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 the Greater Binghamton Airport (BGM 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.

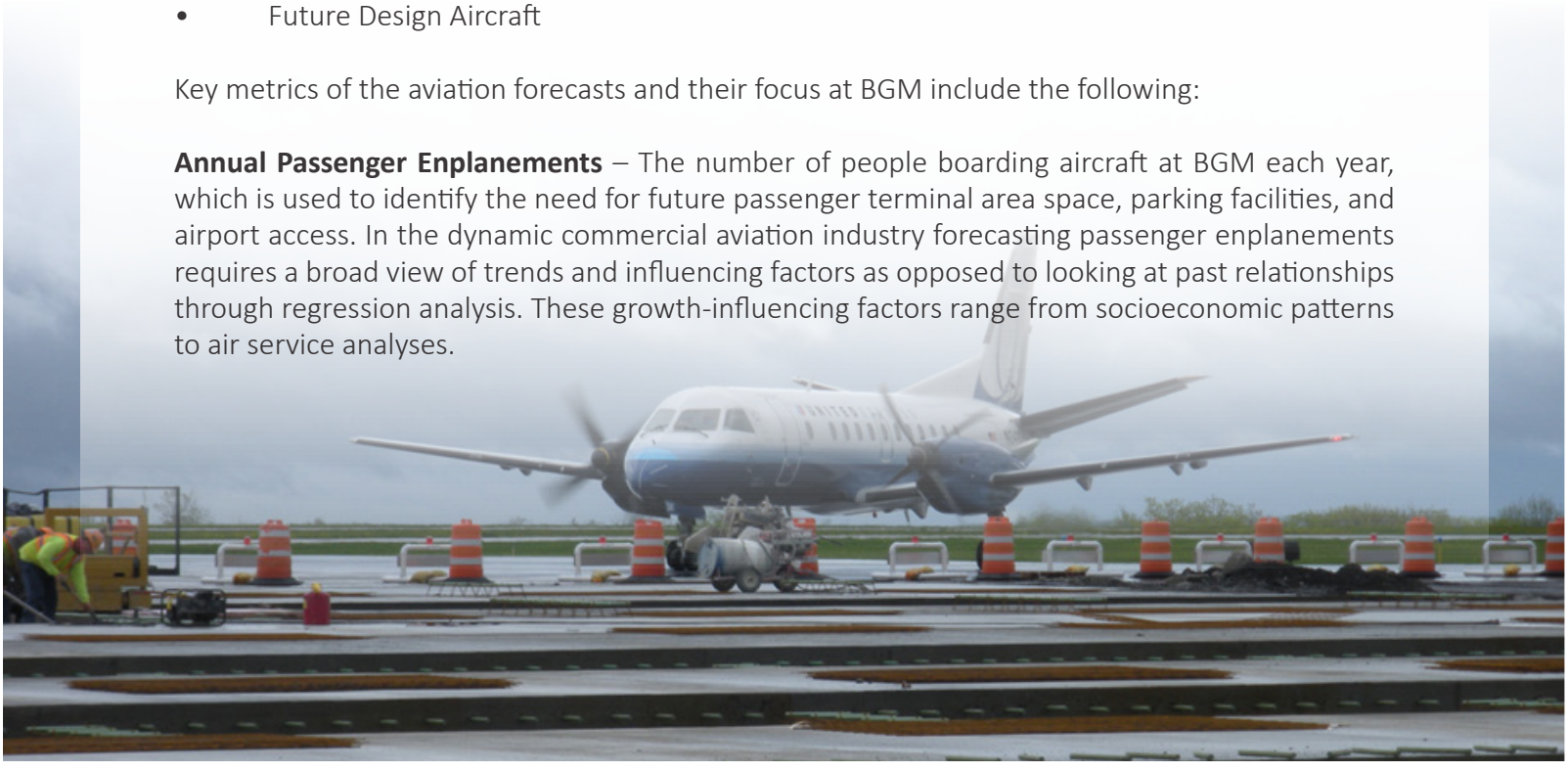
This forecast was prepared prior to the impacts of COVID-19. The forecast approval is based in reference to the data and methodologies used and the conclusions at the time the document was prepared. However, consideration must still be given to the significant impacts of COVID-19 on aviation activity; as a result, there is lower than normal confidence in future growth projections. FAA approval of the forecast does not provide justification to begin airport development. Justification for future projects will be made based on activity levels at the time the project is requested for development, rather than this forecast approval. Further documentation of actual activity levels reaching the planning activity levels will be needed prior to FAA participation in funding for eligible projects.

The key elements of this chapter include:

- Forecast Influencing Factors
- Socioeconomic Trends
- Passenger Enplanements
- Aircraft Operations
- Based Aircraft
- Forecast Summary
- Future Design Aircraft

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

Annual Passenger Enplanements – The number of people boarding aircraft at BGM 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 BGM each year, which is used to determine the necessary capacity of the airfield and aircraft operating area. A takeoff and landing are each counted individually as one operation.

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

General Aviation Operations – The estimated number of GA takeoffs and landings at BGM, which is 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 GA demand.

3.2. FORECAST INFLUENCING FACTORS

The forecast analysis for the BGM 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 BGM forecast. Changing variables and guaranteed uncertainty are underlying reasons 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*, BGM's potential commercial service area encompasses all areas within a 60-minute drive of BGM. The true service area is defined as the area for which BGM is the closest commercial airport up to 60 minutes, meaning the commercial service area ranges from as little as 25 minutes as you approach Elmira and Ithaca and 60 minutes for locations east, after which, New York Metro area airports or Albany, become more likely options. The Airport is the only commercial service airport within a 60-minute drive and within a 90-minute drive there are four commercial service airports: Wilkes-Barre/Scranton (AVP), Ithaca Tompkins Regional (ITH), Elmira/Corning Regional (ELM), and Syracuse (SYR) Airports. A detailed analysis of the other commercial service airports in the region is included in the passenger enplanements section of this chapter.

The GA service area is generally defined as within a 30-minute drive from/to BGM. There are three public-owned GA airports within this area). The three GA airports and their proximity to BGM are Tri-Cities Airport (Endicott, NY) – 9 nautical miles (NM) Southwest, Cortland County Airport – Chase Field – 25 NM North and Sidney Municipal Airport - 26 NM East.

Each of these airports have an instrument approach, fuel, and basic aircraft servicing, however each of these facilities are limited in their abilities to accommodate jet and larger turbo-prop aircraft.

For both commercial and GA, changes in facilities or activity at other airports in the service area have the potential to affect demand and activity levels at BGM 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 1,500 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 up-gauging 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 BGM'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 BGM 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 in the effort to explore for potential correlations to aviation demand.

3.3.1. Population

Population is often a strong indicator of the potential for activity and growth at an airport as the size of the potential user base is one of the key indicators for aviation demand. Population in the Southern Tier of New York has been slowly declining for years, while not at the same pace as enplanements, the two have shared a consistent decline. The population trends for both the Binghamton's metropolitan statistical area (MSA), compared to both Ithaca's and Elmira's MSA are shown in Table 3-1. Binghamton had the highest percentage decline in population, while Ithaca has sustained increases over the past 25 years.

Table 3-1: Metropolitan Statistical Areas - Population Trends

Year	Binghamton	Elmira	Ithaca
1990	264,497	194,283	94,097
1991	263,277	193,835	94,336
1992	262,057	193,386	94,575
1993	260,837	192,938	94,814
1994	259,617	192,490	95,053
1995	258,398	192,042	95,292
1996	257,178	191,593	95,531
1997	255,958	191,145	95,770
1998	254,738	190,697	96,009
1999	253,518	190,248	96,248
2000	252,298	189,800	96,487
2001	252,242	189,603	96,998
2002	252,186	189,407	97,508
2003	252,130	189,210	98,019
2004	252,074	189,014	98,530
2005	252,018	188,817	99,041
2006	251,961	188,620	99,551
2007	251,905	188,424	100,062

Year	Binghamton	Elmira	Ithaca
2008	251,849	188,227	100,573
2009	251,793	188,031	101,083
2010	251,737	187,834	101,594
2011	250,463	187,072	102,140
2012	249,189	186,310	102,686
2013	247,916	185,548	103,233
2014	246,642	184,786	103,779
2015	245,368	184,024	104,325
2016	244,094	183,262	104,871
1990-2016	-0.31%	-0.22%	0.42%
1990-2001	-0.43%	-0.22%	0.28%
2002-2016	-0.23%	-0.24%	0.52%

Source: New York State Department of Labor, 2017.

3.3.2. Employment/Labor Force

With no single metric to measure the specific economy of the region, several indicators are used to help provide insight into economic performance. Two key areas are unemployment and the size of the labor force. Reviewing unemployment is better for shorter term periods, while the size of the labor force is more telling when reviewing longer periods of time. Table 3-2 displays the size of the labor force for the Binghamton MSA as well as both Ithaca and Elmira. Similar to population, Binghamton has the greatest decline in labor force size of compared to neighboring peers, with Ithaca yielding the strongest labor force growth/stability comparted to Binghamton and Elmira.

Table 3-2: Metropolitan Statistical Areas – Labor Force Size (in thousands)

Year	Binghamton	Elmira	Ithaca
1990	131.6	90.6	49.0
1991	131.5	91.4	48.5
1992	131.1	92.1	48.3
1993	129.8	91.4	48.7
1994	128.4	91.8	48.9
1995	124.3	91.0	49.1
1996	122.6	92.5	49.6
1997	126.4	94.4	50.3
1998	126.1	94.1	50.5
1999	125.8	93.3	52.1
2000	124.1	90.4	50.5
2001	124.6	90.7	51.2
2002	125.5	89.4	52.6
2003	123	86.1	53.3
2004	122.4	84.6	54.0
2005	122.6	85.2	54.6

Year	Binghamton	Elmira	Ithaca
2006	123.5	85.5	55.4
2007	123.0	85.7	55.4
2008	124.5	87.4	56.2
2009	123.7	87	56.7
2010	124.4	88.9	54.8
2011	120.5	86.9	54.2
2012	119.5	86.4	55.1
2013	116.6	85	55.8
2014	112.3	87.7	55.0
2015	110.5	81.4	50.6
2016	109.1	79.6	50.4
1990-2016	-0.72%	-0.50%	0.11%
1990-2001	-0.50%	0.01%	0.40%
2002-2016	-1.00%	-0.83%	-0.30%

Source: New York State Department of Labor, 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 resulting PCPI growth for the same time intervals reveals similar socioeconomic trends for Binghamton, Ithaca, and Elmira with no discernable differences in the trends for each.

3.3.4. Socioeconomic Summary

The trends analyzed reveal consistently weaker socioeconomic trends for the Binghamton area relative to both Ithaca and Elmira, lending credence to sustained decline in activity, especially passenger enplanements over the past 25 years. While the data supports a general decline, no indicators support changes substantially different from peers, nor anything of significance in the past few years, that would lend itself to the sharp decline in scheduled passenger seats at BGM. Additional influencing factors are discussed in the passenger enplanements section that follows.

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, helping to ensure that they are adequately sized for future demand.

3.4.1. Historical Activity

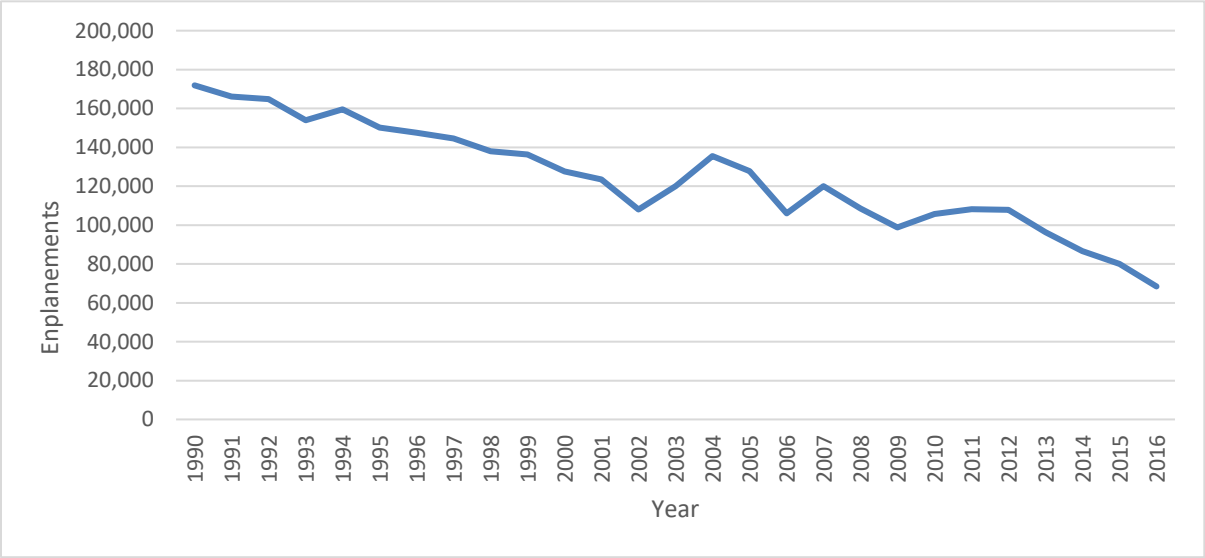
The historical data for passenger enplanements presented in **Figure 3-1** depicts a gradual decline over the past 20 years. The decline in passenger enplanements is likely attributed to the erosion

of the local labor force, the relocation of notable local employers and mergers, and acquisitions in the airline industry that has resulted in fewer choices for passengers. In 2017, the Greater Binghamton Airport reported passenger enplanements totaling 33,666, which is utilized as the base year in the development of forecasts of future passenger enplanements.

3.4.2. Passenger Service Area Dynamics

The socioeconomic indicators previously mentioned lend credence to the prolonged decline in passenger enplanements. However, the local socioeconomic conditions are not dissimilar to those from the Elmira/Corning area or Ithaca. Ithaca's socioeconomic indicators appeared to be the best of the three even though it is the smallest market population wise. Based on these observations, historical service options and low fare choices at other airports in the service area were reviewed for insights into the decline in service at BGM.

Figure 3-1: Historical Passenger Enplanements



Source: BGM Airport Records, 2017.

Service Area Options

A drive time analysis reveals that excluding ITH and ELM, there are nine airports with low fare air service options within a three-hour drive to BGM, this is compared to six for ITH and five for ELM. Table 3-3 compares the drive time options for the three Southern-Tier airports to other airports with low fare options, up to a three-hour drive.

Table 3-3: Airports with Low Fare Air Services

Airport	ELM	SYR	ROC	ALB	SWF	ABE	EWR	PHL	BUF	IAG	Airports <3 hours
BGM	68 mins	80 mins	153 mins	129 mins	132 mins	135 mins	165 mins	170 mins	180 mins	*+3hr*	9
ITH	54 mins	79 mins	109 mins	*176 mins*	*+3hr*	*+3hr*	*+3hr*	*+3hr*	150 mins	178 mins	6

Airport	ELM	SYR	ROC	ALB	SWF	ABE	EWR	PHL	BUF	IAG	Airports <3 hours
ELM	N/A	120 mins	100 mins	*+3hr*	*+3hr*	*+3hr*	*+3hr*	*+3hr*	140 mins	164 mins	5

Source: Google Maps, 2018.

The availability of low fares at these airports did not happen all at once, but rather over time. The incremental additions of low fares starting in the late 1990's and early 2000's has resulted in incremental pressure on the local BGM market in the form of increased low fare options at other airports. In this analysis, low fare airlines are those who's business model is based on value and low fares to their national customer base; they include Southwest, JetBlue, Spirit, Frontier and Allegiant. Table 3-4 displays the chronological timing of the introduction of low fare options at airports within three hours of BGM.

Table 3-4: Introduction of Low Fare Options to Airports

Year	Airports with Low Fare Airlines
1990	None
1995	None
2000	BUF, ROC
2005	BUF, ROC, SYR, ALB, EWR, PHL, ABE
2010	BUF, ROC, SYR, ALB, EWR, PHL, ABE, SWF, ELM
2015	BUF, ROC, SYR, ALB, EWR, PHL, ABE, SWF, ELM

Source: McFarland Johnson, 2018.

The combination of the prolonged weakness on socioeconomic conditions, particularly the declining population and labor force, along with increased low fare options at twice as many airport choices than other Southern Tier airports, in the face of significantly reduced service creates a challenging environment for the BGM market.

Factors such as the proximity and low fare offerings from others is beyond the control of BGM and represents a new reality for local passenger market. The sharp recent cuts (suspension of service by two of the three airlines serving BGM) from the previous 18 months (since November 2016) are excessive considering the service area choices and socioeconomic conditions over the previous five-year period are not indicative of anything that would result in a 75 percent reduction in capacity. While this correlation supports a near-term rebound, even in a smaller form, the baseline forecast will consider the existing conditions as the minimum core market. Future enplanement levels will likely be the result of air service-based network planning decisions by the airlines. Forecast methodology for enplanements will be based on air-service and consider existing trends of similar airports.

3.4.3. Forecasting Factors

Several industry trends were prominent in the review of air service changes since the last master plan:

Airline and Hub Consolidation – In the mid 2000's, BGM was served by several of the major legacy carriers of the time including Delta, Northwest, United, and US Airways, each of which have since

been involved in mergers and acquisitions that reshaped their route networks. For BGM, major hubs like Pittsburgh, which closed as a hub for US Airways in 2005, supported mainline service for many years from BGM. Other former hubs, such as Cincinnati for Delta, have had resources shifted to Detroit as result of the merger with Northwest. United, whose eastern US hub has traditionally been Washington Dulles, inherited Newark as a result of their merger with Continental, reshaping their network in the Northeast.

Low-Cost Airline Growth – Low-cost and less than daily service has been introduced at dozens of small-hub and non-hub airports throughout the US. As previously displayed, the number of airports with low fare service had increased steadily over time. Low cost and especially ultra-low-cost carriers (ULCC) have commenced service at small and non-hub airports in a less than daily capacity. The most relevant example to BGM is the Allegiant service at ELM which has grown from twice weekly seasonal flights to Orlando over the past 10 years to as many as eight weekly flights serving both Orlando and St. Petersburgh/Clearwater. Allegiant also served AVP for several years up until January 2018.

Aircraft Up-Gauging – 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. This trend has included as a highlight in the FAA's Aerospace Forecast for 2017-2037, which notes "US carrier system capacity measure in available seat miles is forecast to grow in line with the increases in demand. The number of seats per aircraft is getting bigger, especially in the regional jet market, where we expect the number of 50 seat regional jets to fall to just a handful by 2023, replaced by 70-90 seat aircraft." The reports continue on to state "The regional carrier fleet is forecast to decline from 2,156 aircraft in 2016 to 2,027 in 2037 as the fleet shrinks by 14 percent between 2016 and 2025. Carriers remove 50 seat regional jets and retire small older turboprop and piston aircraft, while adding 70-90 seat jets, especially the E-2 family after 2020. By 2025 only a handful of 50 seat regional jets remain in the fleet." The current air service provider, SkyWest (operating as Delta Connection), confirmed this in a letter dated January 9, 2019 and attached within Appendix B.

The upgauging of aircraft has been readily apparent at other airports within a 90-minute drive of BGM. According to the FAA's Traffic Flow Management System Counts for 2018, nearly 2,400 of the 10,100 (approximately 24%) regional jet operations were completed by aircraft with greater than 50 seats at Wilkes-Barre/Scranton International Airport. Additionally, over 5,500 regional jet operations, out of a total of approximately 6,500 (approximately 85%), at Elmira Corning Regional Airport were completed by regional jets with greater than 50 seats. Lastly, at Syracuse Hancock International Airport, with nearly 25,000 annual regional jet operations, over 18,000 (approximately 72%) of those operations were completed by regional jets with greater than 50 seats. When comparing these figures for 2013, the percentage of regional jet operations by aircraft with greater than 50 seats was much less at all of the airports. At Wilkes-Barre/Scranton, aircraft with greater than 50 seats completed over 46% of the regional jet operations, while this figure was 72% at Elmira/Corning and 44% at Syracuse. As a result, the proportion of regional jet flights operated at these nearby airports by aircraft with greater than 50 seats have increased over the past five years and is anticipated to continue increasing based on the national trends identified.

3.4.4. Forecast Methodologies

Several methodologies were explored to create additional forecasts for consideration using FAA guidance, air service dynamics, and historical growth rates.

FAA Aerospace Forecast (2017-2037) – This forecast methodology applies the 1.6 percent average annual growth rate for domestic passenger traffic for US regional carriers scheduled service. While this is a national forecast with no connection to the BGM market, the long-term patterns are useful for comparison purposes.

High Air Service Growth – As previously mentioned, the existing service levels are considered to be the baseline despite evidence that the recent sharp cuts were not supported by changes in the socioeconomic or catchment area profiles. The high growth scenario introduces the industry trend of up-gauging to larger regional jets in the five-year timeframe, extends the season of the third frequency in the 10-year timeframe, and adds a fourth daily flight, to Detroit or to another market, in 2030.

Low Air Service Growth – The low growth forecast scenario considers greater focus on medium and larger airports and that BGM maintains a schedule similar to the current schedule with incremental up-gauging of aircraft on one of the frequencies every 5 years.

Blended Air Service Growth – This forecast is a blend of the low and high growth forecast scenarios.

Historical Performance – This forecast methodology uses the 26-year (since 1990) historical compounded annual growth rate (CAGR) for BGM of -3.20 percent. This growth rate accounts for the effects of 9/11, three economic recessions, and multiple airline mergers.

The resulting methodologies contain enplanement forecasts ranging from 21,158 to 75,451 as displayed in Table 3-5.

Table 3-5: Forecast Enplanements by Methodology

	FAA Aerospace	High	Low	Blend	Historical
2017 (Existing)	33,666	33,666	33,666	33,666	33,666
2022	38,914	48,206	38,346	43,276	34,462
2027	42,128	53,633	40,629	47,131	29,290
2032	45,608	70,239	47,584	58,912	24,894
2037	49,375	75,451	50,450	62,951	21,158

Source: 2017 (Existing Enplanements) as calculated by Greater Binghamton Airport, McFarland Johnson analysis, 2017.

3.4.5. Selected Forecast

The blended forecast scenario is the selected forecast for enplanements and is displayed in Table 3-6.

Table 3-6: Baseline Enplanement Forecast

Year	Enplanements
2017 (Existing)	33,666

Year	Enplanements
2022	43,276
2027	47,131
2032	58,912
2037	62,951

Source: McFarland Johnson analysis, 2017.

3.4.6. Derivative Forecast Scenarios

The following sections outline additional derivative forecast 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 are speculative and are not included in the baseline forecast identified in Table 3-6 and utilized as the basis for this Master Plan Update. These scenarios are solely provided for reference should a change in airline service come to fruition. Any scenario identified in this section will be additive to the selected baseline forecast, as identified in Table 3-6, and will be used for future facility planning only should the need arise.

New Regional Airline – This scenario considers the impacts associated with the introduction of a new regional airline offering approximately 12 weekly flights on 50-seat regional jets. Service will increase to 14 weekly flights on 66-seat aircraft in year five, and 19 weekly flights with an average of 70 seats in year 12.

Small Leisure Airline - This scenario considers the impacts associated with the introduction of a small leisure airline offering twice weekly flights on regional jet aircraft for a six-month period for years one and two, nine months in years three through four, and twice weekly year-round for year five. An additional market is added in year 10, growing at the same schedule as the initial market.

ULCC Leisure Airline - This scenario considered the impacts associated with the introduction of a ULCC offering twice weekly flights on mainline sized aircraft (160 seats) for a six-month period for years one and two, nine months in years three through four, and twice weekly year-round for year five. An additional market is added in year 10, growing at the same schedule as the initial market.

Small Business Airline - This scenario considered the impacts associated with the introduction of a small business-oriented airline providing an average of 19 weekly flights on nine-seat aircraft to one or more business markets. An additional business market with a total of 12 weekly flights is added in year five.

Table 3-7 displays the additional service levels of the derivative scenarios associated with new service at BGM.

Table 3-7: New Service Derivative Scenarios

	New Regional		New Small Leisure		New ULCC		Small Business	
Year	Ops.	Enpl.	Ops.	Enpl.	Ops.	Enpl.	Ops.	Enpl.
1	1,248	24,960	104	2,210	104	7,363	1,976	5,780
5	1,456	29,120	208	4,420	208	14,726	3,432	10,039

	New Regional		New Small Leisure		New ULCC		Small Business	
10	1,456	30,940	312	6,630	312	22,090	3,432	10,039
20	1,976	43,472	520	11,050	520	36,816	3,432	10,039

Source: McFarland Johnson analysis, 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 BGM passenger market is more balanced on an annual basis compared to similar sized airports with no dramatic peaks in activity. Airport records indicate that August is the peak month with approximately 10 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. The peak month activity is divided by 30 days.

Peak Hour – Peak hour enplanements is the critical metric when planning for passenger terminal facilities. At small airports like BGM with a single airline, and when operations do not occur simultaneously, the peak hour is based on a single full operation and is based on the largest aircraft utilized by the air carrier. As noted previously, and detailed in the letter provided by SkyWest, it is anticipated that the aircraft used will increase in size over the planning period. As a result, the Canadair (Bombardier) Regional Jet 200 (CRJ-200), with 50 seats, was utilized in 2017, and it is assumed that upgauging will occur over the planning period with a CRJ-700 or similar aircraft in 2022 increasing to a CRJ-900 or similar aircraft in 2027. Between 2027 and 2037 it is anticipated that the CRJ-900 or similar aircraft, will continue to be utilized at the Airport, however, larger variants with additional seats are anticipated to be introduced into the market. Peak enplanement characteristics for BGM are displayed in **Table 3-8**. While the peaking characteristic does not account for a second airline, it is worth noting that BGM has supported peak hours of between 100 and 150 passengers in recent years.

Table 3-8: Peak Enplanement Characteristics

	2017 (Existing)	2022	2027	2032	2037
Enplanements	33,666	43,276	47,131	58,912	62,951
Peak Month	3,367	4,328	4,713	4,890	6,295
Average Day Peak Month	112	144	157	163	210
Peak Hour	50	66	76	76	85

Source: McFarland Johnson analysis, 2017.

3.5. 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), GA (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.

While historical trends point to a continued decline, recent activity levels indicate that GA at BGM has stabilized. Current levels equate to an approximate average of eight GA itinerant departures per day and four local departures per day and it is not anticipated that activity will drop below these levels. In addition, Evolution Jets recently announced the opening of a maintenance base in Hangar 1 at BGM. As a result, Evolution Jets will cycle their fleet of Embraer Legacy jets through BGM on a daily basis for maintenance activities. It is anticipated that this will increase GA itinerant operations by an average of up to 16 daily operations through the planning period as documented in a letter provided by Evolution Jets and available in **Appendix B**. Otherwise, activity at BGM is generally expected to follow national GA trends absent any notable changes in the based user profile.

The growth rates used in the most recent FAA National Aerospace Forecast for 2017-2037 result in an operations forecast that is close to the FAA Terminal Area Forecast (TAF) in many categories. The primary differences being in the air carrier operations totals which do not consider the eventually up-gauging to larger aircraft, as well with itinerant GA operations, which do not account for the added frequencies associated with the new activity associated with Evolution Jets. The overall master plan operations forecast is displayed in **Table 3-9**. The growth elements discussed for each operation type below include both local and airline industry factors that could impact aircraft operations at BGM.

3.5.1. Historical Activity

The historical data for aircraft operations, shown in **Figure 3-2**, depicts various trends for each type of operation. Overall activity has declined at consistent rate for many years, with levels being relatively stable in recent years.

Table 3-9: Annual Operations Forecast by Type

Year	Air Carrier	Air Taxi	Itinerant		Local		Total Ops.
			GA	Military	Civil	Military	
2017 (Existing)	19	3,331	5,886	218	2,995	98	12,547
2022	710	2,421	9,260	218	3,040	98	15,747
2027	1,415	1,586	11,175	218	3,086	98	17,578
2032	2,150	790	11,997	218	3,133	98	18,386
2037	2,940	755	12,089	218	3,180	98	**19,280**

Source: FAA Terminal Area Forecast, 2017 (Existing Conditions); 2022 – 2037 based on McFarland Johnson analysis, 2019.

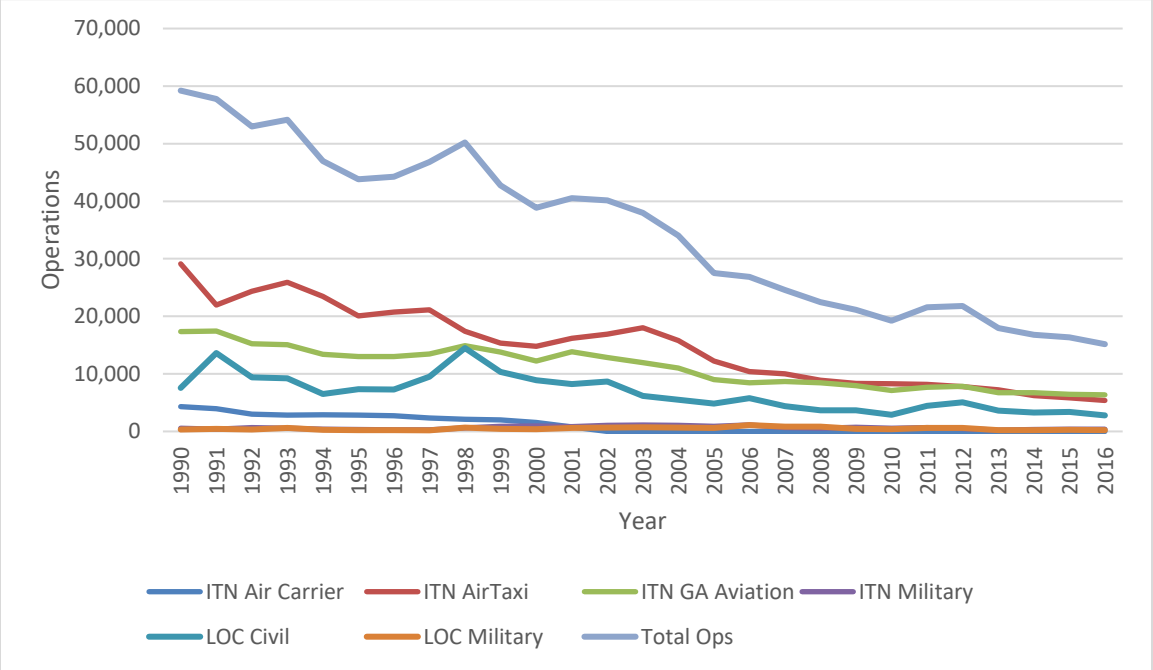
3.5.2. Air Carrier and Air Taxi

Air Carrier operations are those conducted by aircraft with 60 or greater passenger seats. Air Taxi/Commuter operations include regional and commuter activity and commercial applications within GA such as Part 135 charter activity. Historically, the air taxi element has made facility planning difficult because it includes both airline and GA operations; however, with the rapid

retirement in 50-seat regional jet and smaller, many airline operations in future years will be classified as air carrier by the end of the planning period. The FAA TAF does not reflect this transition; there is no net effect on the total airport operations.

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. Derivative forecast scenarios will consider activity from new airlines.

Figure 3-2: Historical Aircraft Operations



Source: FAA TAF, 2017.

3.5.3. General Aviation Operations

Annual itinerant aircraft operations, those flights originating or terminating 20 miles or greater from BGM, similar to air carrier activity, have experienced a slow and steady decline to what is believed to be minimum core activity levels. Unlike commercial activity, GA has been somewhat stable in the recent years. The GA itinerant operations include anticipated growth from the new tenant, Evolution Jets, which is expected to cycle aircraft through BGM on a daily basis for maintenance and grow over time. Aside from this new tenant activity, it is expected that itinerant GA operations at BGM will grow in line with the national forecast outlined over the long term. The opportunity exists to grow above these levels should the airport attract tenants from outside of the region (i.e. New York City metro area).

Local GA operations at BGM are projected to show 0.4 percent growth based on the 2017 FAA Aerospace Forecast. Activity levels will be relatively stable barring the introduction of a new flight school, as training operations typically comprise the majority of local operations.

3.5.4. Military Operations

With constant changes in national security and relief needs, military operations tend to fluctuate over time. At BGM, local and itinerant military operations have been relatively stable over the past 20 years ranging between 200 and 1,000 total operations for both itinerant and local military operations. The FAA TAF reports zero growth in military operations at BGM; it is anticipated the annual averages will fluctuate within the historical ranges. It anticipated the C-130 aircraft will conduct the majority of the military operations.

3.5.5. Aircraft Fleet Mix

As alluded to previously in **Section 3.2**, both commercial and GA 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 3-10** contains a representative sample of the existing and anticipated future fleet mix for BGM. It is important to note that aircraft not yet in the marketplace, 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 3-10: Aircraft Fleet Mix

	Existing (2017)	Future (2037)
Commercial Service (Air Carrier)	CRJ-200	CRJ-700
		CRJ-900
		Embraer 175
	35.30%	37.40%
General Aviation Itinerant (Including Air Taxi)	Falcon 2000 LXS	Gulfstream G-V
	Cessna Citation 525	Embraer Phenom 300
	Hawker 849	Dassault Falcon 5X
	Piper Navajo	Pilatus PC-12
	42.1%	40.80%
General Aviation Local	Cessna Skyhawk (172)	Diamond DA-42
	Piper Seminole	Cessna Skycatcher
	18.50%	18.0%
Other	C-130 (Military)	C-130J (Military)
	4.10%	3.80%

Source: McFarland Johnson, 2017.

3.5.6. 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 BGM passenger market is more balanced on an annual basis compared to similar sized airports. Like with passenger enplanements, there is no significant peak in activity on an annual basis for commercial activity. With GA factored in for the overall airport operational counts, recreational activity is elevated in the summer and fall months. A peaking factor of 10 percent will be used for planning purposes (equal monthly 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 when planning and analyzing an airport's peaking characteristics. In the case of BGM the peak month activity is divided by 30 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. A peaking factor of 15 percent will be applied to the average day of the peak month for peak hour planning at BGM.

Peak operational characteristics for BGM are displayed in **Table 3-11**.

Table 3-11: Peak Hour Operations

	2017 (Existing)	2022	2027	2032	2037
Operations	12,547	15,747	17,578	18,386	19,280
Peak Month	1,041	1,307	1,459	1,526	1,600
Average Day Peak Month	35	44	49	51	54
Peak Hour	6	7	8	8	9

Source: McFarland Johnson, 2017.

3.6. BASED AIRCRAFT

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

3.6.1. Growth Elements

As with operations, growth elements affecting based aircraft at BGM are expected to generally follow national trends related to GA fleets. The current breakdown of aircraft by type at BGM is consistent with similar sized airports in the region. The growth rates used in this forecast represent those in the most recent FAA Aerospace Forecast for 2017 to 2037.

Single/Multi Piston –Piston (single and multi) aircraft are forecasted to follow a negative growth rate over the next 20 years while turbine aircraft will grow positively throughout the planning period. As the economic advantage of aircraft leasing, renting, fractional ownership, and flying clubs become more popular, the number of newly purchased piston engine aircraft is decreasing in most regions. While the aircraft counts are negative, the negative aspects are offset from enhanced utilization from a broader user base not burdened by high-entry costs.

Turbine/Jet – Advancements in fuel efficiency and aircraft technology has resulted in a wide variety of new products entering the turbine and jet aircraft market. More aircraft options at lower costs have increased the number of aircraft in the business aviation market not only as a lease/purchase capacity but also more fractional ownership and charter options. 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 throughout the planning period.

Table 3-12 displays the based aircraft forecast for BGM.

Table 3-12: BGM Based Aircraft Forecast

	Single	Multi	Jet	Rotor	Total
2017 (Existing)	26	6	3	2	37
2022	25	6	3	2	36
2027	24	6	4	2	36
2032	23	7	4	3	37
2037	22	7	5	3	37

Source: Greater Binghamton Airport (2017); Growth rates based on FAA National Aerospace Forecast 2017-2037.

BGM's location relative to the congested and costly New York Metro area airports could result in additional jet aircraft being attracted to the Airport to use BGM as an operating base for the northeast. A planning scenario will consider the facility impacts of an additional 12 based turbine/jet aircraft at BGM.

3.7. FORECAST SUMMARY

Table 3-13 presents a summary of the aviation demand forecasts developed for BGM and detailed throughout this chapter. 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.

3.7.1. 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 an 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 National Plan of Integrated Airport Systems (NPIAS) airports. Table 3-14 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 operations forecast exceed the general guidelines identified by the FAA (10 percent within 5 years, 15 percent within 10 years) however this is due to the overall small total numbers which reduces the size of the tolerances. The forecast is below past activity peaks and these forecasts levels, while above the TAF, will not drive any

facility requirements as they do not surpass highs in recent years. In the past 20 years, BGM has at its peak handled over 144,508 annual enplanements and 50,174 annual operations. Comparison with the FAA TAF can be seen in Appendix C.

Table 3-13: Aviation Demand Forecast Summary

	FORECAST				
	2017 (Existing)	2022	2027	2032	2037
Enplanements					
Air Carrier/Airline	33,666	43,276	47,131	58,912	62,951
Peak Hour	50	66	76	76	85
Aircraft Operations	**12,547**	**15,747**	**17,578**	**18,386**	**19,280**
Air Carrier/Air Taxi	3,350	3,131	3,001	2,940	3,695
General Aviation					
GA Itinerant	5,866	9,260	11,175	11,997	12,089
GA Local	2,995	3,040	3,086	3,133	3,180
Military	316	316	316	316	316
Peak Hour	6	7	8	8	9
Based Aircraft	**37**	**36**	**36**	**37**	**37**
Single	26	25	24	23	22
Multi	6	6	6	7	7
Jet	3	3	4	4	5
Rotor	2	2	2	3	3

Source: McFarland Johnson 2019.

3.8. 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 3-15 displays the RDC criteria used in airport planning to determine AAC and ADG.

For air carrier traffic, the CRJ-200 currently meets the critical aircraft requirement of a minimum of 500 annual itinerant operations at BGM and is classified as a D-II aircraft. However, as regional airlines gradually up-gauge aircraft over time, the critical aircraft is forecast to change to the larger CRJ-900, which is a C-III aircraft due to a longer wingspan. The C-III ADG designation is consistent with previous, as well as ongoing, planning efforts for BGM. The anticipated replacement of the CRJ-200 with the CRJ-900 is confirmed in the letter provided by the current air carrier, SkyWest, which is provided in Appendix B. While the timeline for the conversion of air carrier aircraft is undetermined at this time, it is prudent to anticipate this change within the 20-year planning

period of the Master Plan Update. Some planning scenarios consider larger aircraft such as the Airbus A320, which is also a C-III aircraft. Table 3-16 presents the design details for each of these aircraft.

Table 3-14: Aviation Demand Forecast vs. FAA Terminal Area Forecast

	BASELINE	FORECAST				
	2017 (Existing)	2018	2022	2027	2032	Average Annual Growth
FAA TAF (2017)						
Enplanements	41,454	41,454	41,454	41,454	41,454	0.00%
Total Operations	12,547	12,062	12,130	12,215	12,300	-0.13%
Based Aircraft	37	39	42	44	44	1.16%
Master Plan Forecast						
Enplanements	33,666	36,520	43,276	47,131	58,912	3.80%
Total Operations	12,547	13,620	15,747	17,578	18,386	2.58%
Based Aircraft	37	37	36	36	37	0.00%
Pct. Difference From TAF						
Enplanements	-18.79%	-12.19%	4.40%	13.69%	42.11%	-
Total Operations	0.00%	12.92%	29.82%	43.91%	49.48%	-
Based Aircraft	0.00%	-5.12%	-14.29%	-18.18%	-15.91%	-

Source: 2017 FAA TAF, and McFarland Johnson, 2019.

Table 3-15: FAA Airport Reference Code

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

Source: FAA AC 150/5300-13A.

Table 3-16: Existing and Future Design Aircraft

	Existing and Future Design Aircraft		
Aircraft Model	CRJ-200	CRJ-900	A320 (Scenario)
Length Overall	87.8 feet	118.9 feet	123 feet 3 inches
Wingspan	69.6 feet	81.6 feet	111 feet 9 inches

	Existing and Future Design Aircraft		
Aircraft Model	CRJ-200	CRJ-900	A320 (Scenario)
Tail Height	20.4 feet	24.6 feet	39 feet 6 inches
Main Gear Width	12.0 feet	16.5 feet	29.4 feet
Cockpit to Main Gear	24.5 feet	55.6 feet	50.2 feet
Maximum Takeoff Weight	51,000 lbs.	84,500 lbs.	17,961 lbs.
Approach Speed Category	D	C	C
Aircraft Design Group	II	III	III

Source: FAA AC 150/5300-13A, FAA Flight Standards Information Management System.

For general aviation traffic, numerous aircraft of all sizes and approach speed capabilities operate at the Greater Binghamton Airport on an annual basis. In review of existing annual operations at the Airport, the representative design aircraft for general aviation operations has been identified as a Swearingen Metroliner and the Beech Super King Air 350, which are categorized with a B-II ADG. Operations levels at present are approaching the threshold of 500 annual operations by general aviation aircraft with an approach speed category of C, which in the future is anticipated to lead to a C-II ADG for general aviation aircraft at BGM, represented by the Embraer Legacy and Gulfstream G200.