3. Forecast of Aviation Activity

3.1 Introduction

Projecting future aviation demand is a critical element in the Airport Master Plan process since many of the ultimate proposals and recommendations are largely based on aviation activity demand forecasts. The forecasts of aviation activity developed in this chapter will be used in subsequent tasks to analyze the Beverly Regional Airport's (the Airport or BVY) ability to accommodate future activity and to determine the type, size, and timing of future airside and landside developments. This step of the master planning process, in essence, acts as the hub for the remainder of the plan in that the decision to proceed with projects is often based on the anticipated levels of demand, including aircraft operations, based aircraft as well as types of aircraft activity.

Forecasts must be both reasonable and defensible, since they can serve as the basis of future facility development requirements.

This chapter discusses the findings and methodologies used to project aviation demand at BVY for the next 20 years (2019 through 2039). While forecasting considers the most accurate information available at the time the projections are completed, it is not an exact science. Divergences from a prepared forecast can often occur due to any number of factors that simply cannot be anticipated. However, when soundly established, a forecast will provide a reasonable and defensible rationale that will guide the analysis of future airport development needs.

2019 serves as the base year of the BVY AMP since it was the last completed calendar year prior to this effort. Forecasts are generated for the near-term (2024), mid-term (2029), and long-term (2039) time frames.

The BVY forecast analysis includes methodologies that consider historical aviation trends at the Airport, the surrounding region, and throughout the nation. Projections were prepared for the near-term (2024), mid-term (2029), and long-term (2039) timeframes. Specifically, the aviation demand forecasts developed for BVY in this study are documented in the following sections:

- Overview of Airport Market Area
- National and Regional Trends
- Historical and Current Aviation Activity
- Projections of Aviation Activity
- Critical Design Aircraft
- Summary

Note: potential implications associated with the COVID-19 pandemic on this forecast are addressed on Page 3-33.

3.2 Overview of Airport Market Area

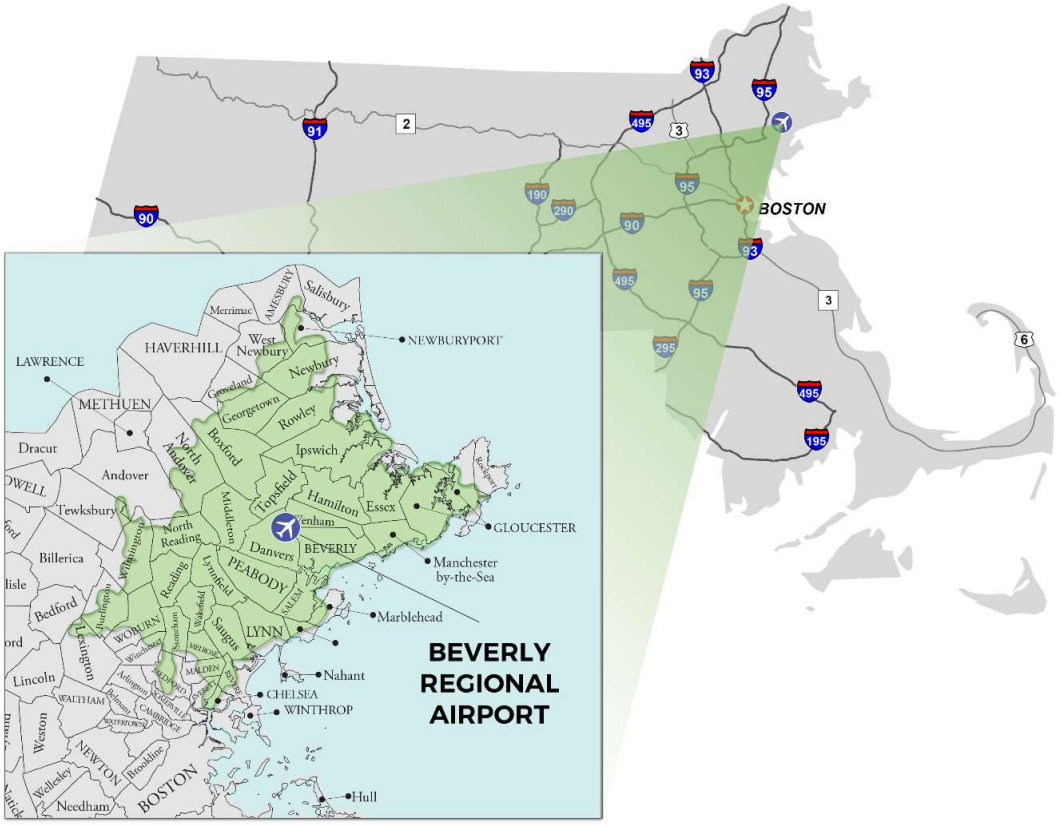
It has been shown that there can be a strong correlation between a region's demographic/socioeconomic conditions and aviation demand within that region. This is because spending on aviation is typically discretionary in nature both in regard to business and personal use. This section will define the BVY airport market area and the factors that typically influence aviation activity projections.

3.2.1 Definition of the BVY Airport Market Area

An airport market area is defined as the actual geographic region served by a particular airport. For the Beverly Regional Airport, the airport market area has been established by the Massachusetts Statewide Airport System Plan (MSASP) and is based on a 30-minute drive time from the Airport. This is a standard industry metric that assumes that a user of an airport like BVY will travel up to 30 minutes to utilize the facility. (Note that it is understood that road types, alignment, and traffic conditions will influence the drive time, so the 30-minute drive time is based on average driving conditions.) The BVY market area for BVY includes elements of 39 municipalities in eastern Massachusetts, including the following:

- Beverly
- Boxford
- Burlington
- Chelsea
- Danvers
- Essex
- Everett
- Georgetown
- Gloucester
- Groveland
- Hamilton
- Ipswich
- Lexington
- Lynn
- Lynnfield
- Malden
- Manchester-by-the Sea
- Marblehead
- Medford
- Melrose
- Middleton
- Nahant
- Newbury
- Newburyport
- North Andover
- North Reading
- Reading
- Revere
- Rowley
- Salem
- Stoneham
- Topsfield
- Wakefield
- West Newbury
- Wenham
- Wilmington
- Winchester
- Woburn

Figure 3-1: Airport Market Area for BVY



Source: Jviation.

3.3 National and Regional Trends

In preparing an aviation forecast, it is important to have a general understanding of recent and anticipated trends in the overall aviation industry. National trends will often provide important insights that can be leveraged for the development of aviation activity projections for an airport. Various data sources were utilized and examined to identify these trends, including the following:

- Federal Aviation Administration (FAA) - *FAA Aerospace Forecasts, 2019-2039*
- National Business Aircraft Association (NBAA) - *NBAA Business Aviation Fact Book 2019*
- Honeywell Corporation – *28th Annual Business Aviation Outlook, 2019*

The following sections provide an overview of the general aviation sector of the aviation industry.

3.3.1 National General Aviation (GA) Trends

At the national level, fluctuating trends related to general aviation (GA) usage and economic uncertainty resulting from the nation's and international business cycles all can have significant impacts on general aviation demand levels. This section provides an overview of those current general aviation trends, as well as some of the various factors that have influenced those trends throughout the U.S. These are important considerations in the development of projections of aviation demand for BVY since it is a general aviation airport.

General aviation aircraft are classified as all aircraft not flown by commercial airlines or the military. This includes an incredibly diverse array of flying that ranges from a personal vacation trip in a small single engine plane to an overnight package delivery to an emergency medical evacuation to business-related travel to flight instruction that trains new pilots to helicopter traffic reports that keep drivers informed of rush-hour delays. Simply stated, general aviation encapsulates all of those individual unscheduled aviation activities that enrich, enhance, preserve, and protect the lives of citizens.

As defined by the FAA, general aviation activities are divided into six use categories:

- Personal - About a third of all private flying in the United States is for personal reasons, which may include practicing flight skills, personal or family travel, personal enjoyment, or personal business.
- Instructional - All private flight instruction for purposes ranging from private pilot to airline pilot is conducted through general aviation.
- Corporate - About 12 percent of the total private flying in the U.S. is done in aircraft owned by a business and piloted by a professional. The majority of these flights are in jets and cover long distances, with some flying to intercontinental and international destinations. Businesses elect to fly these trips to save time and expand their geographic markets.
- Business – It's estimated that almost 11 percent of the total private flying in the U.S. is done by businesspersons flying themselves to meetings or other events, primarily in piston or turboprop aircraft. Most of the pilots own or

work for relatively small businesses and use the aircraft to accomplish missions that would otherwise take more time or would be infeasible.

- Air Taxi - When scheduled air service either is not available or inconvenient, businesses and individuals can charter aircraft from air taxi service providers. These flights save time and make it possible to fly directly to places that cannot be reached by scheduled service. (Note that "air taxi" is also utilized as a commercial air service classification, which is discussed later.)
- Other – All other activities under general aviation are classified as being "other." Given the diverse nature of general aviation, this includes broad uses such as, but not limited to disaster relief, search and rescue, police operations, news reporting, border patrol, forest firefighting, aerial photography and surveying, crop dusting, and tourism activities.

Business Use of General Aviation

Business and corporate aviation are the fastest growing facets of general aviation, contributing $150 billion to U.S. economic output annually and employing more than 1.2 million people. The difference between the facets is that corporate aircraft are flown by professional pilots, whereas business aircraft are flown by non-professional pilots on company business. Companies and individuals use aircraft as a tool to improve the efficiency and productivity of their business and personnel. Use of general aviation aircraft afford businesses and individuals direct control of their travel itineraries, destinations and significantly reduce travel times and inconveniences often associated with scheduled airline service.

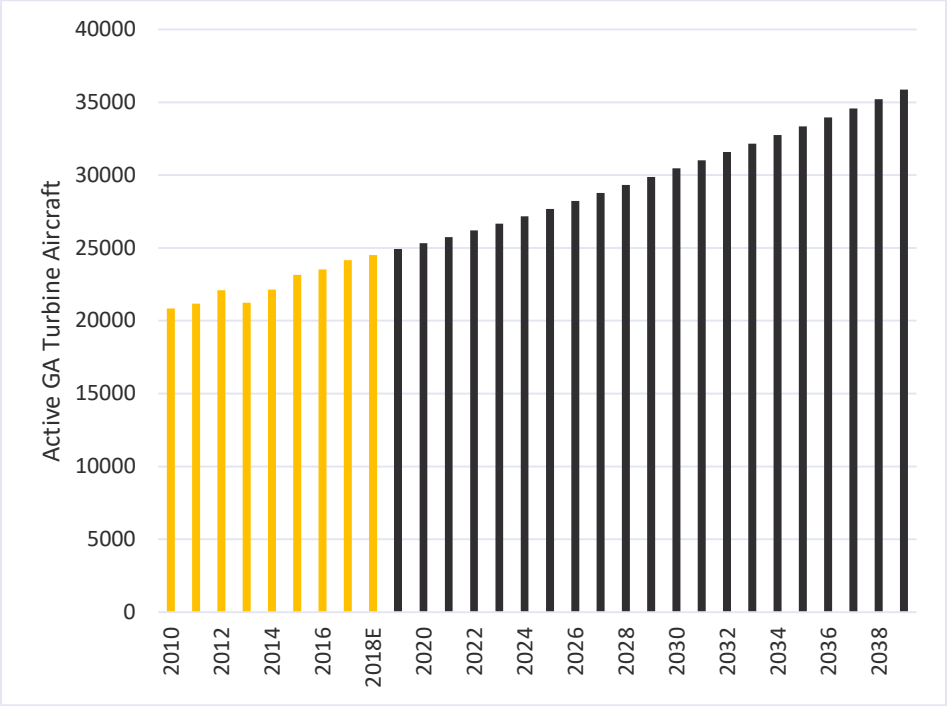
It should be understood that corporate general aviation is not the exclusive concern of Fortune 500 companies. In fact, according to the NBAA's Business Aviation Fact Book 2019, only 3 percent of the approximately 15,000 business aircraft registered in the U.S. are flown by these companies. The remaining 97 percent are actually operated by a broad cross-section of organizations, including government, universities, charitable organizations, and businesses of all sizes. The vast majority of the U.S. companies that utilize business aircraft (85 percent) are small- and mid-size businesses, many of which are based in communities across the country where commercial air service providers have reduced or eliminated service. Honeywell's 28th Annual Business Aviation Outlook, 2019 highlighted the following:

- Up to 7,700 deliveries of new business jets valued at over $251 billion are expected through 2028
- Operators plan to replace 20 percent of their fleets with new jets within the next 5 years
- Large cabin jets account for more than 62 percent of new purchases
- 61 percent of worldwide sales originate in North America

Additionally, business and corporate aviation operations are a source of good jobs. Flights made by these aircraft require significant technical and operational support. Tens of thousands of pilots, maintenance technicians, schedulers, dispatchers, flight attendants, training professionals, airport employees and other support personnel are employed to support corporate and business aviation.

Use of general aviation aircraft by business and corporate aviation ranges from small, single-engine aircraft rentals to multiple aircraft corporate fleets supported by dedicated flight crews and mechanics. Business aircraft usage by smaller companies has also escalated dramatically as various chartering, leasing, fractional ownership, interchange agreements, partnerships, and management contracts have emerged. The growth in this facet of the industry is demonstrated in **Figure 3-2** below that the FAA's historical and projected number of turbine aircraft.

Figure 3-2: Active General Aviation Turbine Aircraft 2010-2039



Source: FAA Aerospace Forecast 2019-2039.
Note: Historical years are in yellow; 2018 is estimated.

Of special note with respect to corporate and business aviation is the immense popularity of fractional ownership operations, which began in 1986 with the creation of programs that offered aircraft owners increased flexibility in the ownership and operation of aircraft, as well as providing a financially viable alternative to flying commercially. Such programs use alternative aircraft acquisition concepts over traditional methods, including shared or joint aircraft ownership, and provide for the management of the aircraft by an aircraft management company. The aircraft owners participating in a program like this agree not only to share their aircraft with others having a common interest in that aircraft, but also to lease their aircraft to other owners in the program. The aircraft owners use a common management company to provide aviation management services including maintenance of the aircraft, pilots, scheduling and administration of the leasing of the aircraft among the owners. Even during times of unsteady economic conditions, fractional operator businesses have consistently grown as existing and new customers increase or initiate their fractional aircraft usage.

Growing segments of the corporate and business aircraft fleet mix include business liners and smaller corporate jets. Business liners are large business jets, such as the Boeing Business Jet and Airbus ACJ, which are reconfigured private versions of those commercial passenger aircraft typically flown by airlines. Smaller corporate jets are typically six-seats or less and cost substantially less than typical business jet aircraft. These aircraft are generally less demanding in terms of runway length requirements. This has allowed small corporate jets to operate at smaller airports with shorter runways, resulting in more airports becoming viable options for these types of jet operations. Three common aircraft in this group are the Eclipse 550, Embraer Phenom 100, and Cessna Mustang.

One of the most important trends identified by the FAA in these forecasts is the strong growth anticipated in active general aviation jet aircraft. In terms of growth in the number of turbine aircraft (i.e., turboprop and jet), impacted by the economic recession and the resultant pressures on companies to reduce costs, the overall production of jet aircraft declined slightly in 2011 and 2012. However, since that time, the production of jet aircraft has experienced substantial growth, increasing at over 2.0 percent annually on average from approximately 20,853 aircraft to 24,510 between 2010 and 2018. The active general aviation turboprop and jet aircraft fleet is anticipated to continue to increase dramatically over the projection period, to an estimated 29,880 aircraft in 2029, and the total number of jet aircraft specifically nearly doubling by 2039.

General Aviation Piston Operators

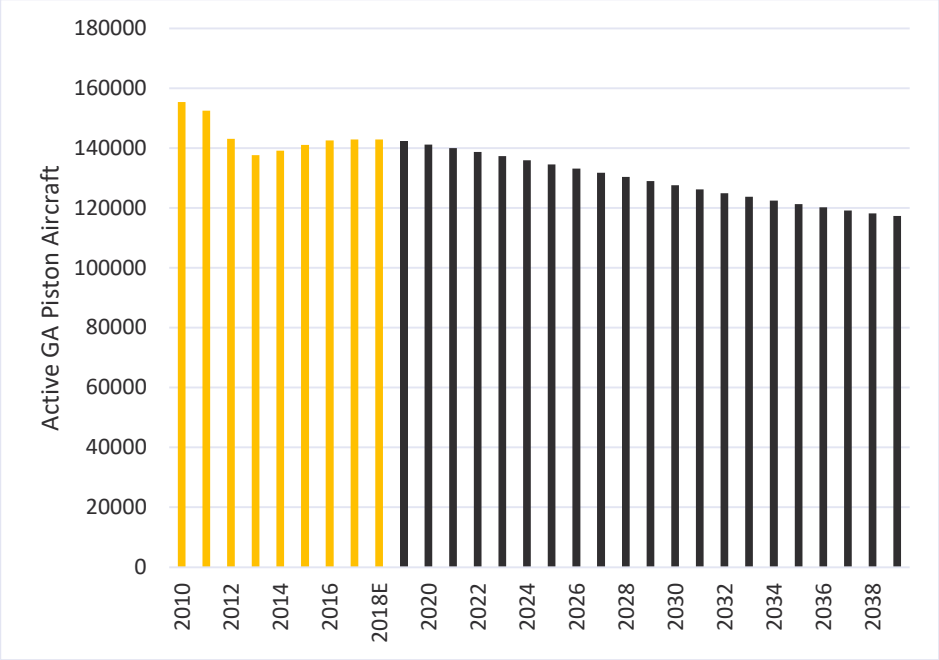
Single and multi-engine piston aircraft experienced a decline in the number of aircraft between 2010 and 2018. Although still the largest portion of aircraft in the active fleet, the number of single engine aircraft fell from 139,519 in 2010 to 129,885 in 2018, a 0.9 percent average annual decline. During that same period, multi-engine piston aircraft had a steeper decline, falling from 15,900 aircraft to 13,040, a 2.4 percent annual decrease. In total, active piston aircraft decreased at 1.0 percent annually over that time period. Much of this decline is attributed to the retirement of older aircraft in combination with the relative high costs for new, replacement aircraft, fuel and maintenance services.

In its annual Aerospace Forecast, the FAA expects the number of active piston general aviation aircraft to continue to decline, similar to that of the past decade. Over the next decade, the decrease in the number of piston aircraft is expected to be 0.9 percent per year and remain at that same rate over the next two decades. The resultant forecast shows total piston aircraft (combined single- and multi-engine) falling from 142,925 in 2018 to 117,280 in 2039. This is reflected in **Figure 3-3** below.

However, it must be also recognized that the FAA has established a relatively new category of piston-engine aircraft: the light sport aircraft. These aircraft are very small (usually holding only one or two people) and meet certain regulations set by the FAA through restricting weight and performance. Aircraft which qualify as a light sport aircraft are smaller, typically 1-2 seats, and may be operated by holders of a sport pilot certificate. These aircraft are being employed to satisfy the demand for personal and recreational flying while the overall number of traditional piston-engine aircraft decline. At the end of 2018, a total of 2,665 active light-sport aircraft were estimated

in this category. The FAA forecast assumes about 3.5 percent average annual growth of the light sport fleet by 2039, to a total of 5,555 aircraft.

Figure 3-3: Active General Aviation Piston Aircraft 2010-2039



Source: FAA Aerospace Forecast 2019-2039.
Note: Historical years are in yellow; 2018 is estimated.

Summary of National General Aviation Trends

The following is an excerpt from the *FAA Aerospace Forecast 2019-2039* that summarizes the overall GA market:

> *The long-term outlook for general aviation is stable to optimistic, as growth at the high-end offsets continuing retirements at the traditional low end of the segment. The active general aviation fleet is forecast to remain relatively level between 2019 and 2039. While steady growth in both GDP and corporate profits results in continued growth of the turbine and rotorcraft fleets, the largest segment of the fleet – fixed wing piston aircraft continues to shrink over the forecast. Against the stable fleet, the number of general aviation hours flown is projected to increase an average of 0.8 percent per year through 2039, as growth in turbine, rotorcraft, and experimental hours more than offset a decline in fixed wing piston hours.*

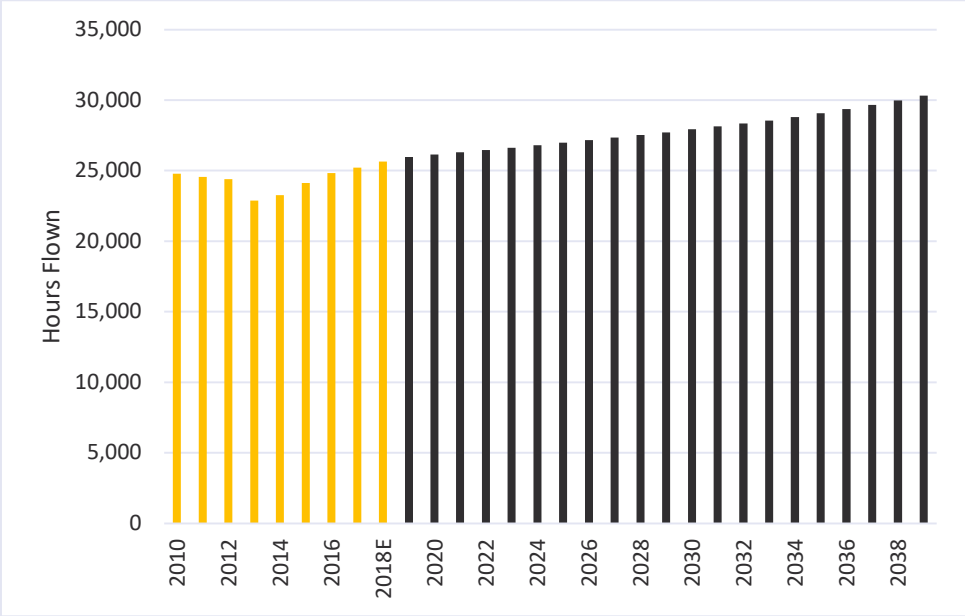
Incentivized by time savings efficiencies and benefits, business demand for general aviation is anticipated to far exceed that of private or recreational aviation, where the rising costs associated with aircraft operations and pilot proficiency have suppressed demand. This simply means that business aviation in the form of turboprops and jets will grow faster than that of piston aircraft, with an average annual growth of approximately 2 percent. But even with the projected robust

growth in turbine aircraft, that increase is not anticipated to offset the entire decline of piston aircraft during the 20-year forecast. This will result in a slight overall decline of total general aviation aircraft of 0.04 percent annually on average per year through 2039.

The FAA also tracks and projects an important metric, known as Active General Aviation and Air Taxi Hours Flown, that captures a number of activity-related data including aircraft utilization, frequency of use, and duration of use. From 2010 to 2018, hours flown in general aviation piston aircraft experienced a slight decline (0.3 percent annual average), which is expected to continue at an increasing rate over the 20-year planning period (1.0 percent annual average). Conversely, turboprop and jet aircraft hours flown are expected to continue to grow at relatively high rate of 2.3 percent on average annually from 2019 to 2039.

Figure 3-4 below depicts historical general aviation and air taxi hours flown from 2010 through 2018 as well as projected hours flown through 2039. Total hours flown by general aviation and air-taxi aircraft are estimated to reach 30.3 million by 2039, compared to 25.6 million in 2018. As shown in the graph, a decline was experienced from 2011 to 2013 spurred by the economic recession, much of which was realized by piston aircraft owners. However, since that time, hours flown totals have recovered and the FAA currently projects a steady increase of 0.46 percent on average through 2039. When comparing this to the FAA projected average annual growth rate of the general aviation active fleet (0.8 percent average annual growth rate), the difference represents an anticipated decrease in aircraft utilization.

Figure 3-4: Historical and Projected Total U.S. General Aviation and Air Taxi Hours Flown 2010-2039

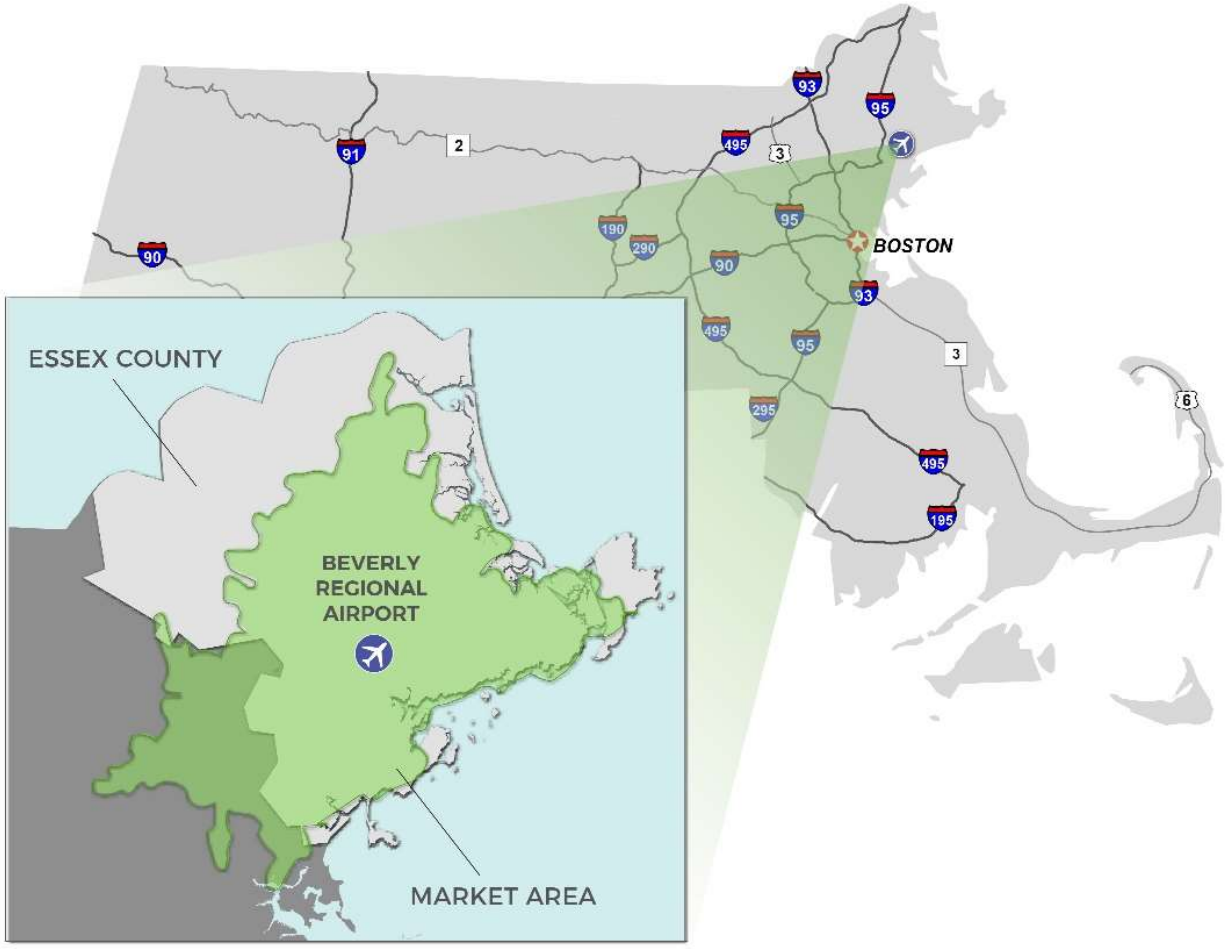


Source: FAA Aerospace Forecast 2019-2039.
Note: Historical years are in yellow; 2018 is estimated.

3.3.2 Regional Trends

In addition to the national level, airport forecasts are impacted by trends are experienced on a regional basis. Thus, additional data was collected and reviewed to identify potential growth areas in aviation demand for BVY's surrounding region. Note that historical and projected demographic and socioeconomic data used in this effort is on county level, since that is how the data has been made available. So, Essex County is serving as the basis of the demographic and socioeconomic assessment for BVY. Though the airport market area extends into neighboring counties, most of it is encompassed by Essex County, as shown in **Figure 3-5.** For this reason, county figures were used as the primary indicators of BVY's market area.

Figure 3-5: Essex County and the BVY Market Area



Source: Jviation.

Regional Socioeconomics

Aviation activity has traditionally been linked to various socioeconomic factors, such as population, employment and earnings. These linkages are related to the discretionary nature of personal and business travel as well as the recreational component of general aviation activity. **Table 3-1** provides historical levels and projections of these key socioeconomic indicators within BVY's market area. These

data were taken from the 2018 *Complete Economic and Demographic Data Source* prepared by Woods and Poole Economics, Inc. In most cases, the Woods and Poole data provides a conservative estimate of growth. Again, since this data is aggregated on a county basis and the majority of BVY's market are lies within Essex County, that is the is the focus of the table.

Table 3-1: Essex County Socioeconomic Data

Year	Population	Employment	Per Capita Personal Income
Historical			
2000	725,030	390.460	$38,118
2010	745,690	402,260	$51,883
2016	779,020	461,140	$61,442
2017	783,250	470,630	$63,640
CAGR 2000-2017	.5%	1.1%	3.1%
Projected			
2020	797,760	488,580	$70,521
2025	822,140	515,760	$86,579
2030	845,920	543,050	$110,002
2040	884,250	595,030	$180,259
CAGR (2020-2040)	.5%	1.0%	5.1%
Massachusetts			
CAGR (2010-2040)	.5%	1.2%	1.2%
United States			
CAGR (2010-2050)	.8%	1.1%	1.5%

Source: Woods & Poole Economics, Inc., 2018.
[1] Essex County, MA.
CAGR = Compound Annual Growth Rate.
CAGRs rounded to nearest percent.

Population

Aviation demand can be strongly tied to the number of people within an airport's market area. For both commercial service and general aviation activity, as the number of people living in a region grows, the demands for these services typically increase. **Table 3-1** presents the most recent and forecasted population for Essex County in Massachusetts. Over the planning period, the population in Essex County is expected to increase 0.5 percent annually through 2040. This rate is consistent with that of Massachusetts (0.5 percent) but is slightly lower than the projected national rate (0.8 percent). Essex County accounts for approximately 11.4 percent of the total population of Massachusetts.

Employment

Levels of employment can also be excellent indicators for aviation demand within a geographic area. As with other metrics, current and forecasted levels for the airport market area were compiled and presented above in **Table 3-1**. Employment within Essex County over the past seven years has increased annually by 1.1 percent. Over the next 20 years, employment levels in the airport market area are expected to be slightly lower than in the past, with an annual increase of 1.0 percent in employment.

Personal Income

Personal income reflects the sum of wages and salaries of workers within a defined geographic area as well as other sources of income. This is reflective of how positive the business climate may be within a region. The growth in personal income relates to aviation activity in that corporate and private use of general aviation services is often discretionary in nature. Due to this relationship, as personal income grows, so too does discretionary spending, and the use of aviation services often increases accordingly. As with other demographic indicators, current and forecasted personal income within the study area was compiled from the Woods and Poole data, and area presented above in **Table 3-1**.

Historically, the BVY market area has experienced a growth rate of 3.26 percent since 2000; this is generally consistent with that of Massachusetts and the U.S., which are 3.4 percent and 3.2 percent, respectively. Over the next 20 years, the data shows that the rate of personal income growth in the airport market area is expected to increase markedly to 5.1 percent annually.

Within the context of this master plan forecasting effort, the projected growth rates for these demographics were applied to various forecasting methodologies. These methodologies were then compared with other forecasting approaches developed through the use of aviation industry trends and FAA metrics.

Local Economic Development

Economic development within the region will influence the future aviation demand at BVY by drawing more people to the area and contributing to growth in the local economy. The City of Beverly itself offers various economic incentives to encourage and maintain development including:

- Sign Improvement Program
- Retail Incentive Program
- STAR Program
- Historically Under-Utilized Business Zones
- Tax Increment Financing Zones

The City of Beverly prides itself on being an all-inclusive environment having arts, food, shopping, recreation and entertainment, making it attractive to companies and corporations wishing to remain within the area or relocate to Beverly. Additionally, potential use of BVY by corporate aviation users will also increase as new companies locate operational bases within the region. A brief review of recent economic growth

within the airport market area was conducted, as well as identifying potential growth areas near BVY.

The Airport is bordered on the south by the Cherry Hill Office Park, generally regarded as one of the area's most successful business parks. Encompassing an area of approximately 245 acres, the office park currently includes the following companies:

- Axcelis Technologies
- ABIOMED Inc.
- Medtronic Inc.
- Amphenol Pcd
- IXYS Integrated Circuits Div

Note that these five companies are part of the 200 largest employers in the Peabody-Salem-Beverly area according to the Massachusetts Executive Office of Labor and Workforce Development.

3.4 Historical and Current Aviation Activity

Historical based aircraft and operations data for BVY provide the baseline from which future activity at the Airport can be projected. While historical trends are not always reflective of future periods, historical data can provide insight into how local, regional, and national demographic and aviation-related trends may be tied to a given airport. The following sections include historical overviews of BVY's based aircraft (generally defined as an aircraft that is permanently stored at an airport) and aircraft operations (generally defined as either an aircraft landing or departure – hence a takeoff and a landing would count as two operations).

Since Beverly Regional Airport has an Airport Traffic Control Tower (ATCT), it has a formal mechanism for counting airport operations on a regular basis. It should also be noted that these operations are only counted during tower operational hours. That information is ultimately provided to the FAA for storage in a centralized federal database to be used by the FAA for the development of a Terminal Area Forecast (TAF) for the Airport. (Note that the TAF is developed by the FAA and combines historical airport operations data and FAA Form 5010 data to generate a long-range forecast). The specific sources that have been utilized to establish the historical activity record for BVY include the following:

- FAA Terminal Area Forecast (TAF) data for BVY *(Forecast Issued February 2019)*
- BVY FAA 5010 Data (Inspection date 10/1/2019)
- FAA Air Traffic Activity Data System (ATADS)
- FAA Traffic Flow Management System Counts (TFMSC)

3.4.1 Aircraft Operations

Annual aircraft operations represent the number of aircraft takeoffs and landings occurring at an airport during a calendar year. The historical operations data includes operations conducted by both based aircraft as well as operations conducted by itinerant aircraft. Based aircraft can be tied to local GA traffic since most it will be

conducted by those same aircraft. Itinerant aircraft are defined as those that are based at other airports that arrive at BVY for a variety of reasons, including business, recreation, or flight training purposes. Historical aircraft operations data for BVY are summarized below in **Table 3-2**.

Aircraft operations are divided into two categories: itinerant operations and local operations. The FAA defines a "local operation" as an operation performed by aircraft that remain in the local traffic pattern, execute simulated instrument approaches or low passes at the airport, and the operations to or from the airport and a designated practice area within a 20−mile radius of the tower. They are often associated with flight training operations. Itinerant operations at a given airport are those operations performed by an aircraft (either based at that airport or not) that land at that airport, arriving from outside the airport area, or departs an airport and leaves the airport area.

The basis for BVY's historical operational counts is the FAA's Air Traffic Activity System (ATADS) which derives its information from operational counts performed by local ATCTs, like that at BVY. This is considered to be the best airport operational data currently available since it is based on actual aircraft operations counted by staff located in the ATCT. However, it is also important to recognize that there are limitations to this data source in that operations are only counted when the ATCT is operational. BVY's ATCT is staffed between the hours of 7:00 am to 8:00 pm between November 14th and May 15th, and 7:00 am to 9:00 pm for the remainder of the year. Thus, the ATADS data is understating the actual operational counts currently being reported for the Airport. To compensate for this deficiency, it is reasonable to assume that an estimated 10 percent of the Airport's total operations are not being reflected in the ATADS operational counts. This correction factor has not been applied to the following table.

Table 3-2: BVY Historical Annual Aircraft Operations

	Itinerant				Local		
Year	Air Carrier	Air Taxi	General Aviation	Military	General Aviation	Military	Total
2010	2	753	28,149	207	31,646	68	60,825
2011	6	853	26,336	184	32,283	32	59,694
2012	3	1,436	24,743	184	32,024	36	58,426
2013	3	1,446	23,461	206	29,280	48	54,444
2014	0	1,480	20,302	206	22,182	36	44,206
2015	0	1,532	23,181	146	25,457	42	50,358
2016	0	1,718	23,831	158	25,330	68	51,105
2017	0	1,878	25,195	93	26,328	50	53,554
2018	3	1,777	25,880	107	29,008	28	56,803
2019[1]	0	1,946	29,028	99	35,854	22	66,949
CAGR[2]	0%	11.1%	0.3%	-7.9%	1.4%	-11.8%	1.07%

Source: FAA ATADS Data (2010 - 2019).
[1] 2019 has been identified as the base year for the BVY Forecast.
[2] CAGR = Compound Annual Growth Rate (for years 2010 to 2019).

Most aircraft operations at BVY are conducted by general aviation aircraft, which include aircraft that are not used for commercial service or military purposes. General aviation encompasses pleasure flying and flight training, along with business and corporate aviation activities. In general, BVY's recent operational history has been one of growth since 2014. This timeframe also marks the end of a severe economic recession experienced locally and nationally. Since 2014, itinerant and local general aviation operations at BVY have increased steadily. This includes robust growth in Air Taxi activities which are generally reflective of air charter operations, themselves being indicators of business aviation in the region.

Overall, operations at BVY over the 10-year historical period increased from 60,825 to 66,949, an average annual increase of 1.07 percent. However, it should also be noted that since the end of the recession in 2014 when operations reached their lowest point, operations at BVY have increased annually at an 8.7 percent growth through 2019.

3.4.2 Based Aircraft

Historically, based aircraft at Beverly Regional Airport, as reflected in the FAA Terminal Area Forecast (TAF) database, have seen a shallow decline over the past 10 years (see **Table 3-3**). It should also be noted that the FAA now employs a more accurate means of tracking based aircraft throughout the country; thus, the National Based Aircraft Inventory (NBAI) is being utilized for BVY's current based aircraft count.

Table 3-3: BVY Historical and Current Based Aircraft

Year	Based Aircraft
2010	112
2011	98
2012	103
2013	98
2014	101
2015	108
2016	102
2017	109
2018[1] TAF Count	109
2019 TAF Count	110
2019[2] NBAI Verified Count	100
CAGR[3]	-.6%

Source: FAA Terminal Area Forecasts.
[1] 2018 has been identified as the base year for the BVY Forecast. Note that 2018 and 2019 operational data are forecasted years in the TAF.
[2] Actual aircraft count per NBAI 09/11/2019.
[3] CAGR = Compound Annual Growth Rate (TAF for years 2010 to 2019).

As part of this planning effort, a review of the Airport's based aircraft records was undertaken in November 2019. That review indicated a total of 105 aircraft currently based at BVY, though only 100 have been verified in the NBAI. To be consistent with FAA guidance, NBAI records are used as the official based aircraft count for the Airport and utilized as the base year figure in upcoming projections.

3.5 Projections of Aviation Activity

Projections of aviation activity are typically generated by employing historical data and incorporating assumptions, conditions, and trends. In truth, forecasting of any type is as much an "art" as a "science", and no matter how sophisticated, it represents an "educated" estimation rooted in the prevailing conditions at the time they are created. Therefore, forecasts must be updated periodically and revised as necessary to reflect new conditions and developments.

During a master planning effort, aviation activity forecasts are typically established by using a variety of assumptions that result in a wide range of outcomes. This is intentionally done in order to provide a broad view of future airport utilization potentials. Once that broad view has been established, then a careful examination of those assumptions can be undertaken to determine which could be most reasonably applied given that airport's current situation.

3.5.1 Forecast Methodologies

For BVY, two existing forecasts for the Airport were considered and ten different types of forecast methodologies were applied to the forecast metrics for assessment. The existing forecasts considered include the MSASP projection and the FAA TAF, while the other methodologies included a wide range of socioeconomic and aeronautical forecast data. These 12 approaches included the following and are reflected in **Figure 3-6** below.

- **FAA Terminal Area Forecast (TAF) (2019-2039):** The TAF is the official FAA forecast of aviation activity for U.S. Airports. It addresses historical and forecasted airport operations, based aircraft, enplanements, and cargo tonnage.
- **Massachusetts Statewide Airport System Plan (MSASP) Forecasts (Operations and Based Aircraft Growth):** The 2010 MSASP included operational and based aircraft forecasts for each public use airport in Massachusetts. These are based on local and regional data from socioeconomic and aeronautical sources.
- **FAA Turbine Aircraft Hours Flown (FAA Aerospace Forecasts FY 2010-2039):** FAA Aerospace Forecasts are published annually and developed using statistical models to explain and incorporate emerging trends of the different aviation sectors. This forecast in particular focuses on hours flown by turbine aircraft including both historical and forecasted years. Turbine activity is a growing component of BVY operations.
- **FAA Active General Aviation and Air Taxi Hours Flown (FAA Aerospace Forecasts FY 2019-2039):** This forecast includes all general aviation and air taxi hours which include both piston and turbine aircraft. Note that air taxi includes general aviation air charter operations.
- **Total Fuel Flowage (FAA Aerospace Forecast FY 2019-2039):** This forecast is based on both Avgas (100LL) and Jet (Jet-A) fuels estimated to be pumped nationally during the forecast period. These are the fuels utilized by the aircraft types operating at BVY.

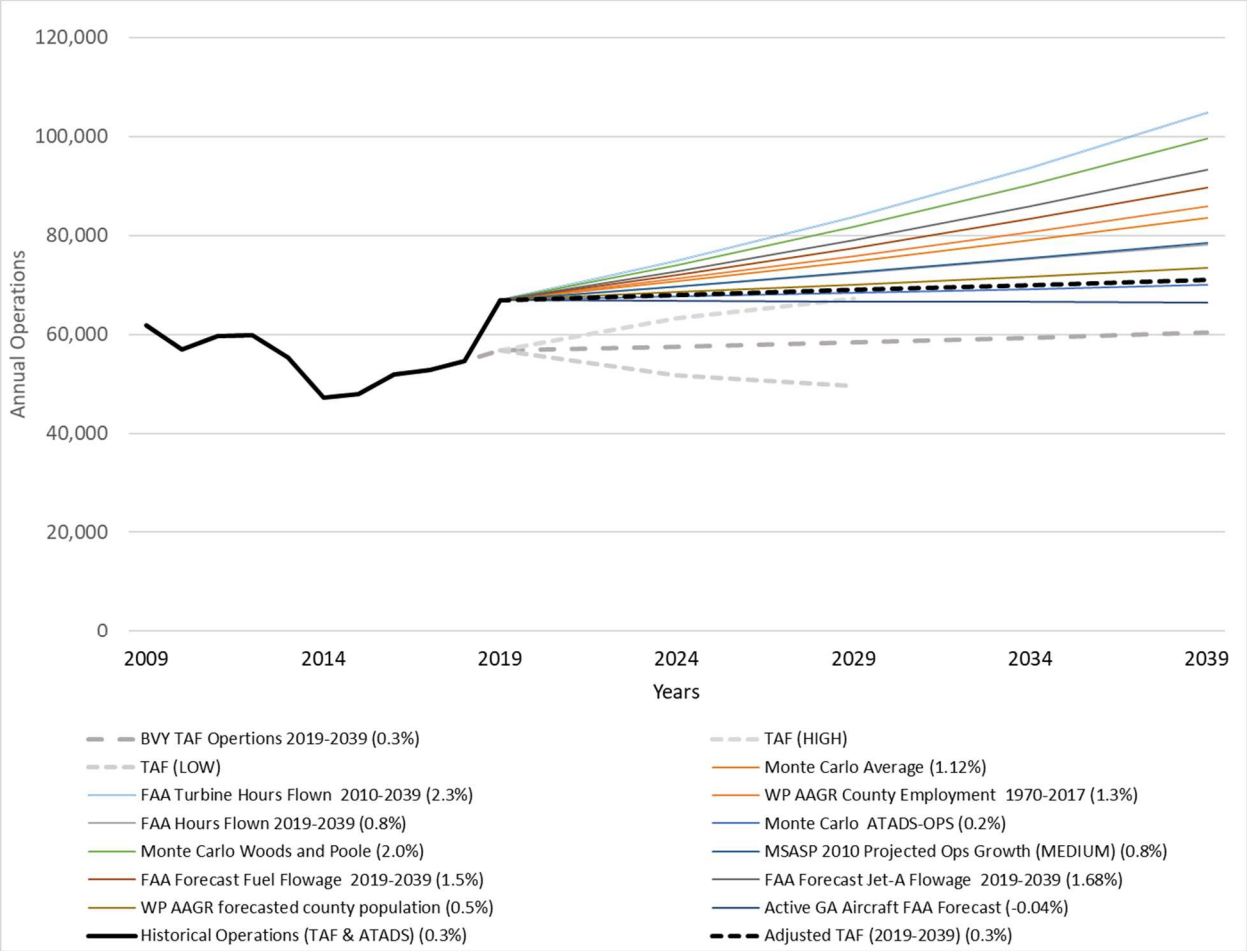
- **Jet-A Fuel Flowage Forecast (FAA Aerospace Forecast FY 2019-2039):** This forecast is based only on Jet-A fuel estimated to be pumped nationally during the forecast period. Jet-A is the fuel utilized by turbine aircraft.
- **Active General Aviation Aircraft (FAA Aerospace Forecast FY 2019-2039):** This forecast is based on all estimated levels of active general aviation aircraft operating in the United States during the forecast period.
- **Forecasted Population Growth in the Airport Market Area:** This forecast is based on growth rate founded on forecasted Woods and Poole population data for Essex County, MA.
- **Employment Growth in the Airport Market Area:** This forecast is based on growth rate founded on forecasted Woods and Poole employment data for Essex County, MA.
- **Woods and Pool - Monte Carlo Simulation Forecast:** A Monte Carlo simulation was utilized to model the probable forecasted result when combining all Woods and Poole socioeconomic data elements. Note that a Monte Carlo simulation generally is a process in which random numbers are used to approximate a solution rather than fitting an equation to the data or simply projecting relevant growth rates. This process is a simulative method as opposed to an explicit solution and allows for the evaluation of probability for any outcome. 10,000 simulation runs were applied to establish this forecast.
- **FAA Historical ATADS - Monte Carlo Simulation Forecast:** This simulation rate was based on historical FAA air traffic data for BVY. As above, 10,000 simulation runs were applied to establish this forecast.
- **Monte Carlo Simulation Forecast Average:** This forecast was based on a combination of both the socioeconomic and BVY ATADS data elements. This approach was employed as a means of weighing and balancing the actual historical operational trends at the Airport with the anticipated regional socioeconomic patterns. As above, 10,000 simulation runs were applied to establish this forecast.

3.5.2 Aircraft Operations

Generally, the most important activity forecast for airfield planning is the level and type of aviation demand generated at the airport, which is measured by aircraft operations. An aircraft operation is either a takeoff or a landing of an aircraft. This activity ultimately serves as the basis for selecting the critical aircraft, which is discussed later in the chapter.

Based on the forecast methodologies presented in the previous section, aircraft operational forecasts for BVY were generated. These are reflected below in **Figure 3-6.** As part of this effort, the FAA requires that study-related forecasts show their consistency with the existing TAF or demonstrate the rational for and significant deviation. Specifically, the FAA considers a forecast to be consistent with its TAF for forecasts differing by less than 10 percent within five years of the base forecast year, and 15 percent within ten years of the base year.

Figure 3-6: Aircraft Operations – All Forecasts (2019-2039)



Source: Jviation.

Scenario Based Forecasting

Given the wide range of forecasting options presented above, three of the twelve forecast scenarios were selected as being representative of the reasonable range of forecasts available for BVY. This occurred through coordination with key project stakeholders representing BVY, the FAA, and MassDOT Aeronautics. It is also important to note that through this coordination process, it was decided that the BVY forecast be portrayed as a "range" in order to better account for the variabilities that are inherent in any forecasting effort. Thus, three forecasts were selected to represent high-, medium-, and low-growth forecast scenarios. These are reflected in the following:

1. **High-Growth Scenario** – This scenario is based on the Jet-A Fuel Flowage Forecast (FAA Aerospace Forecast FY 2019-2039), which represents a 1.7 percent average annual growth rate throughout the 20-year planning period. This forecast is a key indicator of the FAA's positive national outlook on the growth of turbine aircraft, including that of general aviation business jets. Since the majority of fuel sold at BVY is Jet-A, which itself is nearly exclusively

related to business aviation activities, it is reasonable to include this as one of the scenarios representing BVY's potential future growth.

2. **Medium-Growth Scenario** – This scenario is based on a Monte Carlo Simulation Forecast and represents a 1.1 percent average annual growth rate. This forecast amalgamates the regional socioeconomic data (including Woods and Poole population, employment, and per capita income) with the historical BVY operational data (based on FAA ATADS) into a single model. Note that a Monte Carlo simulation essentially takes existing data (like aircraft operations or population) and models possible future results within a range limited by historical and projected values. Each time the simulation is run, a different set of values result due to the inherent variabilities of probability. When the simulation is run multiple times (in this case 10,000 simulations were run), a natural averaging occurs that creates a holistic forecast for BVY that directly considers area population, employment, per capita income, and airport-specific aircraft operations. Based on the ability of this methodology to integrate these key metrics into a single model, it is reasonable to include this as one of the scenarios representing BVY's potential future growth.
3. **Low-Growth Scenario** – This scenario is based on the Active General Aviation Aircraft (FAA Aerospace Forecast FY 2019-2039), representing a -0.04 percent average annual growth rate. As discussed previously, the number of small piston-engine general aviation aircraft throughout the country is currently experiencing a 1.0 percent average annual decline that is anticipated to continue, if not accelerate in the future. Conversely, business aviation has experienced consistent and significant growth (over 2.0% annually with projections of turbo jet aircraft exceeding 2.5% annually). When combined, the net number of all general aviation aircraft is in a shallow, but steady decline. This current and projected decline is reflected in this forecast. Since all of BVY's aircraft operations and based aircraft are related to general aviation, it is reasonable to relate this low-growth scenario to BVY.

Scenario Based Forecasting Results

The following provide a review of the primary forecast metrics identified for the Beverly Regional Airport Master Plan process. These forecast metrics include general aviation activity (including itinerant and local operations), commercial air service activity, military activity, based aircraft, and fleet mix. Within each, the results of the three forecast scenarios described above are presented.

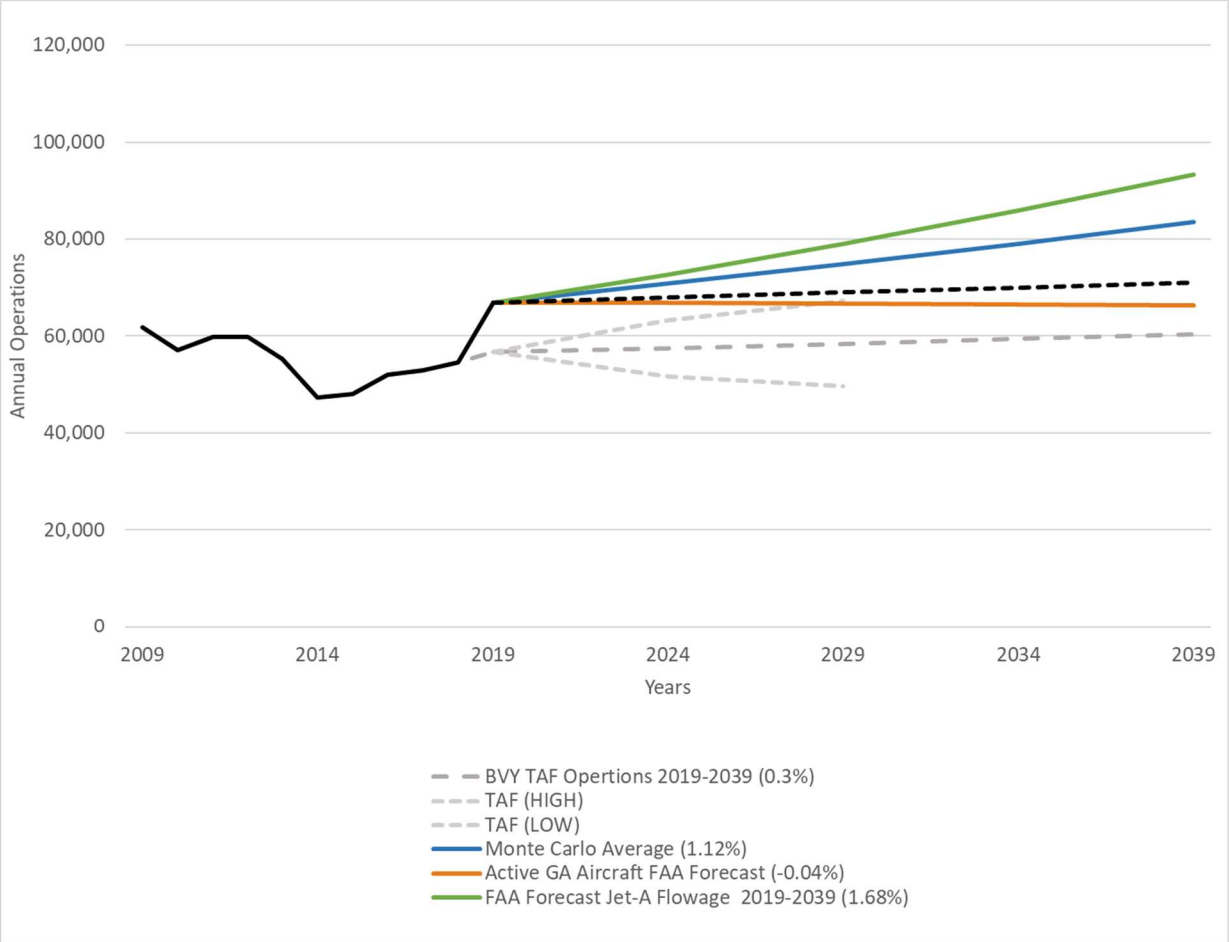
The total general aviation operations at BVY for the master planning period (2019-2039) based on the High-Growth, Medium-Growth, and Low-Growth scenarios for are presented below in **Table 3-4** and are depicted in **Figure 3-7**.

Table 3-4: Total Operations Forecast (2019-2039)

Year	Scenario 1 High-Growth[1]	Scenario 2 Medium-Growth[2]	Scenario 3 Low-Growth[3]
2019[4]	66,949	66,949	66,949
2024	72,750	70,766	66,815
2029	79,054	74,800	66,682
2034	85,904	79,064	66,548
2039	93,347	83,571	66,415
CAGR[5]	1.7%	1.1%	-.04%

Source: Jviation.
[1] Forecasted Jet-A Consumption (FAA Aerospace Forecasts FY 2019-2039) = 1.7 percent CAGR.
[2] Monte Carlo Forecast Model = 1.1 percent CAGR.
[3] Forecasted Active General Aviation Aircraft (FAA Aerospace Forecast FY 2019-2039) = -.04 percent CAGR.
[4] Base Year = Actual Totals.
[5] CAGR = Compound Annual Growth Rate (for years 2019 to 2039).

Figure 3-7: Scenario-Based Aircraft Operations Forecasts (2019-2039)



Source: Jviation.

The forecasts also include a breakdown of forecasted operations in to local and transient activities. Local operations are those performed by aircraft that are based at BVY and operate in the local traffic pattern and/or within sight of the Airport. These operations also include simulated instrument approaches, and departures to or arrivals from practice areas within a prescribed distance from the Airport. Itinerant or transient operations are operations by aircraft that leave the local airspace, including those based at other airports. The results for the High-Growth, Medium-Growth, and No-Growth scenarios for itinerant operations at BVY for the master planning period (2019-2039) are presented in **Table 3-5**. These scenarios only include operations that were counted during operational ATCT hours.

Table 3-5: Itinerant Operations Forecast (2019-2039)

Year	Scenario 1 High-Growth[1]	Scenario 2 Medium-Growth[2]	Scenario 3 No-Growth[3]
2019[4]	31,073	31,073	31,073
2024	33,765	32,844	31,011
2029	36,691	34,717	30,949
2034	39,870	36,696	30,887
2039	43,325	38,788	30,825
CAGR[5]	1.7%	1.1%	-.04%

Source: Jviation.
[1] Forecasted Jet-A Consumption (FAA Aerospace Forecasts FY 2019-2039) = 1.7 percent CAGR.
[2] Monte Carlo Forecast Model = 1.1 percent CAGR.
[3] Forecasted Active General Aviation Aircraft (FAA Aerospace Forecast FY 2019-2039) = -.04 percent CAGR.
[4] Base Year = Actual Totals.
[5] CAGR = Compound Annual Growth Rate (for years 2019 to 2039).

The results for the High-Growth, Medium-Growth, and Low-Growth scenarios for local general aviation operations at BVY for the master planning period (2019-2039) are presented in **Table 3-6**.

Table 3-6: Local Operations Forecast (2019-2039)

Year	Scenario 1 High-Growth[1]	Scenario 2 Medium-Growth[2]	Scenario 3 Low-Growth[3]
2019[4]	35,876	35,876	35,876
2024	38,985	37,921	35,804
2029	42,363	40,083	35,733
2034	46,033	42,368	35,661
2039	50,022	44,783	35,590
CAGR[5]	1.7%	1.1%	-.04%

Source: Jviation.
[1] Forecasted Jet-A Consumption (FAA Aerospace Forecasts FY 2019-2039) = 1.7 percent CAGR.
[2] Monte Carlo Forecast Model = 1.1 percent CAGR.
[3] Forecasted Active General Aviation Aircraft (FAA Aerospace Forecast FY 2019-2039) = -.04 percent CAGR.
[4] Base Year = Actual Totals.
[5] CAGR = Compound Annual Growth Rate (for years 2019 to 2039).

Preferred Forecast

The Medium-Growth Scenario (or Monte Carlo Simulation Forecast Average) was selected as the Preferred Forecast since it considers both regional socioeconomic and airport operations data. The combination and average of the data results in a growth scenario representative of the Airport and the associated market area. Though the Airport has seen significant growth in recent years that could be representative of the High-Growth scenario, the Medium-Growth scenario was nevertheless selected since it represents a reasonable balance between the aggressive growth rates recently experienced at BVY, and the inherent market uncertainties associated with the aviation industry and the regional economy.

The Medium-Growth scenario was applied to BVY's operational data to determine total operational numbers for the forecast years. The 2019-2039 FAA Aeronautical Forecast ratios were then applied to the projected operational numbers to determine projected aircraft type levels in **Table 3-7**. These were derived from projected active general aviation aircraft ratios as presented in the 2019-2039 FAA Aerospace Forecast. As you can see below the jet aircraft market

Table 3-7: Airport Operations Forecast by Type (2019-2039) - *Scenario 2 Medium-Growth*[1]

Type	2019[2]	2024	2029	2034	2039
Single Engine	40,839	41,044	41,140	41,113	41,786
Percent of annual total	61%	58%	55%	52%	50%
Multi-Engine	4,017	4,246	4,488	4,744	5,014
Percent of annual total	6%	6%	6%	6%	6%
Turboprop	3,347	3,538	3,740	3,953	5,014
Percent of annual total	5%	5%	5%	5%	6%
Jet	4,686	5,661	6,732	7,906	9,193
Percent of annual total	7%	8%	9%	10%	11%
Helicopter	3,347	3,538	4,488	5,534	5,850
Percent of annual total	5%	5%	6%	7%	7%
Other[3]	10,712	12,738	14,212	15,813	16,714
Percent of annual total	16%	18%	19%	20%	20%
Total	66,949	70,766	74,800	79,064	83,571
TAF	56,699	57,643	58.601	59,576	60,570
TAF Variance	15.31%	22.8%	27.6%	30.6%	35.1%

Source: FAA ATADs; Jviation; FAA Aeronautical Forecast of Active GA Aircraft Ratios.
[1]Monte Carlo Forecast Model = 1.1 percent CAGR.
[2]Base Year.
[3]Other includes experimental and light-sport aircraft.

Air Taxi Activity Forecast

The FAA ATADS system indicates that Beverly Regional Airport has been experiencing an increase in air taxi service throughout the last 20 years. In 2009 BVY counted 616 air taxi operations and by 2019 ops numbers increased to 1,946. BVY will continue to

see air taxi operations increase during the planning period. This has been included in the operations projections above. Note that an air taxi operator is defined as one which carries cargo or mail on either a scheduled or charter basis, and/or carries passengers on an on-demand basis or limited scheduled basis. For BVY, an air taxi service would generally encompass charter operators.

Military Activity Forecast

Military operations do not significantly contribute to the number of operations at BVY and are not dependent on the same stimuli as general aviation activity. The FAA ATADS system indicates that the Beverly Municipal Airport experiences a low level of military activity throughout each year, generally 200-300 ops per year. Due to the fluctuation and unpredictability of military operations, it is projected that military operations will remain constant throughout the forecast period.

3.5.3 Based Aircraft Forecast

The based aircraft forecast helps determine the future activity levels and the potential requirement for expanded or improved airport facilities. Based aircraft are those that are permanently stored at an airport. Estimating the number and types of aircraft expected to be based at BVY over the 20-year study period will impact the planning for future airport facility and infrastructure requirements. As the number of aircraft based at an airport increases, so too does the aircraft storage required as well as supporting infrastructure and services.

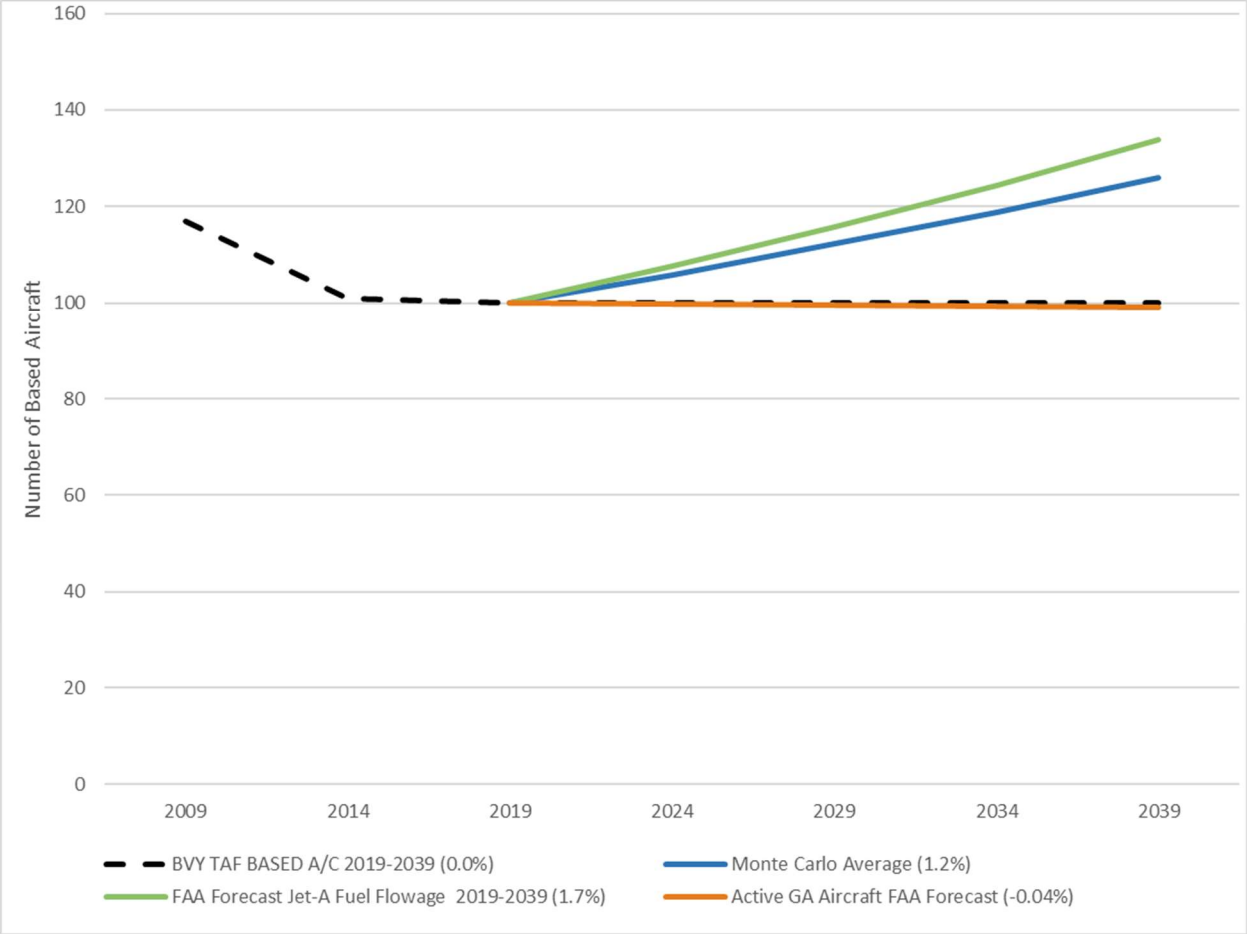
BVY currently has 100 verified based aircraft according to the National Based Aircraft Inventory (NBAI). These aircraft were projected forward using the three forecast scenarios described above. The results for the High-Growth, Medium-Growth, and Low-Growth scenarios for based aircraft at BVY for the master planning period (2019-2039) are presented in **Table 3-8**, and in graphical form in **Figure 3-8**.

Table 3-8: Based Aircraft Forecast (2019-2039)

Year	Scenario 1 High-Growth[1]	Scenario 2 Medium-Growth[2]	Scenario 3 Low-Growth[3]
2019[4]	100	100	100
2024	109	106	100
2029	118	112	100
2034	128	119	99
2039	139	125	99
CAGR[5]	1.7%	1.1%	-.04%

Source: Jviation.
[1] Forecasted Jet-A Consumption (FAA Aerospace Forecasts FY 2019-2039) = 1.7 percent CAGR.
[2] Monte Carlo Forecast Model = 1.1 percent CAGR.
[3] Forecasted Active General Aviation Aircraft (FAA Aerospace Forecast FY 2019-2039) = -.04 percent CAGR.
[4] Base Year = Actual Totals
[5] CAGR = Compound Annual Growth Rate (for years 2019 to 2039).

Figure 3-8: Total Based Aircraft (2019-2039)



Source: Jviation

The Medium-Growth model was also selected as the preferred forecast for the total based aircraft fleet at BVY. This model was selected because it best represents both regional socioeconomic data, as well as, local, and national aviation industry historical data. The total based aircraft projected for BVY over the planning period were then allocated to six general aircraft categories (single-engine piston, multi-engine piston, turbine/jet, military, rotorcraft, and other) to develop a projection of BVY's based aircraft fleet mix through the planning period. The existing fleet mix was developed based on the fleet mix percentages reported by the Airport in 2019. Through the forecasting process, and based on anticipated migrations of the fleet, those percentages are anticipated to change over the long-term. The preferred existing based aircraft fleet mix percentages for BVY are shown below in **Table 3-9**.

Table 3-9: Based Aircraft Forecast by Type (2019-2039) - *Scenario 2 Medium-Growth*[1]

Aircraft Type	2019[2]	2024	2029	2034	2039
Single Engine	82	84	85	87	89
Percent of annual total	82%	79%	76%	73%	71%
Multi-Engine	9	10	10	11	11
Percent of annual total	9%	9%	9%	9%	9%
Jet/Turboprop	5	7	10	13	16
Percent of annual total	5%	7%	9%	11%	13%
Helicopter	4	5	7	8	9
Percent of annual total	4%	5%	6%	7%	7%
Total Aircraft	100	106	112	119	125

Source: Jviation; NBAI; FAA Aeronautical Forecast.
[1] Monte Carlo Forecast Model = 1.1 percent Compound Annual Growth Rate.
[2] Base Year

Given the opportunities in this business-friendly community and positive economic initiatives and expectations in the market area, it is likely that BVY will follow national trends for aircraft market share and see an influx of business aircraft and helicopters. The fleet mix projection shows a greater integration of turbines/jets over the planning period. This is consistent with FAA projections for the share of turbines/jets within the general aviation market segment. The FAA predicts that the declining market share of single and multi-engine piston aircraft at general aviation airports will be replaced by turbines/jet aircraft used for business travel.

3.6 Critical Design Aircraft

The ultimate design and development of airport facilities is directly impacted by the demand for those facilities. Aircraft-related activities (in the form of based aircraft, operational levels, and types of operations) typically serve as the basis for that demand since aircraft tend to generate the most challenging and specific operational requirements. In general, airport infrastructure components are designed to accommodate the most demanding aircraft type that will utilize the infrastructure on a regular basis. The FAA refers to this aircraft type as the Critical Design Aircraft, which it defines as being the most demanding airplane, or family of airplanes, that accounts for at least 500 annual itinerant operations at a given airport within the planning period.

This Critical Design Aircraft designation is important since it will serve as the basis of the Airport Reference Code (ARC) and/or Runway Design Code (RDC), which are facility classification systems given to aircraft based on its maximum approach speed and wingspan. While this subject will be discussed in detail in the next chapter, for this discussion related to critical design aircraft, what is relevant to know is that the letters (ranging from A-E) represent progressively faster landing airspeeds, with "A" being the slowest. Similarly, the roman numerals represent wingspans, with "I" being the smallest wingspan (see **Figure 3-9** below for examples of ARC/RDC aircraft types).

The FAA then uses this classification to apply specific airport design criteria that are appropriate to operational and physical characteristics of the aircraft types operating at that airport.

Figure 3-9: ARC/RDC Aircraft Examples

Source: Jviation

The 2010 BVY ALP Update established the ARC/RDC as a B-II based on the need to accommodate a Dassault Falcon 50, the most demanding aircraft regularly operating on the Airport at the time. Specifically, BVY's current Airport Layout Plan indicates this RDC for both runways, with an existing Airport Approach Category (AAC) of B, and an Airplane Design Group (ADG) of II. This design category accommodates business jets up to the Falcon 2000 and 900; Cessna Citation X; Challenger 100,

Hawker 4000, among others. An RDC of B-II also allows operations by smaller aircraft such as the Cessna Citation 1, 2, and CJ-series; Learjet 31, 35, 36, 45; Beech King Air 90, 200, and 350; Pilatus PC-12; TBM-850; as well as almost all piston engine aircraft, many of which are at or below the B-II RDC. Note that this does not mean that BVY has not historically or will not in the future accommodate larger or demanding aircraft. In fact, the Airport will occasionally accommodate operations by larger corporate jets such as the Gulfstream G-650 and Bombardier 700/Global 6000/Global Express (RDC C-III). However, these aircraft have not yet approached the 500 itinerant annual operational threshold established by the FAA to qualify them as a candidate to be a Critical Design Aircraft for the Airport.

To project the current and future Critical Design Aircraft for BVY, an itinerant aircraft operations analysis was conducted to determine if the Airport has experienced an increase in operations by more demanding aircraft since 2010, and if so, which aircraft and to what degree. As seen below in **Table 3-10**, aircraft operations data from the FAA's Traffic Flow Management System Counts (TFMSC) database was used to evaluate historical operations at BVY in order to either validate the existing or identify a more appropriate critical design aircraft. It is important to recognize that TFMSC data represents actual flights recorded and validated by the FAA through means of flight plans, instrument flight operations, and/or other radar-based tracking applications. It is the most accurate FAA flight data currently publicly available, and identifies aircraft type, flight dates, flight origins and destinations, etc.

In reviewing the BVY TFMSC data for 2019, several observations can be made:

- The highest number of operations being experienced at BVY is A-I, which is reflective of small, single-engine piston aircraft. This has been historically the most predominant aircraft type using the Airport and includes most flight training operations. Based on an examination of historical trends, growth in this segment of airport operations is largely flat with between 1,400 and 1,700 annual operations.
- Following closely behind is the B-II category that has the second highest number of operations. The B-II segment, which is also BVY's current ARC/RDC, has demonstrated a steady and strong rate since 2016 (up to 1,334 annual operations). This reflects the increasing number of small to mid-sized business aircraft activities being experienced at the Airport.
- Category C-II aircraft have likewise experienced strong and steady growth over the past three years, increasing from 361 operations in 2017 to 468 operations in 2019 (with a slight regression in 2018). Currently, the C-II designation is the most demanding aircraft type that is approaching the FAA 500-annual itinerant operation threshold. However, this trend, as identified through an examination of historical TFMSC counts, is too recent and variable to be able to correctly identify C-II as being the design aircraft for BVY. Additional years of TFMSC data would be required to validate this potential transition. Nevertheless, it is important to recognize this potential eventuality with respect to future planning efforts associated with the Airport.
- There are no other larger aircraft categories nor associated trends at BVY that would warrant a larger design aircraft. The C-III category has shown a consistently positive trend, but it remains well short of the FAA 500-annual

itinerant operation threshold. Other aircraft categories reflect occasional use of the Airport by larger aircraft types, but not to any significant levels.

Based on an examination of FAA historical aircraft operations data and as described above, it is evident that BVY's current ARC of B-II remains appropriate. This specific category continues to show strong and steady growth and is reflective of the majority of the most demanding aircraft currently operating at the Airport. However, it must also be recognized that BVY is experiencing an increasing level of C-II operations as well. If that recent trend of increasing operations were to continue into future years, it is possible that the Airport's design aircraft could eventually evolve to a C-II. Thus, this potential should be considered in future planning initiatives.

Table 3-10: BVY TFMSC Counts (2017-2019)

ARC/RDC	2017	2018	2019
No Data	153	122	139
A-I	1,477	1,681	1,403
A-II	763	609	509
B-I	489	404	405
B-II	1,226	1,314	1,334
B-III	7	19	7
C-I	428	317	199
C-II	361	351	468
C-III	68	122	126
C-IV	0	0	2
D-I	19	5	8
D-II	24	18	29
D-III	70	62	25
D-IV	0	0	1
Total	**5,085**	**5,024**	**4,655**

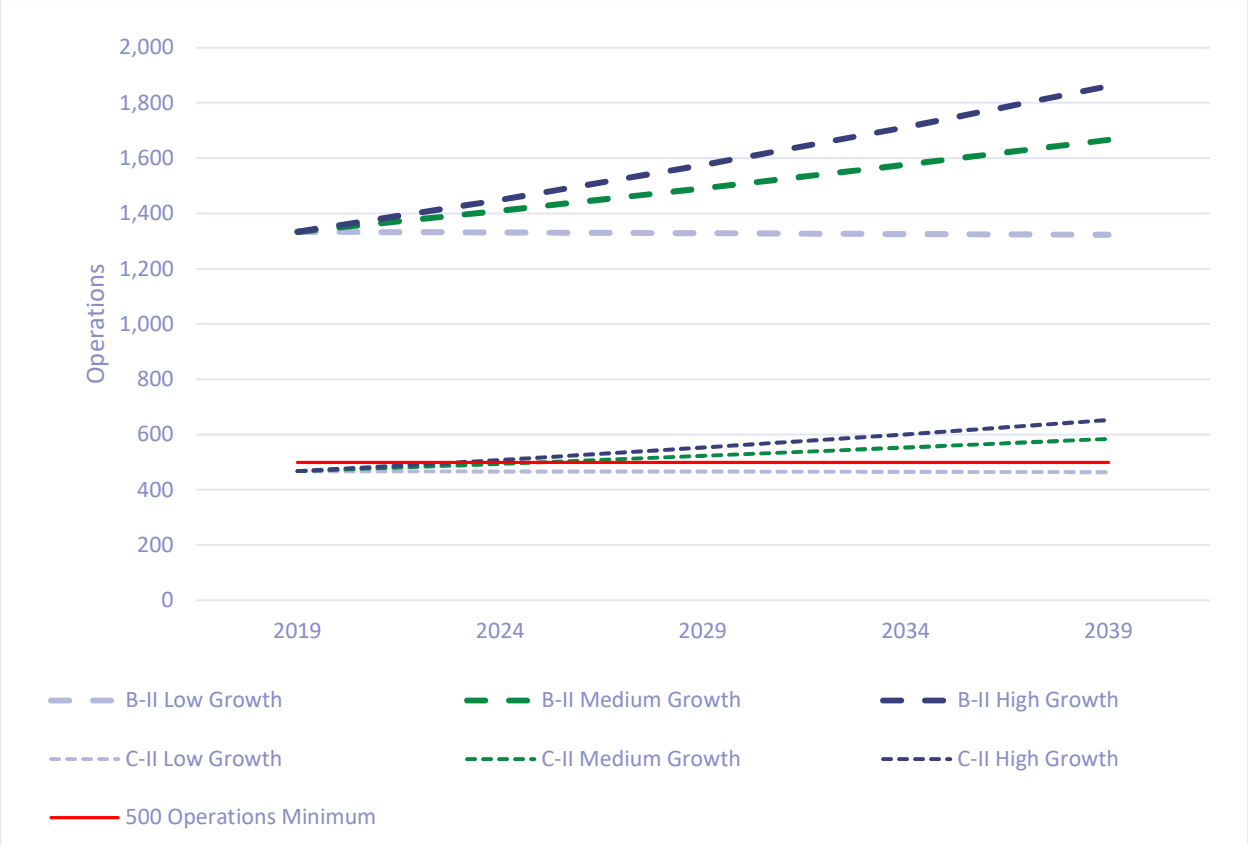
Source: FAA TFMSC.

Greater examination of the TFMSC data also showed that the Cessna Citation Latitude (680A) followed closely by the Cessna Excel (C56) and the Dassault Falcon 900 comprised the majority of the B-II operations at BVY since 2017. The Cessna Citation Latitude is the primary aircraft being utilized by national corporate aircraft charter companies (e.g., NetJets, Flexjet, etc.), all of which operate regularly at BVY. Additionally, a Falcon 900 is actually based at the Airport. Both of these aircraft types represent the group of small- to mid-sized corporate aircraft that use the Airport on a daily basis. Thus, the Cessna Citation Latitude has been identified as being the primary design aircraft for BVY and for Runway 16-34. Note that other operations were also conducted by a wide range of corporate jet aircraft types including: Global Express BD-700, Citation CJ1-3, Citation Excel, Citation Sovereign, (Citation II, V, X), Cessna XLS, Challenger 300, Phenom 100 and 300, Eclipse 500, (Falcon 50, 7X, 8X, 2000), Gulfstream II-V, Hawker 800, Lear 31-60, etc. Nearly all of these aircraft types are over 12,500 pounds maximum take-off weight and have physical and operational characteristics generally similar to that of the Cessna Citation Latitude. (Note that the

Dassault Falcon 900 was likewise identified as being the design aircraft for Runway 9-27.)

While historical trends and recent data can provide a good perspective on the current conditions at an airport, the Critical Design Aircraft determination must also consider patterns forecasted to occur within the planning period. When the three forecast scenario growth rates were applied to the FAA TFMSC data for BVY, the results showed an ARC/RDC of B-II throughout the 20-year planning period (see **Figure 3-10**) along with the potential of C-II reaching the 500 annual itinerant operational threshold in the range of 8 to 15 years.

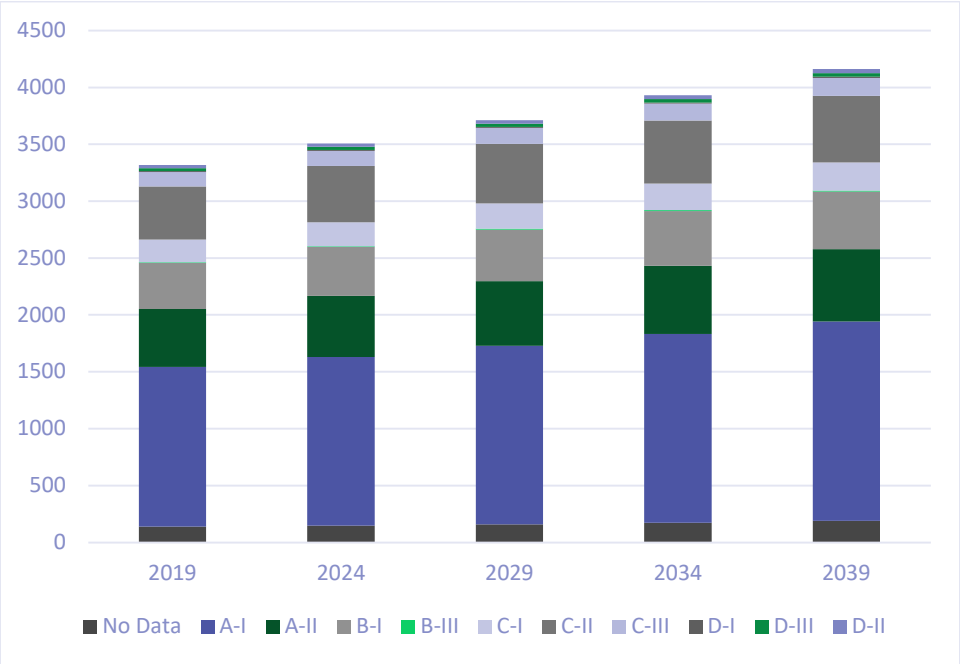
Figure 3-10: BVY Annual Operations of B-II and C-II Aircraft – All Forecasts



Source: Jviation; FAA TFMSC Data
Forecasted Active GA Aircraft (FAA Aerospace Forecast FY 2019-2039) = -.04 percent CAGR (Low-Growth).
Monte Carlo Forecast Model; 1.1 percent CAGR (Medium-Growth).
Forecasted Jet-A Consumption (FAA Aerospace Forecasts FY 2019-2039) = 1.7 percent CAGR (High-Growth).

As the preferred forecast, the Medium-Growth Forecast has been applied to the aircraft categories in **Table 3-10** and **Table 3-11.** Although some C-II scenarios show operations reaching the 500-operation threshold, the future increase of operations within this ARC is viewed as speculative and is not deemed reliable enough to change the ARC within the 20-year planning period. Given these projections, however, it reasonable to assert that the Airport will ultimately achieve C-II status beyond the planning period.

Figure 3-11: Annual Operations of ARC Categories– Medium-Growth Forecast[1]



Source: Jviation; FAA TFMSC Data

[1]Monte Carlo Forecast Model = 1.1 percent CAGR (Medium-Growth).

Table 3-11: BVY Annual Operations by ARC - Medium-Growth Forecast[1]

ARC	2019[2]	2024	2029	2034	2039
No Data	139	147	160	174	189
A-I	1,403	1,483	1,568	1,658	1,753
A-II	509	538	569	602	636
B-I	405	428	453	479	506
B-II	1,334	1,410	1,491	1,577	1,667
B-III	7	7	8	8	9
C-I	199	210	222	235	249
C-II	468	495	523	553	585
C-III	126	133	141	149	157
C-IV	2	2	3	4	5
D-I	8	8	9	9	9
D-II	29	31	32	34	36
D-III	25	26	28	30	31
D-IV	1	1	2	2	2
Total	**4,655**	**4,919**	**5,209**	**5,514**	**5,834**

Source: Jviation; FAA TFMSC Data.

[1] Monte Carlo Forecast Model = 1.1 percent CAGR (Medium-Growth).

[2] Base Year = 2019 (last calendar year with complete TFMSC data)

In summary, based on the information presented above and for purposes of the subsequent analyses included in this Airport Master Plan, the ARC/RDC for Runway 16-34 will remain a B-II and a design aircraft of a Cessna Citation Latitude. This has been established with the knowledge that larger aircraft do occasionally operate at the Airport and that a C-II designation could potentially be realized sometime in the future. The ARC/RDC for Runway 9-27 will also remain a B-II with a design aircraft of a Dassault Falcon 900.

3.7 Summary and TAF Comparison

It is anticipated that BVY will experience moderate growth during the 20-year planning period that generally reflects the regional aviation industry trends and the socioeconomic development growth of the area. Most market demographic trends indicate that the Airport will slightly outpace prevailing national and state growth trends, while other key economic indicators project continued robust growth in the area economy, and by extension, business-related general aviation. Based aircraft are expected to increase from approximately 100 aircraft to 125 aircraft by 2039. While the Airport fleet mix may transition to larger aircraft over time and ultimately achieve C-II status, the B-II designation is expected to remain in place throughout the planning period.

The Airport will also realize an increase in the number of aircraft operations. By the end of the planning period in 2039, over 83,000 operations are anticipated. Additional operations could be experienced in future years should addition aviation businesses locate on or around the Airport. **Table 3-12** summarizes the projections for the preferred forecast (Medium-Growth) contained in this chapter.

Table 3-12: Summary of Preferred Aviation Activity Forecasts (2019-2039) – Scenario 2 Medium-Growth[1]

	2019[2]	2024	2029	2034	2039
Operations					
Type					
Single Engine	40,839	41,044	41,140	41,113	41,786
Multi-Engine	4,017	4,246	4,488	4,744	5,014
Turboprop	3,347	3,538	3,740	3,953	5,014
Jet	4,686	5,661	6,732	7,906	9,193
Helicopter	3,347	3,538	4,488	5,534	5,850
Other	10,712	12,738	14,212	15,813	16,714
TOTAL	66,949	70,766	74,800	79,064	83,571
Category					
General Aviation	64,882	58,050	61,359	64,857	68,544
Military	121	128	135	143	151
Air Taxi	1,946	2,057	2,174	2.298	2,429
TOTAL	66,949	70,765	74,800	79,064	83,571
TAF	56,699	57,643	58,601	59,576	60,570
Local vs. Itinerant					
Local Operations	35,876	37,921	40,083	42,368	44,783
Itinerant Operations	31,073	32,844	34,717	36,696	38,788
Based Aircraft by Type					
Single Engine	82	84	85	87	89
Multi-Engine	9	10	10	11	11
Jet/Turboprop	5	7	10	13	16
Helicopter	4	5	7	8	9
Total Based Aircraft	**100**	**106**	**112**	**119**	**125**
TAF	**110**	**110**	**110**	**110**	**110**

Source: Jviation, FAA Aerospace Forecast
[1] Monte Carlo Forecast Model; 1.1 percent CAGR
[2] Base Year – Actual

Additionally, and as described previously, to secure FAA approval for the Master Plan activity projections, FAA requires a comparison of the forecasts to the annually produced TAF, preferring that airport planning forecasts not vary significantly from the TAF. Specifically, the FAA looks at the airport's recommended passenger enplanements, commercial operations, and total operations forecasts to be within 10 percent of their five-year TAF and within 15 percent of their 10-year TAF. If they are not within these tolerances, an explanation must be provided directly to the FAA. A comparison between the forecasts shows that the preferred projections lie outside of the FAA tolerances (see **Table 3-13**).

Table 3-13 – Comparison of BVY Projections with FAA TAF

	Year	BVY Preferred Forecast	BVY TAF[1]	Forecast / TAF (% diff)
Passenger Enplanements[2]				
Base year	2019	0	0	0.0%
Base year + 5 years	2024	0	0	0.0%
Base year + 10 years	2029	0	0	0.0%
Base year + 15 years	2039	0	0	0.0%
Commercial Operations[3]				
Base year	2019	1,946	1,732	11.6%
Base year + 5 years	2024	2,057	1,732	17.2%
Base year + 10 years	2029	2,174	1,732	22.6%
Base year + 15 years	2039	2,429	1,732	33.5%
Total Operations				
Base year	2019	66,949	56,699	16.6%
Base year + 5 years	2024	70,765	57,643	20.4%
Base year + 10 years	2029	74,800	58,601	24.3%
Base year + 15 years	2039	83,571	60,570	31.9%

Source: Jviation
[1] FAA TAF Issued February 2019.
[2] Includes only reported Air Carrier and Commuter enplanements (not air taxi, general aviation, etc.).
[3] Includes Air Carrier, Commuter, and Air Taxi operations.

The reasons for the differences between the two forecasts are summarized in the following:

- The existing BVY TAF is based on actual aircraft operational figures only through 2017. So, the 2018 and 2019 operational totals are projections based on 2017 conditions and do not consider any changes experienced at BVY over the past two years. It should also be noted that the current FAA TAF high and low tolerances are based on the 2019 TAF projections which themselves are rooted in 2017.
- Since 2017, BVY has experienced growth that exceeds the FAA TAF projections. In 2018, the TAF projected 54,640 operations while the ATCT counted 56,803 operations (a 3.9 percent difference). A more dramatic difference was experienced in 2019 when the TAF projected 56,699 operations while the BVY ATCT counted 66,949 (a 16.6 percent difference). It is evident that when the FAA next updates the BVY TAF to reflect actual operational totals, it will reflect this increased baseline of operational data.
- With respect to the FAA TAF tolerances, it is critical to note that if the FAA TAF were to reflect the current and correct 2019 operational totals, the Preferred Forecast would in fact lie within those five- and ten-year tolerances (see **Table 3-14**). Note that the FAA TAF adjustments reflect the current growth projections incorporated within the TAF. Given the dramatic recent increase in BVY operations, the FAA could reasonably increase its own

growth projections, which would increase the TAF operational totals shown below. Regardless, the BVY Preferred Forecast would remain within those tolerances.

Table 3-14 – Comparison of BVY Projections with Adjusted FAA TAF

	Year	BVY Preferred Forecast	BVY TAF[1]	Forecast / TAF (% diff)
Total Operations				
Base year	2019	66,949	66,949	0.0%
Base year + 5 years	2024	70,765	67,953	4.1%
Base year + 10 years	2029	74,800	68,973	8.1%
Base year + 15 years	2039	83,571	70,007	17.7%

Source: Jviation

[1] FAA TAF Issued February 2019. Years 2019, 2024, 2029, and 2034 have been adjusted to directly reflect an adjusted 2019 base year operational total of 66,949.

[2] Includes only reported Air Carrier and Commuter enplanements (not air taxi, general aviation, etc.).

[3] Includes Air Carrier, Commuter, and Air Taxi operations.

Based on the rationale and analysis included within Table 3-14, it is concluded that the Preferred Forecast is consistent with the standards and requirements associated with the FAA TAF for BVY.

Finally, it is also important to recognize that the Preferred Forecast for BVY is unconstrained, meaning that all facilities necessary to accommodate the forecasted growth could and will be constructed, regardless of potential constraints to development or other possible limiting factors. The following chapters of this Master Plan Update will explore the facility implications of accommodating the projected demand and design requirements based on the critical design aircraft.

3.8 Potential COVID-19 Implications

The forecasts in this chapter were prepared in part using the Airport's historical records and area socioeconomic trends, as well as through the FAA's Aerospace Forecasts (2019-2039), all of which were prepared before the onset of the COVID-19 Pandemic. The virus' potential impacts on long-term aviation forecasts throughout the country and BVY are unknown at this time. Key stakeholders of this Airport Master Plan, including BVY, the FAA, and MassDOT Aeronautics, are in concurrence that the forecasts included in this chapter should assume that aviation in the United States, the Commonwealth of Massachusetts, and Beverly Regional Airport will return to pre-Pandemic levels. The timing, however, is unknown and cannot be foreseen at this point. Thus, while it is expected that BVY will realize significant short-term negative impacts on its aircraft operational levels for 2020, it is anticipated that those operational levels will ultimately return to be generally consistent with the forecasts presented in this chapter. (It should be recognized that pre-Pandemic BVY operational numbers in the first two months of the year were tracking 10 to 27 percent higher than 2019.) Based on this, potential longer-term impacts for BVY should not be significant, although potential COVID-19 implications will be addressed as required in subsequent chapters.

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