plan aviation forecasts are often compared with other aviation forecasts prepared for the airport and the region. Ideally, this report's forecasts should be reasonably consistent with other forecasts of future airport activity, and compatible with forecasts for the larger region. With master plan forecasts being much more specific to the airport, it is not

unusual to see some variation from national forecasts. The most useful forecasts for comparison are those prepared by the FAA with the standard being the TAF and the national and regional forecasts previously referenced in this report. The TAF is prepared annually and includes airport forecasts for all active NPIAS airports. **Table 3-21** shows the compared results between the selected forecast and that of the FAA's TAF.

The comparison shows that the results of the Master Plan forecast are within the allowed tolerances permitted by the FAA (10 percent within 5 years; 15 percent within 10 years) and is considered reasonable for planning purposes. Facility improvements associated with passenger enplanements may want to consider construction in advance of the forecast years to avoid temporary facilities required from a short-term spike in demand.

Table 3-21: Aviation Demand Forecast vs. FAA Terminal Area Forecast

| | ACTUAL | FORECAST | | | |
|---|---|---|---|---|---|
| | 2016 | 2017 | 2022 | 2037 | Growth |
| **FAA TAF (2016)** | | | | | |
| Enplanements | 987,307 | 983,978 | 1,077,708 | 1,348,414 | 1.48% |
| Total Operations | 47,315 | 44,317 | 46,562 | 55,885 | 1.23% |
| **Master Plan Forecast** | | | | | |
| Enplanements | 987,307 | 1,014,611 | 1,182,700 | 1,648,052 | 2.46% |
| Total Operations | 47,315 | 44,317 | 46,562 | 55,885 | 1.23% |
| **Pct. Difference From TAF** | | | | | |
| Enplanements | 0.00% | 3.11% | 9.74% | 22.22% | - |
| Total Operations | 0.00% | 0.00% | 0.00% | 0.00% | - |

*Source: McFarland Johnson, 2017*

## 3.9. FUTURE DESIGN AIRCRAFT

The Runway Design Code (RDC) used in airport planning is derived from the features of the most demanding aircraft using the airport on a regular basis coupled with the best available instrument approach minimums. The first component, depicted by a letter, is the Aircraft Approach Category (AAC) and relates to aircraft approach speed (operational characteristics). The second component, depicted by a Roman numeral, is the Airplane Design Group (ADG) and relates to either the aircraft wingspan or tail height (physical characteristics), whichever is most restrictive. The third component relates to the visibility minimums expressed by Runway Visual Range (RVR) values. **Table 3-22** displays the RDC criteria used in airport planning.

The Boeing 767-300F combined with the similar Airbus A300-600F currently meet the critical aircraft requirement of a minimum of 500 annual itinerant operations at GSP and are classified as a D-IV aircraft. However, as cargo and air carrier traffic increases, the critical aircraft is forecast to change in the intermediate future and again in the distant future. The Boeing 747-400F, classified as D-V, is currently operating 200 to 300 operations per year at GSP and is forecast to become the design aircraft in the next five to 10 years. In the distant future, the Boeing 747-8F is anticipated to replace the Boeing 747-400F as the critical aircraft for the airport and will require D-VI design standards. **Table 3-23** presents the design details for each of these aircraft.

Table 3-22: FAA Airport Reference Code

| FAA Airport Reference Code Parameters | | | | |
|---|---|---|---|---|
| Category | Approach Speed | Group No. | Wing Span (ft.) | Tail Height (ft.) |
| | (knots) | I | < 49 | < 20 |
| A | <91 | II | 49 to < 79 | 20 to < 30 |
| B | 91 to < 121 | III | 79 to < 118 | 30 to < 45 |
| C | 121 to < 141 | IV | 118 to < 171 | 45 to < 60 |
| D | 141 to < 166 | V | 171 to < 214 | 60 to < 66 |
| E | 166 or more | VI | 214 to < 262 | 66 to < 80 |

*Source: FAA AC 150/5300-13A*

Table 3-23: Future Design Aircraft

| | Future Design Aircraft | | |
|---|---|---|---|
| Aircraft Model | B767-300F | B747-400 | B747-8F |
| Length Overall | 180 ft. | 232 | 250 |
| Wingspan | 156 ft. | 213 | 224 |
| Tail Height | 53 ft. | 64 | 63 |
| Main Gear Width | 30 ft. 6 in. | 36 ft. 1 in. | 36 ft. 1 in. |
| Cockpit to Main Gear | 64 ft. 7 in. | 84 ft. 0 in. | 97 ft. 4 in. |
| Maximum Takeoff Weight | 412,000 lbs. | 875,000 lbs. | 987,000 lbs. |
| Typical Approach Speed | 145 kts. | 158 kts. | 159 kts. |
| Approach Speed Category | D | D | D |
| Aircraft Design Group | IV | V | VI |

*Source: FAA AC 150/5300-13A*

## 3.10. LONG RANGE PLANNING

The project development process (planning, environmental, design and construction) for large scale airport improvements can often take in excess of 10 years meaning that the planning process begins long before the project objectives are necessary. While many uncertainties exist beyond the 20-year planning period, forecast results were developed for the 2045, 2055 and 2065 planning-year horizons. Facility requirements and alternatives will identify potential facility land development needs to ensure that short term development does not impede long term facility needs. Table 3-24 contains the forecast highlights for the beyond planning period horizons.

Table 3-24: Long Range Planning Forecast

| | Enplanements | Air Cargo (pounds) | Operations | Based Aircraft |
|---|---|---|---|---|
| 2045 | 2,153,123 | 302,738,694 | 63,895 | 35 |
| 2055 | 2,745,443 | 500,219,598 | 72,203 | 39 |
| 2065 | 3,500,708 | 826,520,202 | 81,592 | 44 |

*Source: McFarland Johnson, 2017*

# 3. Aviation Forecasts

## 3.1. INTRODUCTION

The purpose of aviation forecasting is to outline future growth of significant areas of activity over a 20-year period at Greenville-Spartanburg International Airport (GSP or the Airport). The Federal Aviation Administration (FAA) requires that all airport planning efforts be based upon an approved forecast methodology as the resulting analysis assists in determining the facility requirements for meeting future demand.

The key elements of this chapter include:

- Forecast Influencing Factors
- Socioeconomic Trends
- Passenger Enplanements
- Air Cargo
- Aircraft Operations
- Based Aircraft
- Forecast Summary
- Future Design Aircraft
- Long Range Planning

Key metrics of the aviation forecasts and their focus at GSP include the following:

Annual Passenger Enplanements – The number of people boarding aircraft at GSP each year, which is used to identify the need for future passenger terminal area space, parking facilities, and airport access. In the dynamic commercial aviation industry forecasting passenger enplanements requires a broad view of trends and influencing factors as opposed to looking at past relationships through regression analysis. These growth-influencing factors range from socioeconomic patterns to air service analyses.

Aircraft Operations – The number of takeoffs and landings at GSP each year, which is used to determine the necessary capacity of the airfield and aircraft operating area. A takeoff and landing is each counted individually as one operation.

Based Aircraft by Type – The number and type of general aviation aircraft maintained at the airport on a permanent basis, which is used to identify the space requirements of future facilities.

Air Cargo Activity – The weight, in pounds, of air freight and air express shipments to/from GSP annually, which is used to determine the size of future cargo facilities.

General Aviation Operations – The estimated number of general aviation takeoffs and landings at GSP, which used to determine the necessary capacity of the airfield and GA support facilities.

The forecast efforts will carefully consider the uses and applications for which the forecast demand will be applied. An emphasis has been placed on activity indicators that drive facility planning such as peak hour enplanements, air cargo and general aviation demand.

## 3.2. FORECAST INFLUENCING FACTORS

The forecast analysis for the GSP master plan reflects a snapshot in time based on historical trends and industry data from the year 2017. Influencing factors presented in this section identify considerations and areas of uncertainty that provide additional context for the GSP forecast. Changing variables and guaranteed uncertainty are underlying reason for the dynamic master plan approach which includes the scenario based forecasts and Dynamic Analysis Tool that combine to enhance the utility of the forecast as the industry evolves.

### 3.2.1. Service Area

As defined in Chapter 2 – *Inventory*, the Airport Service Area (ASA) encompasses all areas within a 60-minute drive of GSP. The Airport is the only commercial service airport within the ASA with Asheville Regional (AVL), Charlotte/Douglas International (CLT), and Hartsfield – Jackson Atlanta International Airport over an hour drive away. Several general aviation (GA) airports are located near GSP that act as both reliever and public use airports.

The general aviation service area is generally defined as a 30 nautical miles (nm) ring centered on GSP. There are four airports within this area of which GSP is the sole commercial service airport. Two of the four airports have ILS services and Donaldson Field Airport (GHY) provides the next largest runway in the area at 8,000 feet.

For both commercial and general aviation, changes in facilities or activity at other airports in the service area have the potential to affect demand and activity levels at GSP both positively and negatively.

Considerations for the local economy are based on existing conditions and past performance. Analysis and speculation regarding possible future economic performance is not part of this master plan. However, any significant future changes in the local economic performance, for better or for worse, would warrant a cursory review of the forecast inputs and assumptions.

### 3.2.2. Aviation Industry

The airline industry is evolving rapidly to maintain sustained profitability as the economy continues to improve. There have been a number of airline mergers reducing overall system capacity and affecting individual market competition. These mergers have created more efficient airlines with increased load factors and profits, primarily resulting from reduced competition and unbundled products driving new ancillary revenues for things such as checked baggage and seat assignments.

The decreases in fuel price across the country have also facilitated record profits for most US airlines in 2015. As of August 2017, this trend has plateaued and airlines may be susceptible to the pressure of rising fuel costs once again. Recovery of the economy has led to steady increases in leisure and business travel while the airlines have continued slow growth in seating capacity. The net result between the economy, airline mergers and the growth of ancillary services and fees is fewer flight options nationwide, moderately higher ticket costs to the passengers, and stronger

airline profits. The bulk of the traffic growth has been occurring at large-hub airports where competition is at its greatest.

Some specific aviation industry influencers include:

*Pilot Supply* – In recent years the industry has begun to see impacts associated with a reduced number of pilots entering the aviation industry. Reduced pay, with the onset of regional jet flying in the 2000's, and regulatory changes requiring 1500 hours for first officers have added to an already increasingly expensive training process. These are compounding factors that will likely increase the severity of this issue in the coming years. Some industry groups also predict a similar shortage in qualified aircraft mechanics as well. Limited pilot supply is a contributing factor to the recent aircraft upgauging trend.

*NextGen* – For the past 10 years, the FAA has been incrementally implementing new technology with the broader goal of modernizing the nation's air traffic control system. Some of the key objectives involve improving the safety and efficiency of airspace in and around high-volume airport regions such as Atlanta, New York and Washington. These improvements may not have a noticeable impact on GSP's operational efficiency; however, it may reduce delays to hub airports and provide the opportunity for additional schedule frequencies resulting in an improved passenger experience.

*Fuel Prices* – Over the past 10 years the aviation industry has demonstrated its sensitivity to fuel prices and their impact on operational cost and ultimately aviation demand. On average, fuel represents approximately one-third of the cost of commercial aviation activity. Thus, during spikes in fuel prices like in 2008, the impacts to both supply and demand are tremendous. Advancements in fuel technology will help reduce industry sensitivity to fuel although it will likely continue to be a key influencer for activity for some time.

*Aircraft Technology* – Over the past 20 years there have been significant advances and innovations to aviation and aircraft technology. With global positioning system (GPS) technology, unmanned aerial systems (UAS) and single pilot operations for complex aircraft systems, the next 20 years will likely yield numerous additional advances in technology that could impact various airline business models. Monitoring and maintaining an awareness of technology enhancements and potential applications for GSP will help ensure the airport is always well-positioned to respond to a changing industry.

## 3.3. SOCIOECONOMIC TRENDS

This section presents social and economic factors to better understand how each, either separately or in combination with other factors, relates to and influences aviation activity. Key indicators such as population, employment, and personal income per capita were analyzed for areas identified as significant for aviation forecasting. The United States, the Southeastern United States, The State of South Carolina (SC), the GSP Catchment Area, the Greenville-Spartanburg-Anderson Economic Area, the Greenville-Spartanburg-Anderson, SC Combined Statistical Area (CSA) and The Counties of Greenville and Spartanburg were each examined as part of this forecast and are defined as follows:

- *United States of America:* United States of America

- *Southeast*: The States of Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia
- *South Carolina*: The State of South Carolina
- *The GSP Catchment Area*: The Counties of Buncombe, Burke, Cherokee, Clay, Cleveland, Graham, Haywood, Henderson, Jackson, McDowell, Macon, Madison, Mitchell, Polk, Rutherford, Swain, Transylvania, and Yancy in North Carolina, as well as Abbeville, Anderson, Cherokee, Greenville, Greenwood, Laurens, McCormick, Newberry, Oconee, Pickens, Richland, Saluda, Spartanburg, and Union Counties in South Carolina
- *The Economic Area*: Polk County, NC and Abbeville, Anderson, Cherokee, Greenville, Greenwood, Laurens, McCormick, Oconee, Pickens, Spartanburg, and Union Counties, SC as defined by the Bureau of Economic Analysis, 2007
- *CSA*: Abbeville, Anderson, Cherokee, Greenville, Greenwood, Laurens, Oconee, Pickens, Spartanburg, and Union Counties, SC
- *Greenville, SC*: The County of Greenville, SC
- *Spartanburg, SC*: The County of Spartanburg, SC

### 3.3.1. Population

Population is often a strong indicator of the potential for activity and growth at an airport as the higher the population growth, the more likely growth in operations and enplanements at an airport will be more stable. Population in the Southeast United States is forecast to increase more rapidly than the U.S. average over the next 25 years. The groupings of this and various other geographic sectors are shown in Table 3-1.

Table 3-1: Historical and Forecast Percentages of Growth in Population

| Year Range | United States | SE | South Carolina | GSP Catchment Area | Economic Area | CSA | Greenville County | Spartanburg County |
|---|---|---|---|---|---|---|---|---|
| 1969-2015 | 1.02% | 1.40% | 1.41% | 1.19% | 1.26% | 1.27% | 1.61% | 1.20% |
| 2016-2041 | 0.87% | 1.07% | 1.16% | 0.81% | 0.85% | 0.88% | 1.21% | 0.77% |

*Note: SE = Southeast*

*Source: Woods and Poole Economics, 2017*

Greenville County population growth outpaced the other sectors between the years 1969 and 2015 with an average annual growth rate of 1.61 percent. The State of Carolina came in second with an average annual growth rate of 1.41 percent, followed closely by the Southeast with 1.40 percent. The United States Population experienced the slowest average annual rate of growth of all the sectors analyzed, with an average annual growth rate (AAGR) of 1.02 percent.

The rate of growth over all the areas is anticipated to be less within the next 25 years than it previously was. Greenville County is expected to have a higher rate of average annual growth, at 1.21 percent, than all the sectors examined. South Carolina and the Southeast are also expected to continue to outperform the national average with 1.16 and 1.07 percent AAGR respectively.

### 3.3.2. Employment

Between the years of 1969 and 2015, Greenville County outperformed every other sector with an average annual growth rate in employment of 2.28 percent AAGR. This was followed by the Southeast sector with 1.94 percent AAGR and South Carolina with 1.78 percent AAGR as shown in Table 3-2. The sector with the lowest average annual rate of growth was the GSP Catchment Area at 1.54 percent AAGR, which was only marginally better than Spartanburg County with 1.55 percent AAGR in employment.

Although periodic business cycles, such as the 2008-2009 recession, have interrupted and changed the growth trajectory, the nation's employment is generally expected to rise over the next 25 years with steady job gains. The rate of growth between 2016 and 2041 is predicted to be less than that of the previous 46 years, but it is anticipated to be steady. Greenville County is forecast to continue to lead the sectors with 1.46 percent AAGR. South Carolina is projected to follow with 1.4 percent AAGR and the Southeast with 1.34 percent AAGR. The lowest performing sector is anticipated to be Spartanburg County with 1.08 percent AAGR for employment.

Table 3-2: Historical and Forecast Percentages of Total Employment

| Year Range | United States | SE | South Carolina | GSP Catchment Area | Economic Area | CSA | Greenville County | Spartanburg County |
|---|---|---|---|---|---|---|---|---|
| 1969-2015 | 1.61% | 1.94% | 1.78% | 1.54% | 1.60% | 1.61% | 2.28% | 1.55% |
| 2016-2041 | 1.22% | 1.34% | 1.40% | 1.13% | 1.17% | 1.17% | 1.46% | 1.08% |

*Note: SE = Southeast*
*Source: Woods and Poole Economics, 2017*

### 3.3.3. Per Capita Personal Income

Per capita personal income (PCPI) has also been found to be a good indicator of potential growth at an airport, as increases in income can yield a greater ability and desire to travel among the population within the area. The percentages of average annual growth in PCPI are shown for each of the sectors in Table 3-3.

Table 3-3: Historical and Forecast Total Percentages of PCPI

| Year Range | United States | SE | South Carolina | GSP Catchment Area | Economic Area | CSA | Greenville County | Spartanburg County |
|---|---|---|---|---|---|---|---|---|
| 1969-2015 | 5.59% | 5.77% | 5.83% | 5.71% | 5.64% | 5.69% | 5.74% | 5.75% |
| 2016-2041 | 4.45% | 4.50% | 4.56% | 4.39% | 4.33% | 4.37% | 4.37% | 4.35% |

*Note: SE = Southeast*
*Source: Woods and Poole Economics, 2017*

The average annual rate of growth for per capita personal income, in current dollars, were higher than those for population and employment and more closely grouped both historically and in the forecasts. Between the years 1969 and 2015, the highest rate of growth for per capita personal income was experienced by South Carolina with 5.83 percent AAGR. This was followed by the Southeast with 5.77 percent AAGR and Spartanburg County with 5.74 percent AAGR. Greenville

came in at a close fourth with 5.74 percent AAGR. The lowest average annual rate of growth in per capita personal income was experienced by the United States with an average annual rate of growth for personal income per capita of 5.59 percent AAGR.

The highest performing sector for average annual growth rate for per capita personal income between the years 2016 and 2041 is predicted to be South Carolina at 4.56 percent AAGR. The Southeast and the United States are forecast to be second and third of those sectors studied with 4.50 and 4.45 percent AAGR respectively. The sector forecast to have the lowest average annual rate of growth in per capita personal income between the years 2016 and 2014 is the Economic Area with an average of 4.33 percent AAGR growth in personal income per capita.

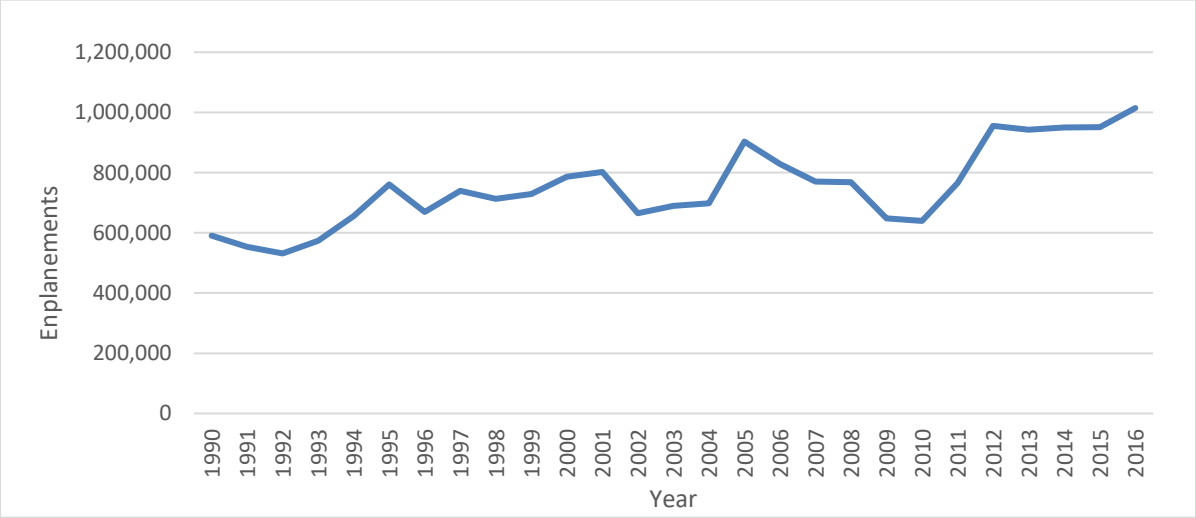
## 3.4. PASSENGER ENPLANEMENTS

Passenger enplanements are a key measure in the forecasting efforts for commercial service airports. The enplanements forecast focuses on the total annual enplanements as well as the peak hour characteristics of busier traffic periods. The results of these forecasts are particularly useful in the assessment of the passenger terminal building and associated facilities such as auto parking lots. Beyond that, the types and quantities of growth extend beyond the terminal area itself to impact elements such as roadways and transportation networks, helping to ensure that they are adequately sized for future demand.

### 3.4.1. Historical Activity

The historical data for passenger enplanements presented in **Figure 3-1** and **Table 3-4** depicts stable and consistent growth, not only over the past 10 years, but also over the past 25 years. This consistent growth in the shadow of growing airline hubs, three recessions, 9/11 and three airline mergers is a testament to the resilience of the overall GSP market.

Figure 3-1: Historical Passenger Enplanements




*Source: GSP Airport Records, 2017*

Table 3-4: Historical Passenger Enplanements

| Year | Passenger Enplanements |
|---|---|
| 1990 | 590,279 |
| 1991 | 554,026 |
| 1992 | 531,593 |
| 1993 | 573,878 |
| 1994 | 655,135 |
| 1995 | 760,918 |
| 1996 | 669,825 |
| 1997 | 739,584 |
| 1998 | 712,733 |
| 1999 | 728,735 |
| 2000 | 786,087 |
| 2001 | 802,132 |
| 2002 | 665,458 |
| 2003 | 690,038 |
| 2004 | 697,698 |
| 2005 | 903,503 |
| 2006 | 828,639 |
| 2007 | 770,406 |
| 2008 | 768,162 |
| 2009 | 648,657 |
| 2010 | 639,646 |
| 2011 | 764,626 |
| 2012 | 955,821 |
| 2013 | 942,465 |
| 2014 | 950,205 |
| 2015 | 951,148 |

*Source: GSP Airport Records, 2017*

### 3.4.2. Existing Forecasts

Several forecasts of activity already exist and were reviewed as part of the preliminary forecast efforts.

***FAA TAF*** – The FAA Terminal Area Forecast (TAF) is a high-level forecast developed by FAA headquarters using macro-level inputs of national and regional data with the airport specific forecast being the result of broad-based forecast applications. While generally understood not to be a detailed reflection of local market demand, the TAF is considered by the FAA to be the basis from which a detailed forecast will be measured. The FAA TAF depicts a compound annual growth rate (CAGR) of 1.46% for GSP between 2016 and 2037.

*FAA Aerospace Forecast* – The National Aerospace Forecast is issued annually by the FAA and contains guidance on a variety of industry segments, including passenger traffic. This forecast projects a 1.7 percent CAGR for air carrier passengers identified in the 2017-2037 FAA Aerospace Forecast.

*2010 Terminal Area Study* – The forecasts developed as part of the *2010 GSP Terminal Area Study* were extrapolated to coincide with the forecast horizons for the master plan. Both the baseline forecast and low cost carrier (LCC) scenarios were extrapolated; it should be noted that the LCC scenario assumes nine flights via Southwest in 2017, compared to the current level of three.

The existing GSP forecasts are displayed in Table 3-5.

Table 3-5: Existing GSP Forecasts

| Year | TAF | FAA Aerospace | 2010 Terminal Study Base | 2010 Terminal Study LCC |
|---|---|---|---|---|
| Existing (2016) | 990,512 | 1,014,610 | 763,800 | 873,200 |
| 2022 | 1,077,708 | 1,122,600 | 831,800 | 1,202,002 |
| 2027 | 1,163,109 | 1,221,320 | 940,600 | 1,466,400 |
| 2037 | 1,348,414 | 1,445,570 | 1,213,600 | 1,902,000 |
| CAGR | 1.48% | 1.70% | 2.55% | 2.74% |

*Source: FAA.gov, August 2017, GSP Terminal Area Study, October 2010*

### 3.4.3. Forecast Methodologies

In addition to existing forecasts, several methodologies were explored to create additional forecasts for consideration using socioeconomic adjustments, service area dynamics and historical growth rates.

*Population Adjusted Aerospace Forecast* – The economic area for GSP has outperformed national average growth rates for population growth by approximately 24 percent. This forecast adds 24 percent to the aerospace forecasts growth rate for a CAGR of 2.61 percent.

*Peer Airport Growth* – One methodology included a review of airports similar to GSP and their historical performance and associated TAF forecasts. The analysis looked at airports with similar enplanement levels to GSP that were also within a two-hour drive of a large hub airport. Airports identified include; Birmingham, AL, Grand Rapids, MI, Harrisburg, PA and Lexington, KY. Of these airports, only Grand Rapids had higher historical growth in the 10 and 25-year periods with GSP outperforming the rest of its peers. The TAF however, identifies higher growth rates for each of the peer airports projecting GSP to underperform despite the strong track record for historical growth that GSP has experienced.

The peer average growth rate for these airports identified in the TAF is 1.91 percent CAGR; this methodology continues the overage in which GSP has outperformed peer airports relative to the peer group average TAF forecast resulting in a projected growth rate of approximately 2.26 percent CAGR.

*Market Share* – The market share forecast methodology considered GSP's position in the regional airport market relative to Asheville (AVL) and Columbia (CAE). Atlanta and Charlotte were excluded from the analysis as the passenger volumes at both of the large airports would dwarf the region thereby eliminating any statistical observations. GSP's market share is currently approximately 50.95 percent relative to AVL and CAE, increasing at a rate of 1.2 percent CAGR. The base growth for the combined three airport region uses the 1.7 percent CAGR from the FAA Aerospace Forecast. The effective resulting growth rate is 1.63 percent CAGR for GSP.

*Population Adjusted Market Share* – The population adjusted market share is similar to the previous market share methodology however, it contains a socioeconomic adjustment for population as the broader region outperforms national trends for population growth. The effective resulting growth rate is 2.58 percent CAGR for GSP.

*Historical 25 Year Growth* – This forecast methodology uses the 25-year historical compounded annual growth rate (CAGR) for GSP of 2.0 percent CAGR. This growth rate accounts for the effects of 9/11, three economic recessions and multiple airline mergers.

*Post 9/11 Growth* – This forecast methodology uses the post 9/11 historical CAGR for GSP of 2.78 percent CAGR. This growth rate accounts for the post 9/11 recession, the great recession of 2008-2010 and multiple airline mergers.

The resulting methodologies contain 2037 enplanement levels ranging from 1,423,577 to 1,805,596 with growth rates ranging from 1.63 percent CAGR to 2.78 percent CAGR as displayed in Table 3-6. These various methodologies are also consistent with the existing forecast ranges identified in the previous section.

Table 3-6: Forecast Enplanements by Methodology

| | Pop. Adj. FAA Aerospace | Peer TAF Airport Growth | Adj. TAF Peer Airport Forecast | Market Share | Pop. Adj. Mkt. Shr. | Historical 25 yr. | Historical Post 9/11 |
|---|---|---|---|---|---|---|---|
| Existing | 1,014,610 | 1,014,610 | 1,014,610 | 1,014,619 | 1,014,610 | 1,014,610 | 1,014,610 |
| 2022 | 1,184,233 | 1,123,925 | 1,160,203 | 1,105,520 | 1,176,471 | 1,142,616 | 1,196,054 |
| 2027 | 1,347,056 | 1,223,965 | 1,297,367 | 1,202,739 | 1,338,227 | 1,261,540 | 1,371,810 |
| 2037 | 1,742,941 | 1,451,552 | 1,622,261 | 1,423,577 | 1,731,517 | 1,537,810 | 1,804,596 |
| CAGR | 2.61% | 1.72% | 2.26% | 1.63% | 2.58% | 2.00% | 2.78% |

*Source: McFarland Johnson Analysis, 2017*

### 3.4.4. Air Service Analysis

Following a review of the previous forecast methodologies that involved various growth rates, an independent analysis was conducted regarding historical and projected scheduled air service levels to further inform the enplanements forecast. For this analysis, schedule data was analyzed for a peak day (Thursday) during the peak month (August) for 2007, 2012 and 2017. These peak characteristics were normalized to reflect an annual number (peaking characteristics are detailed later in the chapter).

Several industry trends were prominent in the review of air service changes over the past 10 years at GSP:

*Airline and Hub Consolidation* – In 2007, GSP was served by each of the major legacy carriers of the time including Continental, Northwest, and US Airways, each of which have since been acquired. As a result of these mergers, several airline hubs have been eliminated or scaled down, with the subsequent effect of GSP no longer having service to cities like Cincinnati, Cleveland and Memphis.

*Low Cost Airline Growth* – Low cost and less than daily service was still in its infancy in 2007 when GSP had twice-weekly service on Allegiant to two destinations in Florida. Service has since grown to additional destinations with weekly frequencies, a trend noticeable at many airports comparable to GSP. The previous 10 years has also seen the introduction of service by Southwest Airlines. Southwest expanded to several markets comparable to GSP, both organically, and also as result of their acquisition of AirTran Airways. The historical airline schedules also clearly show Southwest's shift from a network of focus cities to larger concentrations similar to that of a network airline hub, while not operating as such (no time-coordinated connections).

*Aircraft Upgauging* – From 2007 to 2017, GSP had nearly 18 percent fewer average scheduled daily departures while transporting over 35 percent more passengers. Industry wide, and especially at small and medium sized airports, regional jets and turboprops with 50 seats or less are being consolidated into larger regional aircraft. In most cases, these larger aircraft come at the expense of frequency. GSP markets that have benefitted from the larger aircraft are primarily the larger, busier airports such as Atlanta, Charlotte, Chicago and Dallas.

Historical scheduled air service activity is detailed in Table 3-7.

Table 3-7: Historical Air Service Activity

| Airline | Destination | 2007 | | 2012 | | 2017 | |
|---|---|---|---|---|---|---|---|
| | | Peak Daily | Seats | Peak Daily | Seats | Peak Daily | Seats |
| American | CLT | 8 | 387 | 8 | 374 | 8 | 478 |
| (US) | DFW | 4 | 200 | 3 | 150 | 3 | 228 |
| | ORD | 3 | 150 | | | 3 | 150 |
| | DCA | 3 | 150 | 3 | 150 | 2 | 139 |
| | PHL* | 3 | 150 | 3 | 150 | 4 | 200 |
| | LGA | 2 | 100 | | | | |
| | TOTAL | 23 | 1137 | 17 | 824 | 20 | 1195 |
| Delta | ATL | 8 | 610 | 10 | 818 | 8 | 1013 |
| (NW) | DTW | 3 | 150 | 4 | 200 | 4 | 245 |
| | CVG | 5 | 224 | 1 | 50 | | |
| | NYC* | 2 | 100 | 2 | 100 | 2 | 145 |
| | MCO | 1 | 50 | | | | |
| | MEM | 3 | 150 | | | | |
| | TOTAL | 22 | 1284 | 17 | 1168 | 14 | 1403 |
| Southwest | ATL | | | | | 3 | 429 |
| | BWI | | | 2 | 274 | | |
| | MDW | | | 2 | 280 | | |
| | HOU | | | 1 | 137 | | |
| | BNA | | | 1 | 137 | | |
| | MCO | | | 1 | 143 | | |
| | TOTAL | | | 7 | 971 | 3 | 429 |
| United | EWR* | 3 | 150 | 3 | 150 | 3 | 150 |
| (CO) | IAH | 3 | 137 | 2 | 100 | 1 | 50 |
| | IAD | 3 | 150 | 3 | 150 | 3 | 150 |
| | CLE | 2 | 100 | 1 | 50 | | |
| | ORD | 3 | 150 | 3 | 150 | 4 | 252 |
| | TOTAL | 14 | 687 | 12 | 600 | 11 | 602 |
| Allegiant | SFB | 0.3 | 45 | 0.3 | 45 | 0.3 | 53.1 |
| (AVG DLY) | PIE | 0.3 | 45 | 0.3 | 45 | 0.3 | 53.1 |
| | PGD | | | 0.15 | 22.5 | 0.15 | 26.55 |
| | FLL | | | 0.3 | 45 | 0.3 | 53.1 |
| | TOTAL | 0.6 | 90 | 1.05 | 157.5 | 1.05 | 185.85 |
| GSP TOTAL | | 59.6 | 3198 | 54.05 | 3720.5 | 49.05 | 3814.85 |
| Monthly Seats | | 1,755 | 94,181 | 1,592 | 109,569 | 1,445 | 112,347 |
| Monthly Enplanements (9.5% of Annual) | | | 72,519 | | 89,846 | | 99,989 |
| Annual TOTAL Enplanements | | 18,476 | 763,363 | 16,756 | 945,751 | 15,206 | 1,052,517 |

*Source: GSP Airport Records, McFarland Johnson Analysis, 2017*

Industry trend applications used in the future air service analysis include:

*New Airlines and Routes* – Industry consolidation has reduced the number of airlines in the domestic market, as a result GSP is served by each of the major network carriers, one low-cost carrier and one ultra-low-cost carrier (ULCC). The timing of introduction of service cannot be predicted and therefore the introduction of a new airline was excluded from this analysis, however derivative forecast scenarios will consider new entrant airline service.

Long-term it is anticipated that congested airports in New York (EWR/LGA/JFK) and Philadelphia will not see additional frequencies, with growth coming from the use of larger aircraft. While no new hubs are anticipated, there are several existing hubs and focus cities that could theoretically be supported from GSP later in the planning period such as Boston, Denver, and Miami, each of which are included in the air service enplanement analysis.

International service is not considered in the air service analysis though it is included in a derivative forecast scenario.

*Low Cost Airline Growth* – Current trends for LCCs and ULCCs are expected to continue, with additional destinations and weekly frequencies for ULCC service and new service to large focus cities for Southwest such as Baltimore, Houston and Orlando.

*Aircraft Upgauging* – Similar to the service patterns at GSP from 2007 to 2017, it is anticipated that the remaining 50-seat regional jets will be replaced by larger two-class regional jets in addition to some mainline aircraft on multiple frequencies. The air service model identifies Charlotte, Chicago and New York as having the most notable aircraft upgauges over the 20-year planning horizon.

This independent, air service based methodology produced forecast enplanements generally consistent with the previously identified methods, being slightly greater with a 2037 enplanement level of 1,870,165 and a growth rate of 3.15 percent CAGR.

Projected scheduled air service activity used in the air service forecast methodology is detailed in Table 3-8.

Table 3-8: Projected Air Service Activity

| Airline | Destination | 2022 | | 2027 | | 2037 | |
|---|---|---|---|---|---|---|---|
| | | Peak Daily | Daily Seats | Peak Daily | Daily Seats | Peak Daily | Daily Seats |
| American | CLT | 7 | 532 | 7 | 588 | 7 | 700 |
| (US) | DFW | 2 | 264 | 3 | 340 | 3 | 368 |
| | ORD | 3 | 228 | 3 | 228 | 3 | 284 |
| | DCA | 2 | 152 | 2 | 152 | 3 | 228 |
| | PHL* | 3 | 228 | 3 | 228 | 3 | 284 |
| | MIA | 1 | 50 | 1 | 76 | 1 | 76 |
| | TOTAL | 18 | 1454 | 19 | 1612 | 20 | 1940 |
| Delta | ATL | 8 | 1192 | 8 | 1280 | 8 | 1280 |
| (NW) | DTW | 4 | 304 | 4 | 338 | 4 | 372 |
| | NYC* | 2 | 152 | 2 | 186 | 2 | 220 |
| | BOS | | | 1 | 76 | 1 | 76 |
| | TOTAL | 14 | 1648 | 15 | 1880 | 15 | 1948 |
| Southwest | ATL | 4 | 572 | 4 | 572 | 4 | 572 |
| | BWI | 2 | 286 | 2 | 286 | 2 | 286 |
| | HOU | | | | | 1 | 143 |
| | MCO | | | 1 | 143 | 1 | 143 |
| | TOTAL | 6 | 858 | 7 | 1001 | 8 | 1144 |
| United | EWR* | 3 | 176 | 3 | 228 | 3 | 284 |
| (CO) | IAH | 1 | 76 | 2 | 152 | 3 | 228 |
| | IAD | 2 | 100 | 2 | 100 | 2 | 152 |
| | ORD | 4 | 252 | 4 | 304 | 4 | 304 |
| | DEN | | | | | 1 | 76 |
| | TOTAL | 10 | 604 | 11 | 784 | 13 | 1044 |
| Allegiant | SFB | 0.4 | 70.8 | 0.4 | 70.8 | 0.5 | 88.5 |
| (AVG DLY) | PIE | 0.4 | 70.8 | 0.4 | 70.8 | 0.4 | 70.8 |
| | PGD | 0.3 | 53.1 | 0.4 | 70.8 | 0.4 | 70.8 |
| | FLL | 0.3 | 53.1 | 0.3 | 53.1 | 0.4 | 70.8 |
| | VPS | 0.3 | 53.1 | 0.3 | 53.1 | 0.3 | 53.1 |
| | LAS | | | 0.3 | 53.1 | 0.3 | 53.1 |
| | TOTAL | 1.7 | 300.9 | 2.1 | 371.7 | 2.3 | 407.1 |
| Other (New or Incumbent) | | | | | | | |
| | TOTAL | 2 | 110 | 3 | 186 | 5 | 220 |
| GSP TOTAL | | 51.7 | 4974.9 | 57.1 | 5834.7 | 63.3 | 6703.1 |
| Monthly Seats | | 1,523 | 146,511 | 1,682 | 171,832 | 1,864 | 197,406 |
| Monthly Enplanements (90% Load Factor) | | | 130,395 | | 154,649 | | 177,666 |
| Annual TOTAL Deps/Enpl. | | 16,027 | 1,372,575 | 17,701 | 1,627,881 | 19,623 | 1,870,165 |

*Source: GSP Airport Records, McFarland Johnson Analysis, 2017*

### 3.4.5. Selected Forecast

The resilience of the GSP passenger market is demonstrated when comparing historical growth and socioeconomic characteristics. The market has demonstrated consistent growth in the face of strong expansion at large competitive environments at Atlanta and Charlotte, industry changing events such as 9/11, and a reduction in service by Southwest Airlines. Historically GSP has outperformed not only regional market airports and peer airports, but also national averages. The FAA TAF projects under-performance in each of these categories and as such was not selected for use in this master plan.

The sustained growth, socioeconomic-outperformance, and region-leading air service all comprise the key factors that will drive long term growth at GSP. The selected enplanement forecast for GSP is a blended average of all of the previously mentioned enplanement forecasts with a CAGR of 2.46 percent. While the air service scenario was not individually selected, it is anticipated that many of the assumptions and considerations will also be true in the selected baseline master plan forecast. Selected forecast enplanement levels are displayed in Table 3-9.

Table 3-9: Baseline Enplanement Forecast

| Year | Enplanements |
|---|---|
| Existing | 1,014,611 |
| 2022 | 1,182,700 |
| 2027 | 1,333,823 |
| 2037 | 1,648,052 |
| CAGR | 2.46% |

*Source: McFarland Johnson, September 2017*

### 3.4.6. Derivative Forecast Scenarios

The following sections outline additional derivative forecasts scenarios that have been developed to address potential market conditions that are reasonably foreseeable but not able to be specifically quantified based on service announcements or contracts. These forecast scenarios will be additive or subtractive to the selected baseline forecast and will be used for facility planning only.

*New ULCC Service –* Compared to network airlines or even LCCs, the ULCC model favors less than daily service and varying schedules. This scenario considers the introduction of a new ULCC providing an average of 10-weekly frequencies to multiple destinations on aircraft in the 150 to 175 seat range. An additional weekly frequency is added in each subsequent year of the forecast for this scenario.

*New LCC Service –* Unlike the various schedules of the ULCC model, the LCC model tends to favor large focus cities as opposed to point-to-point or hub-and-spoke models. This scenario considers the introduction of new LCC service to one or two large focus cities with an average of three daily departures on aircraft in the 100 to 120 seat range.

*New International Service* – Many medium sized airports such as Buffalo, Columbus and Providence have seen the introduction of international service over the past several years and there is potential opportunity for this trend to continue for small-hub airports such as GSP. This scenario will consider the demand and facility impacts associated with the introduction of twice weekly international service to markets such as Cancun on aircraft in the 150 to 175 seat range.

Table 3-10 displays the additional service levels of the three derivative scenarios associated with new service at GSP.

Table 3-10: New Service Derivative Scenarios

| Year | New ULCC | | New LCC | | New International | |
|---|---|---|---|---|---|---|
| | Operations | Enplanements | Operations | Enplanements | Operations | Enplanements |
| 1 | 1,040 | 74,880 | 1,976 | 83,980 | 104 | 7,488 |
| 5 | 1,456 | 104,832 | 2,080 | 89,838 | 208 | 14,976 |
| 10 | 1,976 | 142,272 | 2,184 | 97,738 | 260 | 18,720 |
| 20 | 3,016 | 217,152 | 2,288 | 115,684 | 312 | 22,464 |

*Source: McFarland Johnson, 2017*

*Market Interruption* – While long term growth is anticipated for GSP, there is a potential for a temporary market interruption due to factors unrelated to the local GSP passenger market. Examples of a market interruption include airline network changes (loss of service or bankruptcy), enhanced low-fare competition at CLT, or a 9/11-like national event. This scenario includes a 10 percent drop in passenger demand/traffic with a 5-year recovery period (2 percent annually).

The enumerative value of this impact (10%) would be directly related to the respective year in which the affect would take place.

*Enhanced Aircraft Upgauging* – While the general trend of aircraft upgauging is contained in the general assumptions of the selected baseline forecast, this scenario will consider upgauging above anticipated levels and the impacts associated with larger aircraft and reduced frequencies. This scenario displayed in Table 3-11 maintains the forecast level of enplanements, however at reduced frequencies due to larger aircraft.

Table 3-11: Enhanced Aircraft Upgauging Scenario

| Year | Change in Annual Operations |
|---|---|
| 1 | 0 |
| 5 | -2,000 |
| 10 | -4,000 |
| 20 | -10,000 |

*Source: McFarland Johnson, 2017*

### 3.4.7. Peak Hour Enplanements/Peaking Characteristics

When divided equally over the year and throughout the day, annual enplanement numbers will not accurately identify specific facility needs. To accurately identify airport requirements for facility planning, peaking characteristics are broken down into the following elements:

***Peak Month*** – The GSP passenger market is more balanced on an annual basis compared to similar sized airports. Between peak summer travel, fall leaf season, holidays and spring break, there are no dramatic peaks in activity. Airport records indicate that August is the most above average period with approximately 9.5 percent of the annual total enplanements (equal distribution equates to 8.3 percent).

***Average Day Peak Month*** – The average day of the peak month (ADPM) is the industry standard measure used in planning and analyzing an airport's peaking characteristics. In the case of GSP, August is the peak month, with July and October also being above average, therefore the peak month activity is divided by 31 days.

***Peak Hour*** – Peak hour enplanements is the critical metric when planning for passenger terminal facilities. At small and medium sized airports, the peak hour is typically associated with the morning originating activity. Flight schedule data indicates that the peak hour for GSP is around the 6 o'clock hour in the morning and represents up to 20 percent of the daily departing seats. Adjacent hours of 5am and 7am are also busy. A normal distribution of a 14-hour day (accounting for single direction of activity) is just over seven percent meaning the 20 percent peak hour for GSP reflects a notable peaking characteristic to be applied when addressing facility requirements.

Peak enplanement characteristics for GSP are displayed in **Table 3-12**.

Table 3-12: Peak Enplanement Characteristics

| | Existing | 2022 | 2027 | 2037 |
|---|---|---|---|---|
| Enplanements | 1,014,611 | 1,182,700 | 1,333,823 | 1,648,052 |
| Peak Month | 96,388 | 112,356 | 126,713 | 156,565 |
| Average Day Peak Month | 3,109 | 3,624 | 4,088 | 5,050 |
| Peak Hour | 622 | 725 | 818 | 1,010 |

*Source: McFarland Johnson, 2017*

## 3.5. AIR CARGO

While enplanements, operations and based aircraft are typically viewed as the key forecast metrics for an airport, for GSP, air cargo is another important forecast metric. The FAA TAF does not have a provision for air cargo for comparison. This forecast considers all-cargo carrier activity only and does not include airline belly cargo activity.

Air cargo activity can be measured in two forms:

***Landed Weight*** – Landed weight includes both the freight/cargo as well as the weight of the aircraft itself. The FAA uses landed weight when reporting statistics for all-cargo carriers.

***Pounds/Tonnage*** – Most airports report cargo activity in either pounds or tonnage for mail/express/freight (some report each category separately). This activity is reported as both enplaned and deplaned activity and the aircraft weight is not included in these totals.

The cargo forecast for GSP uses the total (both directions) weight for combined cargo activities (mail/express/freight) in pounds.

The network cargo carriers (UPS and FedEx) have regional processing facilities (cargo equivalent of a focus city) at nearby airports with a FedEx facility at Greensboro (GSO) and a UPS facility at Columbia (CAE). As a result, the majority of GSP cargo involves mail/express/freight destined for or originating from the local Greenville/Spartanburg area. The amount of cargo activity at GSP, despite these processing facilities at other airports, underscores the strength of the local market for air cargo.

Historical demand for air cargo has been strong with a growth rate at nearly four times the national average over the past five years. Historical landed weight and overall pounds for GSP along with growth rates is displayed in Table 3-13.

Table 3-13: Historical Cargo Demand

| Year | Landed Weight | Pounds |
|---|---|---|
| 2002 | 154,923,100 | 41,806,000 |
| 2003 | 146,468,200 | 41,747,017 |
| 2004 | 151,162,700 | 45,720,706 |
| 2005 | 158,942,800 | 45,989,732 |
| 2006 | 158,795,700 | 52,274,546 |
| 2007 | 165,788,304 | 55,414,531 |
| 2008 | 169,776,120 | 51,966,318 |
| 2009 | 133,654,250 | 38,507,819 |
| 2010 | 152,218,275 | 48,654,867 |
| 2011 | 191,294,860 | 52,991,146 |
| 2012 | 203,367,812 | 54,607,566 |
| 2013 | 213,414,150 | 56,761,250 |
| 2014 | 249,117,397 | 58,574,065 |
| 2015 | 222,392,195 | 56,575,883 |
| 2016 | 247,817,497 | 63,807,773 |
| 2017E | | 89,999,195 |
| 5 yr. (2012-2016) | 5.07% | 3.97% |
| 10 yr. (2007-2016) | 4.57% | 1.58% |
| 15 yr. (2002-2016) | 3.41% | 3.07% |

*Note: E = Estimated*

*Source: GSP Airport Records, 2017*

The current year statistics do not include the full resulting activity associated with the introduction of scheduled service by Senator Logistics Freight Forwarding, LLC (Senator), which is estimated to add over 26,000,000 pounds to the annual totals with potential for some additional service in the near term. Growth for 2017 and 2018 is expected to significantly exceed historical rates.

The methodologies reviewed for air cargo include the following:

*Historical Growth Trends* – Historical growth rates for the five, 10 and 15-year time periods were used to project future activity levels. Both the five and 15-year trends are over three percent which is over three times national averages for the same period. The 10-year growth rate is lower as this

period includes the Great Recession of 2008-2009, which had a significant impact on air cargo activities nationwide.

*FAA Aerospace Forecast* – The FAA Aerospace Forecast contains guidance for air cargo in the form of Revenue Ton Miles (RTM) projections for both domestic and international cargo. While RTMs are not the metric used in this forecast or by the Airport, the growth rate is still applicable for use. The FAA Aerospace Forecast identifies a growth rate of 1.7 percent for domestic, and 3.2 percent for international. At GSP, all of the Senator activity is between GSP and Germany and is not reflected in the historical growth rates as the service commenced in late 2016.

The FAA Aerospace Forecast applications used in this master plan include a blend of the domestic and international rates with a growth rate of 2.45 percent CAGR and also a scenario that adjusts the domestic growth for GSP's performance against the national average with an effective growth rate of 4.58 percent CAGR. A third FAA Aerospace Forecast scenario is a blend of both methodologies which is the selected air cargo forecast used as the baseline analysis for this master plan. Forecast air cargo activity (bi-directional pounds) is displayed in Table 3-14.

Table 3-14: Forecast Air Cargo Activity

| Year | Historical 5 yr | Historical 10 yr | Historical 15 yr | FAA Aero RTM | FAA Aero Adjusted | FAA Aero Blend (Selected) |
|---|---|---|---|---|---|---|
| 2016 | 63,807,773 | 63,807,773 | 63,807,773 | 63,807,773 | 63,807,773 | 63,807,773 |
| 2022 | 109,339,943 | 97,337,383 | 104,688,748 | 101,577,715 | 112,585,332 | 107,081,523 |
| 2027 | 132,837,002 | 105,273,899 | 121,775,910 | 114,645,827 | 140,839,670 | 127,742,749 |
| 2037 | 196,064,743 | 123,141,034 | 164,772,278 | 146,042,036 | 220,399,891 | 183,220,963 |
| CAGR | 5.49% | 3.18% | 4.62% | 4.02% | 6.08% | 5.15% |

*Source: GSP Airport Records, FAA Aerospace Forecast, McFarland Johnson Analysis, 2017*

While the growth rates are higher than the recent historical averages, it is important to note that they include the recent 26,000,000 pounds in additional activity associated with Senator and do not include speculative expansion proposals for the near term.

## 3.6. AIRCRAFT OPERATIONS

The FAA defines an aircraft operation as a takeoff or a landing and categorizes the operations by aircraft type and purpose. These categories include commercial (all airline operations at the passenger terminal), general aviation (both recreational and corporate), and military. The forecasting of these operations by category is used in the planning of terminal buildings, runways, taxiways and other airport infrastructure.

Growth elements affecting operations at GSP are expected to generally follow national trends related to aviation fleets. The growth rates used in the most recent FAA National Aerospace Forecast for 2017-2037 result in an operational forecast that is in close proximity to the FAA TAF. The air carrier operations totals (discussed later in this section) were also compared to the previously discussed air service scenario, with which it was highly consistent. Based on these strong consistencies with existing forecasts and independent methodologies, this master plan will use the TAF for the selected aircraft operations forecast.

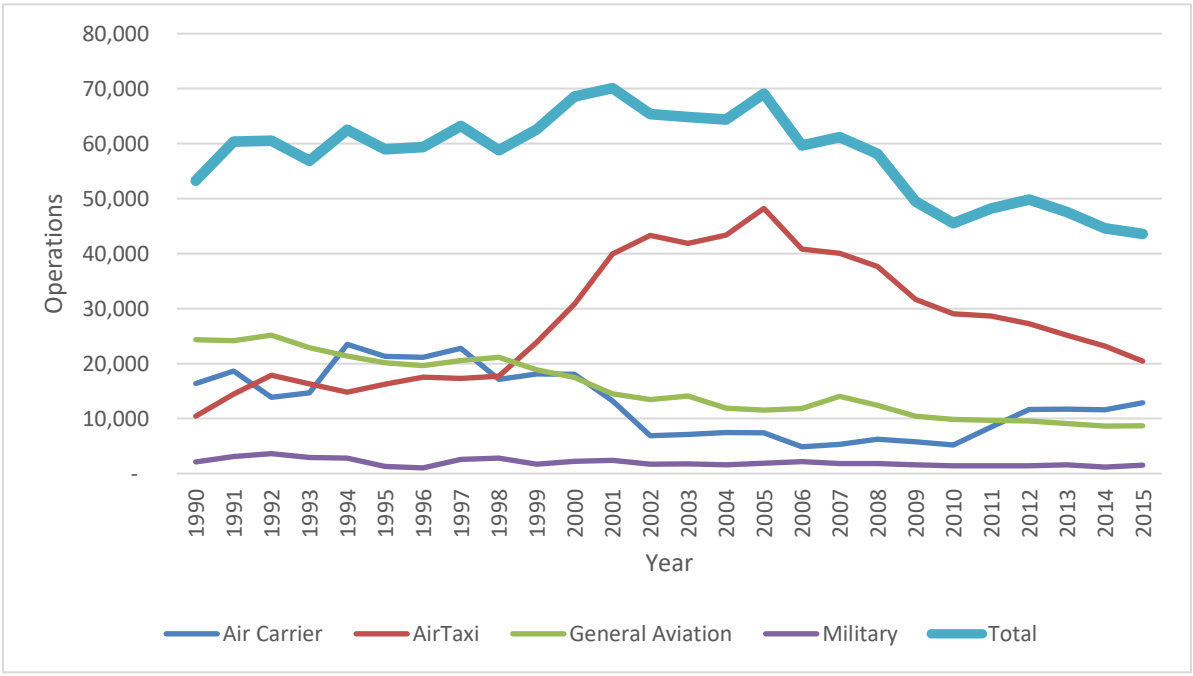
Growth in the total number of aircraft operations over the 20-year forecast period is approximately 1.23 percent CAGR.

Total general aviation operations are projected to increase at an average annual rate of 0.31 percent CAGR during the forecast period. Air taxi operations are projected to decrease at a negative average annual rate of 5.98 percent CAGR. The growth elements discussed for each operation type below include both local and airline industry factors that could impact aircraft operations at GSP.

### 3.6.1. Historical Activity

The historical data for aircraft operations, shown in **Figure 3-2** and **Table 3-15**, depicts trends for each operational type. Air carrier operations have fluctuated in the last 25 years with the initial growth of air service followed by a reduction in airlines at GSP. However, in the last 10 years, air service operations have slowly increased year over year. Air taxi operations peaked in 2005 at 48,221 and have followed a steady negative trend since. Total general aviation operations have seen a consistent decline historically, with both local and itinerant operations following negative trends, and military operations have remained consistently low over the last 25 years. Overall, the decline in total operations that has been seen historically has plateaued in recent years, with positive trends on the forecast horizon.

Figure 3-2: Historical Aircraft Operations




*Source: FAA TAF, 2017*

Table 3-15: Historical Aircraft Operations

| Year | Air Carrier | Air Taxi | General Aviation | Military | Total |
|---|---|---|---|---|---|
| 1990 | 16,356 | 10,440 | 24,357 | 2,100 | 53,253 |
| 1991 | 18,647 | 14,432 | 24,192 | 3,117 | 60,388 |
| 1992 | 13,868 | 17,899 | 25,172 | 3,622 | 60,561 |
| 1993 | 14,686 | 16,337 | 22,893 | 2,939 | 56,855 |
| 1994 | 23,497 | 14,809 | 21,398 | 2,822 | 62,526 |
| 1995 | 21,330 | 16,231 | 20,141 | 1,276 | 58,978 |
| 1996 | 21,164 | 17,532 | 19,644 | 1,031 | 59,371 |
| 1997 | 22,784 | 17,284 | 20,571 | 2,570 | 63,209 |
| 1998 | 17,136 | 17,682 | 21,157 | 2,838 | 58,813 |
| 1999 | 18,145 | 23,866 | 18,872 | 1,694 | 62,577 |
| 2000 | 18,076 | 30,783 | 17,469 | 2,213 | 68,541 |
| 2001 | 13,221 | 39,939 | 14,525 | 2,407 | 70,092 |
| 2002 | 6,902 | 43,309 | 13,469 | 1,709 | 65,389 |
| 2003 | 7,130 | 41,862 | 14,081 | 1,753 | 64,826 |
| 2004 | 7,455 | 43,379 | 11,914 | 1,611 | 64,359 |
| 2005 | 7,410 | 48,221 | 11,545 | 1,909 | 69,085 |
| 2006 | 4,868 | 40,810 | 11,829 | 2,162 | 59,669 |
| 2007 | 5,311 | 40,055 | 14,035 | 1,801 | 61,202 |
| 2008 | 6,248 | 37,689 | 12,389 | 1,834 | 58,160 |
| 2009 | 5,761 | 31,674 | 10,439 | 1,592 | 49,466 |
| 2010 | 5,187 | 29,067 | 9,862 | 1,398 | 45,514 |
| 2011 | 8,460 | 28,646 | 9,686 | 1,418 | 48,210 |
| 2012 | 11,636 | 27,260 | 9,537 | 1,402 | 49,835 |
| 2013 | 11,742 | 25,159 | 9,073 | 1,609 | 47,583 |
| 2014 | 11,599 | 23,197 | 8,633 | 1,176 | 44,605 |
| 2015 | 12,892 | 20,440 | 8,708 | 1,544 | 43,584 |

*Source: FAA TAF, 2017*

### 3.6.2. Growth Elements

*Air Carrier/Taxi* – Industry consolidation has reduced the number of airlines and hubs resulting in fewer nonstop routes than what were once available in the market. New airlines and new markets could be introduced over time, however the timing of introduction of service cannot be predicted and therefore the introduction of a new airline was excluded from this analysis. However, derivative forecast scenarios will consider activity from new airlines.

Trends for LCCs and ULCCs are expected to continue into the future, with additional destinations and weekly frequencies for ULCC service and new service to large focus cities for Southwest such as Baltimore, Houston and Orlando.

Similar to the service patterns at GSP from 2007 to 2017, it is anticipated that the remaining 50-seat regional jets will be replaced by larger two-class regional jets in addition to some mainline

aircraft used to replace multiple frequencies. Larger aircraft in place of greater frequency will maintain or even boost enplanements however it will slow overall operational growth.

*General Aviation* – At the time of this analysis, the airport has recently become the owner and operator of the FBO at the airport. For many years, general aviation has been only a minor presence on the airfield and with the new management structure, the overall goal is to enhance the general aviation presence at GSP. Presently there are only several months of data which are not sufficient in number to analyze and formulate reliable trends. A review of general aviation activity at GSP relative to industry trends should occur at a later time once multiple years of data are available. The facility requirements and alternatives chapters of this master plan will identify and reserve facilities for enhanced general aviation growth based on GSP's mission and goals for FBO growth.

*Military* – The growth of military operations is largely dependent on the security interests of the nation. Military aircraft are constantly relocated throughout the aviation system. Threats to the United States and disaster relief efforts may impact the amount of military operations at and around the Airport.

### 3.6.3. Air Carrier and Air Taxi

Air Carrier operations are those conducted by aircraft with 60 or greater passenger seats. Air Taxi operations include regional and commuter activity and commercial applications within general aviation such as Part 135 charter activity. Historically, the air taxi category has made facility planning difficult because it includes both airline and general aviation operations, however with the rapid retirement in 50-seat regional jet and smaller, nearly all airline operations in future years will be classified as air carrier. This transition between the two categories is reflected in the FAA TAF. As a result, the remaining Air Taxi operations will be considered as part of general aviation in facility planning.

Before endorsing the TAF operations forecast for the master plan, the air carrier operations were compared with the air service forecast methodology presented previously. The air service scenario depicts approximately 39,246 airline operations, while the TAF depicts 41,066 by 2037, a difference of 1,820 which equates to less than three departures per day.

### 3.6.4. General Aviation Operations

Annual itinerant aircraft operations, those flights originating or terminating 50 miles or greater from GSP, declined by 14.89 percent annually between 2011 and 2016. Itinerant GA operations are forecasted to slightly increase over the next 20 years. Though GSP's historic trend of GA itinerant operations has followed a negative growth rate, 2017 marked a return to positive growth, increasing operations of this type by 0.32 percent CAGR. It is expected from this point forward that itinerant GA operations at GSP will grow in line with the national forecast outlined in the TAF.

Defined as operations originating or terminating within 50 miles of GSP including traffic pattern operation, local GA activity has seen variations in growth over the last 10 years. Local GA operations at GSP are projected to show zero growth which is line with the FAA TAF.

### 3.6.5. Military Operations

With constant changes in national security and relief needs, military operations tend to fluctuate over time. At GSP, local and itinerant military operations have followed this characteristic trend over the last 10 years. In 2016, total military operations stabilized at 2,483 total and it is forecasted that GSP will maintain this plateau of operations for the next 20 years. The FAA TAF reports zero growth in military operations at GSP. However, it is anticipated that occasional local and itinerant military operations will occur as they have in the past with the C-130 conducting the majority of these.

Table 3-16 shows the forecasted annual operations by type.

Table 3-16: Annual Operations Forecast by Type

| Year | Air Carrier | Air Taxi | General Aviation | | | Military | | | Total Ops. |
|---|---|---|---|---|---|---|---|---|---|
| | | | Itinerant | Local | Total | Itinerant | Local | Total | |
| 2017 | 20,242 | 14,071 | 7,171 | 350 | 7,521 | 1,715 | 768 | 2,483 | 44,317 |
| 2022 | 32,491 | 3,957 | 7,281 | 350 | 7,631 | 1,715 | 768 | 2,483 | 46,562 |
| 2027 | 35,445 | 3,808 | 7,393 | 350 | 7,743 | 1,715 | 768 | 2,483 | 49,479 |
| 2037 | 41,066 | 4,363 | 7,623 | 350 | 7,973 | 1,715 | 768 | 2,483 | 55,885 |
| CAGR | 3.79% | -5.98% | 0.32% | 0.00% | 0.31% | 0.00% | 0.00% | 0.00% | 1.23% |

*Source: FAA Terminal Area Forecast, 2017*

### 3.6.6. Aircraft Fleet Mix

As eluded to previously in Section 3.2, both commercial and general aviation aircraft are getting progressively more fuel efficient with improved engines and aerodynamic design. Engine technology will yield quieter, more fuel-efficient engines, while aircraft design may slightly change the aircraft shape, primarily in the form of increased wingspans. Table 3-17 contains a representative sample of the existing and anticipated future fleet mix for GSP. It is important to note that aircraft not yet in the market place, such as a large passenger turboprop or a new generation of regional jets is not reflected as they are not in the current manufacturer marketplace but have the potential to exist inside the 20-year horizon.

Table 3-17: Aircraft Fleet Mix

| Category | Existing (2017) | Future (2037) |
|---|---|---|
| Commercial Service (Air Carrier) | Embraer 145 | Embraer 175 |
| | Bombardier CRJ-900 | C-Series CS 110/130 |
| | McDonnell Douglas MD-88 | Boeing 737 Max-8 |
| | Boeing 767-300F (Cargo) | Boeing 747-8F (Cargo) |
| | 61.6% | 73.5% |
| General Aviation Itinerant (Including Air Taxi) | Falcon 2000 LXS | Pilatus PC-12 |
| | Cessna Citation 525 | Embraer Phenom 300 |
| | Beech Baron | Dassault Falcon 5X |
| | Hawker 850 | Gulfstream G500 |
| | 32% | 21.5% |
| General Aviation Local | Cessna 208 Caravan | Beech Super King Air 350 |
| | Cessna Skyhawk (172) | Diamond DA-42 |
| | 0.8% | 0.6% |
| Other | C-130 (Military) | C-130J (Military) |
| | 5.6%% | 4.4% |

*Source: McFarland Johnson, 2017*

### 3.6.7. Peaking Characteristics – Aircraft Operations

Like the peaking characteristics used for passenger enplanements, annual operations numbers when divided equally over the year and throughout the day will not accurately identify capacity constraints or facility needs during busier periods. To accurately identify airport requirements for facility planning, peaking characteristics are broken down into the following elements:

***Peak Month*** – The GSP passenger market is more balanced on an annual basis compared to similar sized airports. Like passenger enplanements, there is no significant peak in activity on an annual basis for commercial activity. With general aviation factored in for the overall airport operational counts, recreational activity is elevated in the summer and fall months. A review of air traffic records resulted in a peak month of approximately 9.4 percent, for consistency purposes, the same peak month metric of 9.5 percent will be used for operations (equal distribution equates to 8.3 percent).

***Average Day Peak Month*** – The average day of the peak month (ADPM) is the industry standard measure used when planning and analyzing the airport's peaking characteristics. In the case of GSP, August is the peak month, with July and October also being above average, therefore the peak month activity is divided by 31 days.

***Peak Hour*** – Peak hour operations is a critical metric when planning for airfield capacity. Traditionally the operational peak hour typically represents between 12 percent and 17 percent of the daily operations total. The busiest hour based on existing (October 2017) flight schedules is 13 operations (arrivals and departures) and airline operations account for 80% of total operations. The resulting 16 existing peak hour operations represents 12 percent of the daily total,

which is within the generally accepted planning range and will be applied to future year peak hour levels.

Peak operational characteristics for GSP are displayed in Table 3-18.

Table 3-18: Peak Hour Operations

| | Existing | 2022 | 2027 | 2037 |
|---|---|---|---|---|
| Operations | 44,632 | 46,562 | 49,479 | 55,885 |
| Peak Month | 4,240 | 4,423 | 4,701 | 5,309 |
| Average Day Peak Month | 137 | 143 | 152 | 171 |
| Peak Hour | 16 | 17 | 19 | 21 |

*Source: McFarland Johnson, 2017*

## 3.7. BASED AIRCRAFT

Forecasting the number and type of based aircraft is critical to planning future GA facilities, especially for the type and size of hangars and aircraft movement and parking areas. The growth elements below discuss the factors that influence the number of based aircraft at GSP

### 3.7.1 Growth Elements

As with operations, growth elements effecting based aircraft at GSP are expected to generally follow national trends related to general aviation fleets. The growth rates used in this forecast represent those in the most recent FAA Aerospace Forecast for 2017 to 2037. As shown in Table 3-19, piston aircraft are forecasted to follow a negative growth rate over the next 20 years while turbine aircraft will grow positively throughout the planning period. This trend is consistent with previous statements regarding fuel efficiency and aircraft technologies.

***Piston*** – Locally, there are multiple general aviation airports that provide FBO services within GSP's ASA. Donaldson Field, Greenville Downtown, and Spartanburg Downtown Memorial Airport are each within a 30-minute drive of the Airport and totaled 329 based aircraft in 2015. The appeal and availability of GA-specific airports negatively impacts the number of based piston engine aircraft at GSP. Nationally, as the economic advantage of aircraft leasing, renting and fractional ownership becomes more popular, the number of newly purchased piston engine aircraft is decreasing in most regions. It is forecast that GSP will follow a negative trend for single and multi-engine based aircraft at a rate of -0.9 percent CAGR and -0.5 percent CAGR respectively.

***Turbine*** – As the full owner and operator of the FBO, GSP has elevated the services available to based and transient aircraft. With this, and the national forecast for based turbine aircraft following a positive trend, it is forecasted that turbo propeller and turbo jet aircraft will increase at a rate of 2.3 percent CAGR and 1.9 percent CAGR throughout the planning period.

Table 3-19: Based Aircraft Forecast

| Year | Piston | | | Turbine | | | Total Based Aircraft |
|---|---|---|---|---|---|---|---|
| | Single | Multi | Total | Turbo Prop | Turbo Jet | Total | |
| 2017 | 5 | 6 | 11 | 4 | 11 | 15 | 26 |
| 2022 | 5 | 6 | 11 | 4 | 13 | 17 | 28 |
| 2027 | 4 | 6 | 10 | 5 | 14 | 19 | 29 |
| 2037 | 4 | 6 | 10 | 5 | 16 | 21 | 31 |
| CAGR | -0.9% | -0.5% | -0.8% | 1.4% | 2.3% | 1.9% | 1.1% |

*Source: FAA National Aerospace Forecast 2017-2037*

## 3.8. FORECAST SUMMARY

Table 3-20 presents a summary of the aviation demand forecasts developed for GSP. These forecasts are considered reasonable and achievable and will be used throughout the Master Plan Update in the development of facility requirements and the identification of alternatives.

Table 3-20 Aviation Demand Forecast Summary

| | FORECAST | | | |
|---|---|---|---|---|
| | Existing | 2022 | 2027 | 2037 |
| **Enplanements** | | | | |
| Air Carriers | 1,014,611 | 1,182,700 | 1,333,823 | 1,648,052 |
| Peak Hour | 622 | 725 | 818 | 1,010 |
| **Aircraft Operations** | | | | |
| Air Carrier/Airline | 20,242 | 32,491 | 35,445 | 41,066 |
| Peak Hour | 21 | 22 | 23 | 27 |
| General Aviation | | | | |
| GA Itinerant* | 7,171 | 11,238 | 11,201 | 11,986 |
| GA Local | 350 | 350 | 350 | 350 |
| Military | 2,483 | 2,483 | 2,483 | 2,483 |
| **Based Aircraft** | | | | |
| Single | 5 | 5 | 4 | 4 |
| Multi | 6 | 6 | 6 | 6 |
| Turbo Prop | 4 | 4 | 5 | 5 |
| Turbo Jet | 11 | 13 | 14 | 16 |

*Note: GA Itinerant Operations include air taxi*

*Source: McFarland Johnson 2017*

### 3.8.1. Comparison with FAA Terminal Area Forecast

To confirm validity, master plan aviation forecasts are often compared with other aviation forecasts prepared for the airport and the region. Ideally, this report's forecasts should be reasonably consistent with other forecasts of future airport activity, and compatible with forecasts for the larger region. With master plan forecasts being much more specific to the airport, it is not

unusual to see some variation from national forecasts. The most useful forecasts for comparison are those prepared by the FAA with the standard being the TAF and the national and regional forecasts previously referenced in this report. The TAF is prepared annually and includes airport forecasts for all active NPIAS airports. **Table 3-21** shows the compared results between the selected forecast and that of the FAA's TAF.

The comparison shows that the results of the Master Plan forecast are within the allowed tolerances permitted by the FAA (10 percent within 5 years; 15 percent within 10 years) and is considered reasonable for planning purposes. Facility improvements associated with passenger enplanements may want to consider construction in advance of the forecast years to avoid temporary facilities required from a short-term spike in demand.

Table 3-21: Aviation Demand Forecast vs. FAA Terminal Area Forecast

| | ACTUAL | FORECAST | | | |
|---|---|---|---|---|---|
| | 2016 | 2017 | 2022 | 2037 | Growth |
| **FAA TAF (2016)** | | | | | |
| Enplanements | 987,307 | 983,978 | 1,077,708 | 1,348,414 | 1.48% |
| Total Operations | 47,315 | 44,317 | 46,562 | 55,885 | 1.23% |
| **Master Plan Forecast** | | | | | |
| Enplanements | 987,307 | 1,014,611 | 1,182,700 | 1,648,052 | 2.46% |
| Total Operations | 47,315 | 44,317 | 46,562 | 55,885 | 1.23% |
| **Pct. Difference From TAF** | | | | | |
| Enplanements | 0.00% | 3.11% | 9.74% | 22.22% | - |
| Total Operations | 0.00% | 0.00% | 0.00% | 0.00% | - |

*Source: McFarland Johnson, 2017*

## 3.9. FUTURE DESIGN AIRCRAFT

The Runway Design Code (RDC) used in airport planning is derived from the features of the most demanding aircraft using the airport on a regular basis coupled with the best available instrument approach minimums. The first component, depicted by a letter, is the Aircraft Approach Category (AAC) and relates to aircraft approach speed (operational characteristics). The second component, depicted by a Roman numeral, is the Airplane Design Group (ADG) and relates to either the aircraft wingspan or tail height (physical characteristics), whichever is most restrictive. The third component relates to the visibility minimums expressed by Runway Visual Range (RVR) values. **Table 3-22** displays the RDC criteria used in airport planning.

The Boeing 767-300F combined with the similar Airbus A300-600F currently meet the critical aircraft requirement of a minimum of 500 annual itinerant operations at GSP and are classified as a D-IV aircraft. However, as cargo and air carrier traffic increases, the critical aircraft is forecast to change in the intermediate future and again in the distant future. The Boeing 747-400F, classified as D-V, is currently operating 200 to 300 operations per year at GSP and is forecast to become the design aircraft in the next five to 10 years. In the distant future, the Boeing 747-8F is anticipated to replace the Boeing 747-400F as the critical aircraft for the airport and will require D-VI design standards. **Table 3-23** presents the design details for each of these aircraft.

Table 3-22: FAA Airport Reference Code

| FAA Airport Reference Code Parameters | | | | |
|---|---|---|---|---|
| Category | Approach Speed | Group No. | Wing Span (ft.) | Tail Height (ft.) |
| | (knots) | I | < 49 | < 20 |
| A | <91 | II | 49 to < 79 | 20 to < 30 |
| B | 91 to < 121 | III | 79 to < 118 | 30 to < 45 |
| C | 121 to < 141 | IV | 118 to < 171 | 45 to < 60 |
| D | 141 to < 166 | V | 171 to < 214 | 60 to < 66 |
| E | 166 or more | VI | 214 to < 262 | 66 to < 80 |

*Source: FAA AC 150/5300-13A*

Table 3-23: Future Design Aircraft

| | Future Design Aircraft | | |
|---|---|---|---|
| Aircraft Model | B767-300F | B747-400 | B747-8F |
| Length Overall | 180 ft. | 232 | 250 |
| Wingspan | 156 ft. | 213 | 224 |
| Tail Height | 53 ft. | 64 | 63 |
| Main Gear Width | 30 ft. 6 in. | 36 ft. 1 in. | 36 ft. 1 in. |
| Cockpit to Main Gear | 64 ft. 7 in. | 84 ft. 0 in. | 97 ft. 4 in. |
| Maximum Takeoff Weight | 412,000 lbs. | 875,000 lbs. | 987,000 lbs. |
| Typical Approach Speed | 145 kts. | 158 kts. | 159 kts. |
| Approach Speed Category | D | D | D |
| Aircraft Design Group | IV | V | VI |

*Source: FAA AC 150/5300-13A*

## 3.10. LONG RANGE PLANNING

The project development process (planning, environmental, design and construction) for large scale airport improvements can often take in excess of 10 years meaning that the planning process begins long before the project objectives are necessary. While many uncertainties exist beyond the 20-year planning period, forecast results were developed for the 2045, 2055 and 2065 planning-year horizons. Facility requirements and alternatives will identify potential facility land development needs to ensure that short term development does not impede long term facility needs. Table 3-24 contains the forecast highlights for the beyond planning period horizons.

Table 3-24: Long Range Planning Forecast

| | Enplanements | Air Cargo (pounds) | Operations | Based Aircraft |
|---|---|---|---|---|
| 2045 | 2,153,123 | 302,738,694 | 63,895 | 35 |
| 2055 | 2,745,443 | 500,219,598 | 72,203 | 39 |
| 2065 | 3,500,708 | 826,520,202 | 81,592 | 44 |

*Source: McFarland Johnson, 2017*