Manassas Regional Airport
Master Plan Update

Chapter 2
Aviation Activity Forecast

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CHAPTER 2

AVIATION ACTIVITY FORECAST

2.1 INTRODUCTION

A critical element in the planning and development of airport facilities is estimating the levels of aircraft operations and based aircraft that can be expected during a prescribed planning time period. This chapter discusses the projected activity levels of aircraft operations and based aircraft that might be expected at Manassas Regional Airport within the 20-year planning horizon. It also describes the methodology used to estimate those volumes. The chapter concludes with recommended operations and based aircraft forecasts that will be used in this study to plan the requirements for future infrastructure and facilities. The forecast is presented in five- and ten-year increments, beginning with a base year of 2021 and projecting outward to 2026, 2031, and 2041.

The Federal Aviation Administration (FAA) annually prepares its Terminal Area Forecast (TAF) for 264 FAA towered airports, 252 federal contract tower airports, 31 terminal radar approach control facilities, and 2,818 non-towered airports. Manassas Regional Airport (HEF) is one of only 84 general aviation (GA) airports in the United States categorized as a national airport.[1] National airports are described by FAA as those that support flights within the nation and globally, accommodating operations by the most sophisticated general aviation aircraft in the fleet. HEF is one of two national airports in Virginia, the other being Leesburg Executive Airport.

For the purposes of this Master Plan Update, the baseline forecasts of aircraft operations and based aircraft annual volumes will be used to plan various airport facility requirements. A review of the Airport's recent historical aviation activity has a critical role in the development of a forecast. Most importantly it provides a means for comparing the projected growth of the forecast with what has happened in the past. This forecast document references historical aviation activity data from 2009 or more recent, depending on the analysis and the data that was available. The historical review contains multiple data sources including the Airport's records and information from the FAA TAF while the basis for comparison of forecasts is the FAA TAF 2022 [2] published in March 2022. The FAA TAF compares data on a fiscal year basis, i.e., October 1 of a year through September 30 of the next year, as opposed to calendar year (CY) which begins January 1 and ends December 31. The forecasts being developed as part of the Master Plan update will use the same fiscal year methodology as the FAA TAF for purposes of direct comparison. Data in calendar year format is identified as year rather than a fiscal year as shown in **Section 2.4.2**.

The Base Case Forecast includes an average annual growth rate (AAGR) that is slightly higher than the AAGR of the FAA TAF 2022. The Base Case Forecast provides a different perspective for the Airport's future. In recognition of the Airport's role as an integral part of the region's general aviation (GA) activity, the Forecast was developed using local characteristics, socioeconomic projections, and the baseline FAA TAF 2022 which makes projections beginning in 2021 and continues over the 20-year forecast period that ends in 2041

- Short-Term Forecast Period: 2021-2026

[1] *General Aviation Airports: A National Asset*, FAA, May 2012

[2] *Terminal Area Forecast: taf.faa.gov, March 2022*

- Intermediate-Term Forecast Period: 2027-2031
- Long-Term Forecast Period: 2032-2041

2.2 AIRPORT ROLE AND HISTORY

The Manassas area has made aviation a point of emphasis for the Washington D.C. Metro area since the 1930s. Beginning in the year 1930, with a community of about 1,200 people, the City Council thought an airport should be developed. Within a year, investors purchased nearly 95 acres of land and leased it to the City of Manassas. The first Manassas airport opened on June 8, 1932. Growth in Manassas triggered the housing development to surround the Airport. It was decided to move the Airport further out, and by September of 1964, Manassas Regional Airport was in its new location.

The Airport continued to grow and evolve and in 1992, an Air Traffic Control Tower (ATCT) was recycled from Centennial Airport near Denver, Colorado and reassembled in Manassas. Additional improvements were implemented, including the construction of a new terminal completed in September 1996. In the years to follow, additional development occurred on the east side of the airfield. A runway extension for Runway 16L-34R was completed in 2012 and is now 6,200 feet. Runway 16R-34L was rehabilitated in 2000 and is 3,715-foot-long. Runway 16L-34R will be rehabilitated in 2023.

Manassas Regional Airport is located thirty miles south of Washington D.C. in Prince William County, Virginia. The City of Manassas oversees the day-to-day operation and management of the Airport. The Airport occupies over 863 acres and is bounded by Prince William Parkway to the east and Nokesville Road (Route 28) to the northwest.

HEF is not certificated by the FAA under 14 CFR Part 139 to serve scheduled air carrier aircraft over 10 seats or commuter aircraft with more than 30 seats. Scheduled service is what typical commercial passenger service airports such as Richmond International Airport provide. Air taxi/commuter operations occurring at HEF are all non-scheduled flights in aircraft with less than 30 seats (mostly private charters).

The Airport is classified in the FAA's National Plan of Integrated Airport Systems (NPIAS) 2021-2025 Report as a public National Reliever airport. National reliever airports are defined as airports that are designated by the FAA to relieve congestion at Commercial Service airports and to provide improved GA access to the overall community. GA airports are public use airports that do not have scheduled service or has service scheduled with less than 2,500 passenger boardings each year. The Manassas Regional Airport is the busiest GA airport in the Commonwealth of Virginia. HEF is one of 57 GA airports within the Virginia Department of Aviation (DOAV) Airport System and identified as Reliever Airport, as described in the 2016 Virginia Air Transportation System Plan (VATSP). With the classification of a Reliever Airport in the VATSP, HEF is eligible for Air Carrier/Reliever discretionary funding from the Commonwealth Airport Fund as opposed to General Aviation discretionary funding which applies to majority of GA airports in the Commonwealth of Virginia.

2.3 GENERAL AVIATION TRENDS

In forecasting aviation demand, it is prudent to consider current and predicted trends related to general aviation. This Master Plan Update will include a chapter section dedicated to this topic within the Facility Requirements, but critical trends that influenced this forecast are detailed below.

- **Pilot Trends**: Pilots within the 40 to 60-year-old age group, a usual pillar in the general aviation industry due to an increase in disposable income and available time, has experienced a sharp decline as a percent of the total certificates between 2012 and 2017[3]. This is related to the fact that many "baby boomers" are now beyond 60 years old, and that recreational flying has become prohibitively expensive. However, pilot and flight instructor certificates began to increase in 2018. Airlines, charter operators, and flight departments are experiencing a pilot shortage, and there are now great incentives for people to pursue their airline transport pilot ratings. These trends are evident in the fact that airline transport and flight instructor certificates increased over the past three years. Locally, HEF may experience decreased recreational pilot demand for T-hangars or tie-downs due to fewer recreational flyers taking to the skies. However, strong airline pilot demand and regulation changes requiring an increase in flight hours for certification are driving substantial growth in flight training. HEF flight schools are experiencing growth and may likely need additional fleet, storage, and office space to meet demand.

- **Existing Aircraft Fleet Trends**: The small twin and single engine piston fleet continues to decline nationally. This is due to numerous factors, including the increase in cost of avgas fuel, increasing operating and ownership expenses for aircraft, and an older fleet of aircraft that is becoming cost prohibitive to keep in operation. The fleet continues to see some replacement by modern piston aircraft, such as Cirrus and new Cessna brand aircraft, which are most often used for mission-specific purposes instead of solely recreational use. Regarding corporate jet aircraft, there has been a trend of owners upgrading from mid-size to large aircraft. Older aircraft are generally flying fewer hours and the business jet market fleet is becoming younger. Cost does not correlate to the aircraft purchases, but aircraft are generally becoming larger.

- **Future Aircraft Fleet Trends**: The future aircraft fleet is expected to eventually contain electric powered aircraft. Additionally, many companies are working to develop electric vertical take-off and landing (e-VTOL) aircraft. Uber is one company pushing to develop these aircraft and add them as part of their on-demand transportation services.

  Electric aircraft, both e-VTOL and fixed-wing, will significantly impact general aviation. However, these leading-edge technologies are not expected to impact HEF, at least to a measurable extent, within the twenty-year planning period. Due to the Airport's proximity to Washington D.C. and secure airspaces, helicopter activity is not typical in the HEF area. Coupled with winter weather, HEF may not be conducive for this type of technology to operate. E-VTOL operations in bad weather pose challenges for e-VTOLs at this time as significant electrical power needs to be

[3] FAA United States Civil Airmen Statistics, 2021

extracted for de-icing. This could greatly reduce usability in areas prone to snow and ice conditions. However, HEF may consider reserving a location or facility space designated for vertical take-off aircraft should e-VTOL activity happen during the planning period.

For the purpose of this forecast, it was deemed speculation to consider these aircraft as being able to come online and fully integrate into the national airspace system within this study's planning period. Thus, the operations and based aircraft forecast for HEF was developed exclusive of these developments. In addition, HEF may need to plan for additional fuel farm space to allow FBOs to offer alternative fuel options and electric charging stations within the first 10 years in the planning period.

2.4 AIRPORT SERVICE AREA

In determining demand at an airport, it is necessary to examine the demographic and socioeconomic conditions of the airport's service area. An airport service area is a broadly-based geographical area around the airport where it is reasonable to assume that a market exists for airport services. In forecasting aviation demand, the socioeconomic characteristics of the service area are examined to identify correlation with previous patterns and forecasted trends as it relates to aviation activity.

As the largest general aviation airport in the Commonwealth of Virginia in terms of based aircraft population, Manassas Regional Airport (HEF) is also the busiest GA airport in terms of total operations for a GA airport in Virginia. The Airport is within the Washington D.C. Special Flight Rules Area and offers private aircraft access to Washington D.C. Due to its proximity to Washington D.C., several government agencies are based on-site. The Airport is home to two full-service fixed base operators, multiple aircraft sales and rental companies, charter companies, robust flight training schools, leading edge aircraft manufacturers, corporate flight departments, and other niche firms related to all aspects of general aviation. HEF also has a U.S. Customs and Border Patrol facility with helicopters and small fixed-wing aircraft.

2.4.1 Geographic Attributes

Manassas Regional Airport is located on the southwest side of the Washington D.C. Metro area within Prince William County which includes the Maryland, Washington D.C. and Alexandria, VA metro area. The Airport is one of four reliever GA airports for Dulles International Airport with the others being Leesburg Executive Airport (JYO) located 21.5 nautical miles north of HEF, Stafford Regional Airport (RMN) located 19.6 nautical miles south of HEF, and Warrenton/Fauquier Airport (HWY) located 12.2 nautical miles southwest of HEF. JYO has a virtual air traffic control tower at this time.

Drive time distances of 30 to 40 minutes from an airport is typically the primary factor determining the geographic area a general aviation airport will serve. For itinerant and local users of an airport, location is critical, as the primary intent of using aircraft is to reduce overall time spent traveling. In this case, the location of Manassas Regional Airport within Virginia, the region, and the nation influences how it is used within the National Airspace System.

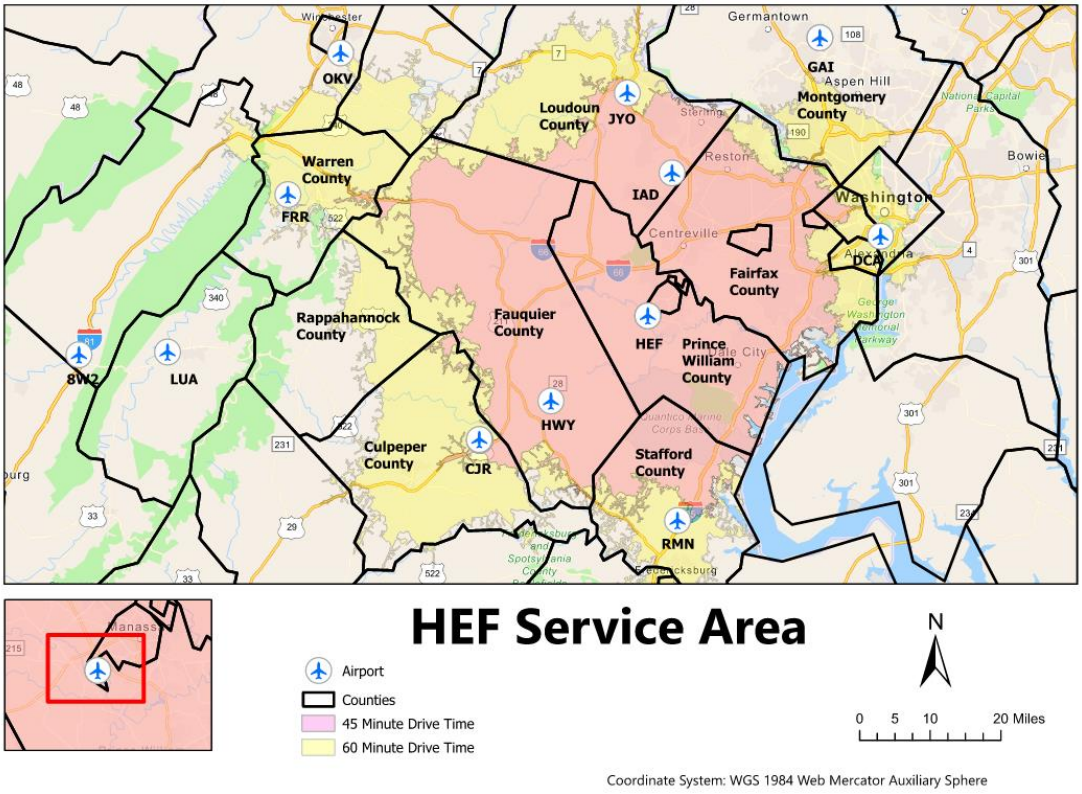
The HEF service area is defined as the maximum boundary from which Airport customers are anticipated to travel through HEF, considering drive time, cost, and the types of services unique to HEF over other airports. Defining the service area plays a major role in the forecast, because it determines the values of the socioeconomic variables that will be considered in analyzing the Airport's traffic growth. Specifically, Interviews with Airport staff were conducted and a drive-time analysis map (**Figure 2-1)** was created. The drive-time analysis map displays the counties within a 45-minute and 60-minute drive time and indicates the typical distance Airport users are willing to drive. In determining the service area of HEF, a heat map was created using based aircraft owner's addresses (illustrated in Error! Reference source not found.) to identify where the majority of airport tenants live. As shown on the map, the majority of airport tenants live within 45 minutes of the airport. The counties and independent cities included in the HEF service area and economic data base used to provide forecasted information socioeconomic variables are listed in **Table 2-1.**

TABLE 2-1
HEF SERVICE AREA AND INDEPENDENT CITIES

Service Area
County/Independent City
Alexandria City
Arlington County
Clarke County
Culpeper County
District of Columbia
Fairfax City
Fairfax County
Falls Church City
Fauquier County
Frederick County
Loudoun County
Manassas City
Manassas Park City
Prince William County
Rappahannock County
Shenandoah County
Stafford County
Warren County

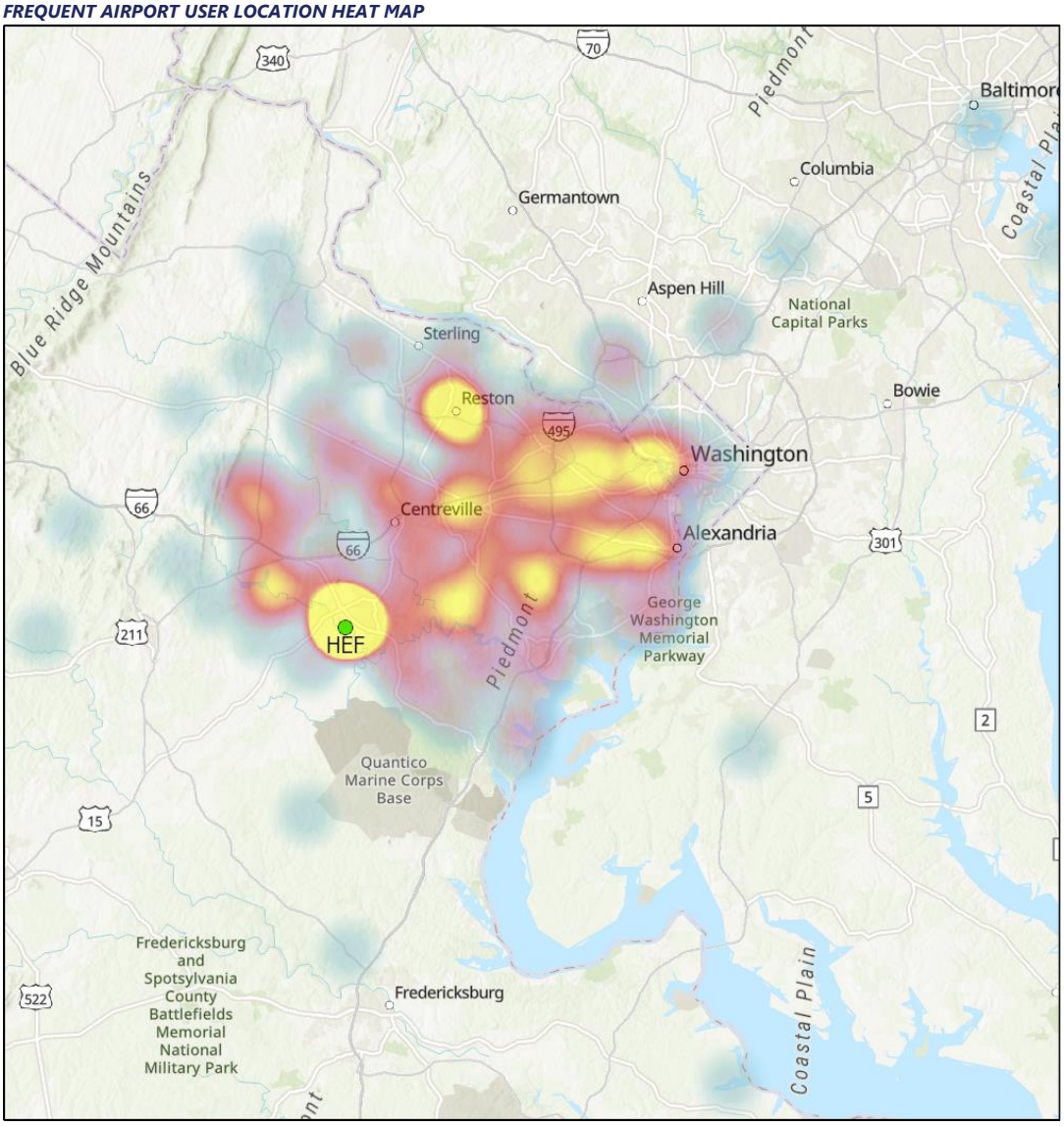
Source: RS&H, 2021; Woods & Poole, Inc., 2021

FIGURE 2-1
HEF SERVICE AREA MAP



Source: ESRI ArcGIS, Prepared by RS&H, 2021

FIGURE 2-2
FREQUENT AIRPORT USER LOCATION HEAT MAP

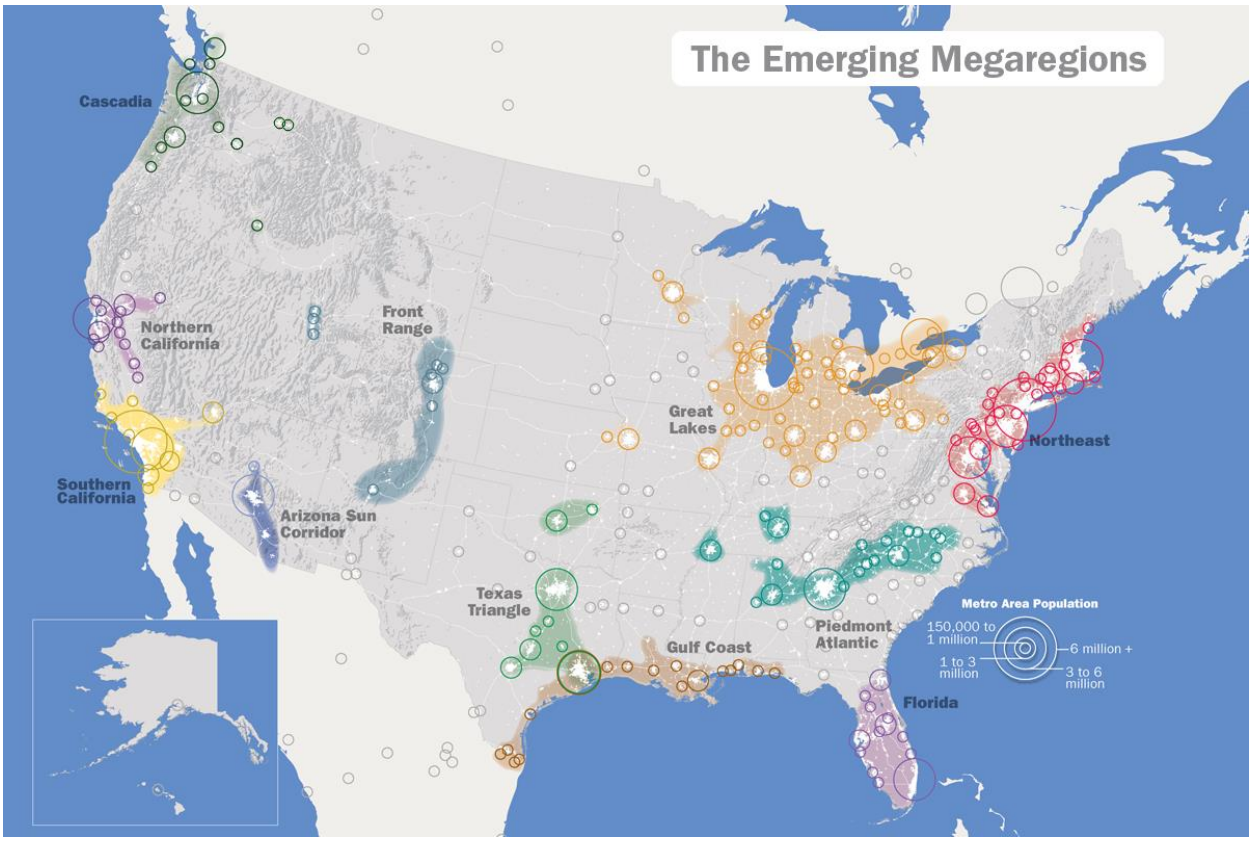


Source: HEF Access Database, ESRI ArcGIS, Prepared by RS&H, 2022

The location of HEF within the metro area directly influences the amount and type of aviation demand seen historically and forecasted. HEF also sits in the upper middle of the Northeast Megaregion, as shown in **Figure 2-3**. Megaregions are roughly defined as metropolitan areas made up of cities that have grown together to form one large economic center. The Northeast Megaregion extends from northern Boston to northern Virginia. It is recognized as the most populous megaregion including the major cities of Boston, Hartford, New York City, Newark, Philadelphia, Baltimore, and Washington D.C. Manassas sits on the southwestern side of this megaregion and is in close proximity to some of the most populated cities within the megaregion. In addition, an Air Defense Identification Zone has existed since 2003 around the Baltimore-Washington Metropolitan Area to restrict air traffic near Washington D.C. The fact that HEF is part of a megaregion means that there is infrastructure in place to ensure easier and less expensive access

to aviation fuels, aircraft parts, and specialty services not often found in rural areas. These geographic factors play heavily into why HEF has grown into the prosperous general aviation airport that it is today.

FIGURE 2-3
UNITED STATES MEGAREGIONS



Source: Regional Plan Association, https://commons.wikimedia.org/wiki/File:MapofEmergingUSMegaregions.png

2.4.2 Socioeconomic Characteristics

Consideration of a community's economic character is particularly important when comparing the vigor and potential growth for travel and general aviation activity to state and national trends. Current and projected economic trends and population projections for HEF's service area were examined and compared to the United States. The service area for HEF includes the counties and independent cities listed in **Table 2-1**.

One of the leading objective sources for assessing economic indices related to economic issues affecting market growth in the U.S. is Woods & Poole. The Woods & Poole's database contains more than 900 variables of economic data and demographic data for the U.S. and all states, regions, counties, and Core Based Statistical Areas for every year from 1970 to 2050. This comprehensive database is updated annually. Relevant economic data from this database for the counties within HEF's service area were used to provide forecasted information on population, per capita personal income (PCPI), employment growth,

and gross regional product (GRP) within the local region. Where relevant some of this information was compared to information provided by the City of Manassas and found to be comparable. Overall, the historical and forecasted socioeconomic characteristics of the HEF service area clearly project continued economic growth for the 20-year planning period.

The following summarizes the Woods & Poole demographic information examined:

- Historical population annual growth rates of the HEF service area have remained relatively strong with an average annual growth rate of 1.1 percent from 2011-2019 in comparison to the United States which had an average annual growth rate (AAGR) of 0.65 percent for the same time period. Manassas population growth is anticipated to remain strong and increase at an average annual growth rate of 1.26 percent.
- Historical PCPI growth rates for the HEF service area showed growth with an average annual growth rate of 2.57 percent from 2011-2019. This rate closely aligns with the United States AAGR of 2.58 percent during the same historical time period. Forecast PCPI growth for the HEF service area is expected to increase at a much higher AAGR of 4.43 percent for 2019-2041.
- The employment forecast for the HEF service area is expected to increase at an average annual growth rate of 1.77 percent from 2019-2041. Historical employment growth for the HEF service area showed a 2.15 percent average annual growth rate from 2011-2019. Both the projected and historical employment for the HEF service area are higher than that of the United States as a whole.
- Historical GRP growth rates for the HEF service area had an average annual growth rate of 1.93 percent from 2011-2019. Forecast GRP growth of the HEF service area remains strong and above the projected national forecast at 2.60 percent average annual growth from 2019-2041.

Table 2-2 shows key socioeconomic indicator growth rates for the HEF service area from 2011-2019 and forecast years from 2019-2041. **Table 2-3** shows the projected socioeconomic indicator values for the baseline year of 2021, and the four forecast years 2026, 2031, 2036, and 2041.

TABLE 2-2
COMPARISON OF KEY SOCIOECONOMIC INDICATOR GROWTH RATES

	Years	
	Historical (CY 2011-2019)	Projected (CY 2019-2041)
HEF Service Area		
Population	1.19%	1.26%
Employment	2.15%	1.77%
PCPI	2.57%	4.43%
GRP	1.93%	2.60%
United States		
Population	0.65%	0.65%
Employment	1.74%	1.09%
PCPI	2.58%	1.85%
GRP	2.44%	1.71%

Note: 1– Percentages are rounded; 2– Calendar Year (CY)
Source: RS&H, 2021; Woods & Poole, Inc., 2021

TABLE 2-3
FORECAST- KEY ECONOMIC SOCIOECONOMIC INDICATOR VALUES (2021-2041)

	2021	2026	2031	2036	2041
Population	3,812,363	4,041,545	4,277,132	4,517,013	4,759,043
Employment	4,410,566	4,740,780	5,064,778	5,381,667	5,691,357
Personal Income Per Capita (Weighted Average)	$83,902	$103,487	$130,439	$165,022	$208,564
Gross Regional Product ($ millions)	$375,293,701	$425,687,031	$479,056,810	$535,303,587	$594,410,499

Notes: Per Capita Personal Income Per Capita and Gross Regional/Domestic Product are shown in 2012 dollars; Average Annual Growth Rates (AAGRs) are rounded to the nearest 0.1 percent; Years represented are calendar years.
Source: Woods & Poole, 2021

2.5 HISTORICAL ACTIVITY AND FORECAST REVIEW

This section provides a review of historical records of aircraft operations and based aircraft. Additionally, all relevant forecasts previously completed for HEF are reviewed.

2.5.1 Historical Operational Activity

An aircraft operation is defined as either a takeoff or a landing. The FAA records annual aircraft operations in the following four categories:

- **Air Carrier** - An air carrier operation involves an aircraft with a seating capacity of more than 60 seats or a cargo payload capacity of more than 18,000 pounds. Additionally, air carrier operations are those carrying passengers or cargo for hire or compensation.

- **Air Taxi / Commuter** – Air taxi operations represent scheduled commercial flights, nonscheduled commercial flights, and charter flights with aircraft with 60 seats or fewer or a cargo payload capacity of 18,000 pounds or less. Additionally, air taxi operations are those carrying passengers or cargo for hire or compensation.

- **Military** - Military operations include all classes of U.S. military or federal government aircraft.

- **General Aviation** - General aviation operations are any type of operation that is not included in one of the previous defined categories and can include aircraft that are categorized as narrow bodies or larger. Specialized GA airports such as HEF, with its long runways and configuration, can expect to see a large variety of aircraft types in the general aviation fleet from time to time. These are typically privately-owned aircraft used for training, recreation, business, or personal use.

Table 2-4 details historical operational activity from Fiscal Year (FY) 2010 to 2021. Overall, annual operations have remained relatively steady after rebounding from the lowest point in 2015. Local GA operations include those that stay within the Airport's Class D airspace. These are predominantly touch-and-go flight training operations. Local GA operations has decreased since FY 2016 according to the TAF. Airport staff indicated that local GA initially declined due to an eight-year recession combined with an on-going pandemic. Due to the unknown circumstances at the time industry publications and discussions

generally expected that a minimum 5-year recover rate would equal levels of service at airports nationwide. However, operations had a dramatic increase in FY 2021 when compared to past years. HEF saw an increase in operations of 27% in 2021 when compared to 2020[4]. Although COVID-19 depressed activity on the aviation industry, the general aviation industry saw significant (3%-7%) positive gains[5]. While business-related GA travel in large metropolitan markets may have declined due to the pandemic and changing business needs, GA activity in many smaller markets returned to increased levels in the past two years, and close to pre-pandemic levels. Representatives of the GA industry, FBOs, GA aircraft manufacturers, state aviation agencies, and business aviation have indicated that charter activity and recreational flying are up and flight training has also returned to pre-COVID-19 levels. With many businesses continuing to promote telecommuting coupled with the lower cost of living, individuals are choosing to move outside major urban areas to smaller communities. Pilots or aircraft owners who have relocated from urban areas may choose to re-base their aircraft closer to new homes as opposed to commuting to large airports with longer ground times. This may result in more frequent operations by the larger aircraft that typically fly into the Airport should owners decide to relocate their aircraft to HEF.

Information gained during interviews with the Airport tenants, including a flight school, indicated that flight schools experiencing large (25%-30%) increases in flight training has factored into the increase in overall local traffic[6]. Within the past three years, three new flight schools have opened at HEF. There are now a total of six flight schools based at HEF. Increases in flight training demand has been seen at airports nation-wide as students seek career opportunities to fill the current shortage of commercial pilots.

Itinerant GA operations include any operation related to aircraft that land at HEF from outside the Airport's Class D airspace, or that depart HEF Class D airspace. Itinerant GA operations include most corporate/businesses aircraft operations and some flight training operations. Corporate itinerant GA activity is steady at HEF. These FBO interviews also verified there has been a trend of operators upgrading to larger aircraft. This may be due to both a strong economy and the COVID-19 pandemic that has brought renewed interest in private aviation travel as opposed to commercial air travel.

Charter operations, accounted for as air taxi operations in the forecast, often have a relationship with commercial airline fares. Air taxi operations have seen a steady increase as customers increase their use of private charter during the COVID-19 pandemic. Air taxi operations have steadily increased as customers have been using private charter as opposed to commercial travel. Itinerant military and local military operations have steadily increased from 2011-2021. Interviews with Airport FBOs indicated that modest (1% - 3%) growth in the future is expected for charter operators[7].

[4] FAA TAF HEF, 2022

[5] *Terminal Area Forecast: taf.faa.gov, March 2022*

[6] Percentage developed from stakeholder interviews

[7] Percentage developed from stakeholder interviews

TABLE 2-4
HEF HISTORICAL OPERATIONAL ACTIVITY

Year	Itinerant Air Carrier	Itinerant Air Taxi	Itinerant GA	Itinerant Military	Itinerant Total	Local GA	Local Military	Total Annual Operations
2010	108	6,585	40,239	648	47,580	45,578	88	93,246
2011	89	7,003	39,011	208	46,311	37,830	85	84,226
2012	34	7,883	37,994	353	46,264	41,561	80	87,905
2013	5	8,134	32,564	341	41,044	42,034	99	83,177
2014	5	10,867	33,465	545	44,882	35,275	234	80,391
2015	11	9,936	32,590	856	43,393	34,780	342	78,515
2016	6	8,285	34,903	543	43,737	43,405	170	87,312
2017	2	9,066	36,275	555	45,898	41,203	88	87,189
2018	3	10,580	34,918	598	46,099	32,481	140	78,720
2019	5	11,374	35,165	695	47,239	38,920	213	86,372
2020	1	8,949	31,902	1,390	42,242	30,103	402	72,747
CAGR 2010-2021	-37.4%	3.1%	-2.3%	7.9%	-1.2%	-4.1%	16.4%	-2.5%

Note- Compound Annual Growth Rate (CAGR) Source: RS&H, 2022; FAA TAF, 2022

2.5.1.1 Historical Based Aircraft

FAA now maintains an online database for based aircraft at GA airports, the FAA National Based Aircraft Inventory Program (the database can be accessed at basedaircraft.com). Airport operators upload to this database the FAA-issued aircraft registration number (the 'N' number) of aircraft based at their airport. FAA checks these entries to ensure the aircraft are airworthy and not being claimed by multiple airports. Should an aircraft be claimed by multiple airports, an airport operator must demonstrate to the FAA that the aircraft owner has an agreement with the airport for storage and the aircraft spends more than six months at the airport.

The FAA makes the final decision on an aircraft's airworthiness and the airport at which it is based. Because some aircraft are stored at multiple airports through the year for mission specific purposes, it often becomes very difficult to determine which of the multiple airports one specific aircraft is stored. Thus, the actual number of accounted based aircraft at an airport can be different in the records kept by the Airport and those reported by the FAA. Historical based aircraft counts, included in the 2022 FAA TAF and Airport records were analyzed. As shown in **Table 2-5**, it is apparent the overall number of based aircraft has remained relatively flat according to the TAF. However, there appears to be a discrepancy in the 2022 TAF and Airport's confirmed based aircraft count (see **Table 2-6)**. All airport sponsors in the Commonwealth are required to submit an annual based aircraft survey to DOAV and **Table 2-6** reflects the based aircraft count reported to the Commonwealth annually. Moving forward in this study, the Airport's updated based aircraft count is used as the baseline starting point for forecasting purposes. Airport records verified based aircraft counts from 2009 to 2015.

TABLE 2-5
FAA TAF HISTORICAL BASED AIRCRAFT

Year	Total Based Aircraft
2009	399
2010	340
2011	340
2012	339
2013	404
2014	404
2015	392
2016	389
2017	395
2018	368
2019	366
2020	339
2021	344

Source: FAA TAF, 2022

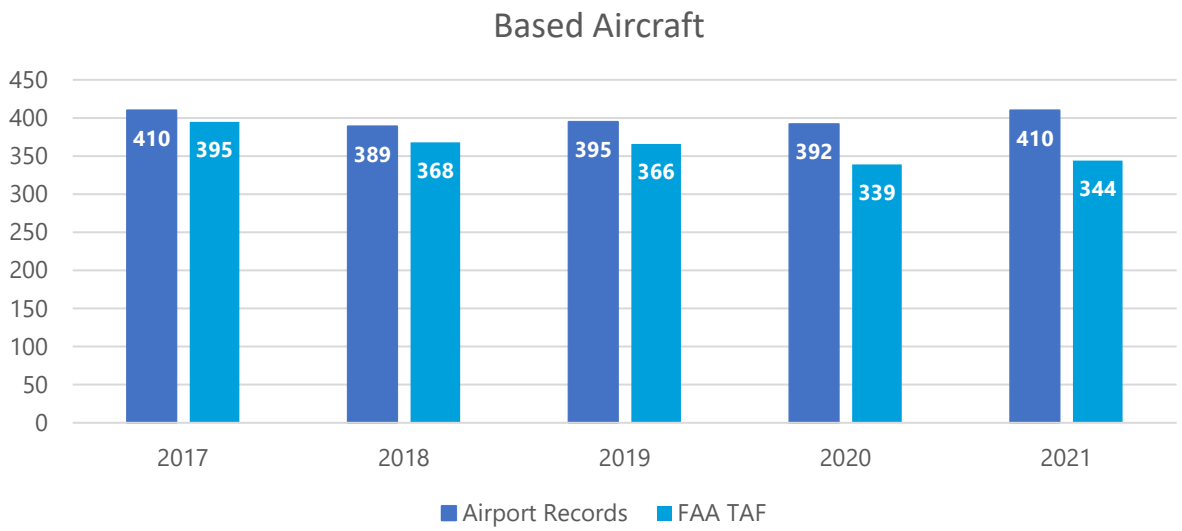
TABLE 2-6
HEF HISTORICAL BASED AIRCRAFT

Year	Single Engine	Multi-Engine	Multi-Engine Turboprop	Jet	Helicopter	Ultra-Light	Other	Total
2009	307	41	6	27	17	1	1	400
2010	311	37	6	29	19	1	1	404
2011	315	38	4	30	18	1	1	407
2012	314	30	10	27	22	0	1	404
2013	324	38	10	37	13	0	1	423
2014	311	42	11	37	16	0	1	418
2015	315	40	12	36	14	0	1	418
2016	306	38	12	37	16	0	1	410
2017	303	45	12	31	19	0	0	410
2018	298	38	7	25	19	0	2	389
2019	299	39	6	29	19	0	3	395
2020	305	34	7	25	18	0	3	392
2021	312	35	16	27	18	0	2	410

Source: HEF Records

As shown in **Figure 2-4**, it is apparent the overall number of based aircraft has fluctuated since 2017 but still higher than TAF records. Airport staff noted that records did not account for some aircraft no longer based on the airfield. Also, there is general awareness of duplicative registration of based aircraft at more than one airport in the Commonwealth, which has likely led to discrepancies in reporting. This complicates the process of determining based aircraft and is anticipated to continually create discrepancies between Airport records and FAA counts.

FIGURE 2-4
HEF AIRPORT RECORDS COMPARISON TO FAA TAF HISTORICAL BASED AIRCRAFT



Source: Airport Records, 2020; FAA TAF 2022

2.5.2 Prior Aviation Forecast Review

This study examined and took into consideration four previously completed aviation demand forecasts including forecasts for the 2002 HEF Airport Layout Plan, the 2022 FAA TAF, the 2021-2041 FAA Aerospace Forecast, and the 2022 Virginia Air Transportation System Plan Update.

2.5.2.1 2002 HEF Airport Layout Plan

The 2002 HEF Airport Layout Plan Technical Report was completed in October of 2002, it included 20-year forecasts with a base year of 1999. Considering the events of September 11, 2001, and the subsequent restrictions that occurred on aviation activity, a multi-variate regression analysis was performed to demonstrate forecasted demand and to better represent what the TAF and Virginia Air Transportation System Plan (VATSP) Forecast of Aviation Demand estimated in Northern Virginia. The 2002 Airport Layout Plan assumed annual aircraft operations were forecast to grow to 180,000 in 2020. Based aircraft was forecast to grow to 550 based aircraft by 2020.

2.5.2.2 2022 FAA TAF Forecast

As the evolving impacts of the COVID-19 public health emergency occurred in 2020, FAA's forecasts account for the downturn and recovery from the pandemic based on airport type. This forecast was prepared in 2022 with considerations of COVID-19's impacts and acknowledged the reduced confidence in growth projections.

Regarding based aircraft, the 2022 FAA TAF forecasted annual growth at 0.90 percent through the planning period. As previously explained, the base year number for 2020 of 339 total aircraft was found to not properly reflect current conditions at HEF and was not used for this study. According to the FAA TAF Detailed 2021 Model, all future growth will materialize in newly based jet aircraft. These factors were considered in the development of the forecast of based aircraft for this Master Plan Update. Between 2009 and 2021, based aircraft grew from 400 to 410. Of that growth, the majority was multi-engine turboprop aircraft growing 1.67 percent from six to 16 between 2009 and 2021.

The 2022 FAA TAF, shown in **Table 2-7**, was published in 2022 and used a base historical year of 2021. Overall, the FAA TAF indicates 2.30 percent growth of total operations between 2021 and 2041. The TAF appears to capture the expected continued increase in local general aviation traffic related to flight training as it shows a 13.50 percent growth between 2017 and 2021 for those operations. The TAF indicates that after 2022, growth will continue. Local and itinerant military operations were held constant from 2021 numbers, as is standard practice for FAA Terminal Area Forecasts.

TABLE 2-7
2022 FAA TAF FORECAST

Fiscal Year	Itinerant Air Carrier	Itinerant Air Taxi	Itinerant General Aviation	Itinerant Military	Local General Aviation	Local Military	Total Annual Operations
2009	99	4,378	46,572	231	66,657	16	117,953
2010	108	6,585	40,239	648	45,578	88	93,246
2011	89	7,003	39,011	208	37,830	85	84,226
2012	34	7,883	37,994	353	41,561	80	87,905
2013	5	8,134	32,564	341	42,034	99	83,177
2014	5	10,867	33,465	545	35,275	234	80,391
2015	11	9,936	32,590	856	34,780	342	78,515
2016	6	8,285	34,903	543	43,405	170	87,312
2017	2	9,066	36,275	555	41,203	88	87,189
2018	3	10,580	34,918	598	32,481	140	78,720
2019	5	11,374	35,165	695	38,920	213	86,372
2020*	1	8,949	31,902	1,390	30,103	402	72,747
Forecast							
2021	1	12,890	37,396	2,425	46,766	171	99,649
2026	5	14,156	37,375	2,425	47,684	171	101,816
2031	5	15,553	37,375	2,425	49,342	171	104,871

Fiscal Year	Itinerant Air Carrier	Itinerant Air Taxi	Itinerant General Aviation	Itinerant Military	Local General Aviation	Local Military	Total Annual Operations
2036	5	17,086	37,375	2,425	51,059	171	108,121
2041	5	18,768	37,375	2,425	52,835	171	111,579
CAGR							
2021-2041	**8.38%**	**1.90%**	**0.00%**	**0.00%**	**0.61%**	**0.00%**	**0.57%**
2021-2026	38.0%	1.9%	0.0%	0.0%	0.4%	0.0%	0.4%
2027-2031	0.0%	1.9%	0.0%	0.0%	0.7%	0.0%	0.6%
2032-2036	0.0%	1.9%	0.0%	0.0%	0.7%	0.0%	0.6%
2037-2041	0.0%	1.9%	0.0%	0.0%	0.7%	0.0%	0.6%

Source: RS&H, 2021; FAA TAF, 2022

2.5.2.3 FAA Aerospace Forecast Fiscal Years 2021-2041

The FAA Aerospace Forecast for FY 2021-2041 was also examined as part of this study. While not directly related to HEF, this report provides forecasts of operations and aircraft fleet mix for the nation. The forecast provides a sound benchmark to compare against when forecasting operations and aircraft fleet at specific airports. **Table 2-8** provides the Aerospace Forecast estimates of operations collectively for all towered airports within the Nation**. Table 2-9** details the U.S. GA aircraft fleet forecast and shows the predicted increases/decreases of specific aircraft categories.

TABLE 2-8
TOTAL COMBINED AIRCRAFT OPERATIONS AT AIRPORTS WITH TOWERS (IN THOUSANDS)

			General Aviation			Military			
Fiscal Year	Air Carrier	Air Taxi/ Commuter	Itinerant	Local	Total	Itinerant	Local	Total	Total All Ops
Historical									
2010	12,658	9,410	14,864	11,716	26,580	1,309	1,298	2,607	51,255
2015	13,755	7,895	13,887	11,691	25,579	1,292	1,203	2,495	49,724
2018	15,686	7,126	14,130	12,354	26,485	1,319	1,155	2,474	51,770
2019	16,192	7,234	14,245	13,109	27,354	1,349	1,134	2,483	53,264
2020	11,737	5,472	12,608	12,333	24,941	1,192	1,020	2,212	44,362
Forecast									
2021	11,219	5,013	13,199	12,744	25,943	1,192	1,020	2,212	44,388
2026	19,050	5,336	15,139	13,632	28,770	1,192	1,020	2,212	55,368
2031	21,337	5,646	15,333	13,877	29,210	1,192	1,020	2,212	58,406
2036	23,490	5,960	15,533	14,131	29,664	1,192	1,020	2,212	61,326
2041	25,571	6,287	15,738	14,393	30,131	1,192	1,020	2,212	64,201
CAGR 2021-2041	4.20%	1.10%	0.90%	0.60%	0.80%	0.00%	0.00%	0.00%	1.90%

Source: FAA Aerospace Forecast Fiscal Years 2021-2041; FAA Air Traffic Activity

TABLE 2-9
U.S. GENERAL AVIATION FLEET FORECAST BY AIRCRAFT TYPE

Year	Piston Engine		Turbine Engine		Rotorcraft	Exper-imental	Light Sport	Other	Total General Aviation Fleet
	Single Engine	Multi-Engine	Turboprop	Turbojet					
Historical									
2010	139,519	15,900	9,369	11,484	10,102	24,784	6,528	5,684	223,370
2015	127,887	13,254	9,712	13,440	10,506	27,922	2,369	4,941	210,031
2018	130,179	12,861	9,925	14,596	9,989	27,531	2,554	4,114	211,749
2019	128,926	12,470	10,242	14,888	10,198	27,449	2,675	4,133	210,981
2020	127,920	12,395	10,205	15,245	10,155	24,455	2,145	2,460	204,980
Forecast									
2021	126,745	12,320	10,170	15,620	10,215	25,250	2,465	3,085	205,870
2026	120,595	11,970	10,165	17,770	10,815	28,075	3,525	4,160	207,075
2031	114,990	11,720	10,390	20,065	11,580	29,965	4,180	4,180	207,070
2036	109,860	11,520	10,725	22,305	12,445	31,625	4,790	4,215	207,485
2041	105,540	11,365	11,385	24,395	13,390	33,050	5,415	4,250	208,790
CAGR 2021-2041	-0.90%	-0.40%	-0.60%	2.30%	1.40%	1.40%	4.00%	1.60%	0.10%

Source: FAA Aerospace Forecast Fiscal Years 2021-2041; FAA Air Traffic Activity

2.5.2.4 2022 Virginia Air Transportation System Plan Draft Forecast

The Virginia Air Transportation System Plan (VATSP) 2022 Update, much like a master plan, is an aviation plan of the entire Commonwealth's airport system that is updated to provide guidance to serve the ongoing growing aviation demand. It is developed by the Virginia Department of Aviation (DOAV) and was most recently updated in 2022. The VATSP identifies HEF as one of its GA airports. The VATSP Update includes an aviation demand forecast published every six years. The forecast draft includes historical and anticipated trends for scheduled air carrier service and general aviation industries. The VATSP analysis indicated that for many aviation demand elements, GA activity was not severely impacted by the COVID-19 pandemic as commercial service operations (see **Figure 2-5**).

The base year for this forecast is 2019 and shows 491,439 GA operations for the Commonwealth of Virginia (see **Table 2-10**) with based aircraft and fleet mix for 2020. Comparing 2020 GA operations to 2019 GA operations signal a reduction of 12.50 percent. This is a slight decrease than the U.S. national average for GA operations which was down 8.90 percent during the same time frame. The Commonwealth of Virginia's general aviation operations are forecasted to grow through 2044 at 0.60 percent per year. In the 25- year forecast period, based aircraft is expected to increase by 282 aircraft, from 3,613 in 2019 to 3,895 in 2044 (see **Figure 2-6**). Virginia's fleet is expected to grow 0.30 percent (see **Table 2-10)** over the forecast period which is consistent with national trends. Business jets are growing the quickest at three percent per year with no growth seen for single engine and multi-engine aircraft. More specifically, business jets share for the Commonwealth's fleet mix is forecasted to increase from four

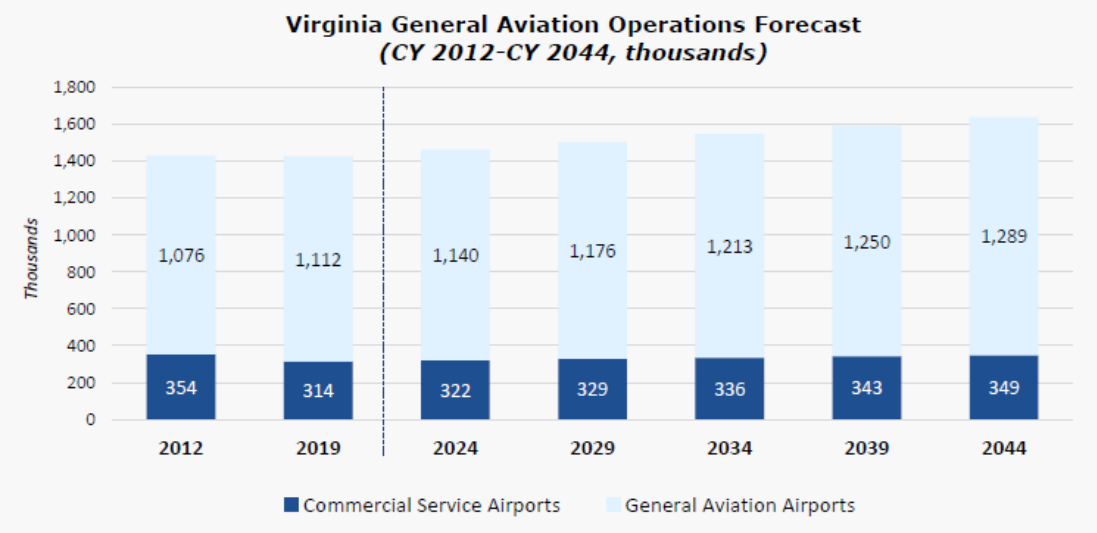
percent in 2019 to eight percent in 2044. For Virginia's forecasted fleet mix, it is expected to be 73 percent singe engine (see **Figure 2-7)** in comparison to the U.S. fleet mix is forecasted to be 51 percent single engine.

TABLE 2-10
COMMONWEALTH OF VIRGINIA'S GA OPERATIONS AT TOWERED AIRPORTS

Year	Itinerant	Local	Total
2015	239,836	252,680	492,516
2016	241,795	259,776	501,571
2017	241,458	253,517	494,975
2018	225,457	244,296	469,753
2019	234,841	256,598	491,439
2020	195,685	234,449	430,134

Source: Virginia Air Transportation System Plan (VATSP) 2021

FIGURE 2-5
COMMONWEALTH OF VIRGINIA'S GA OPERATIONS FORECAST



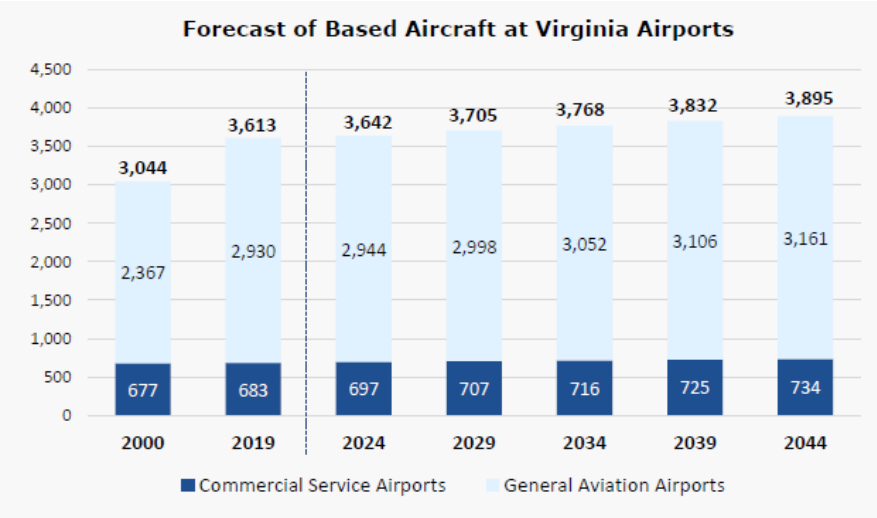
Source: Virginia Air Transportation System Plan (VATSP) 2021

TABLE 2-11
COMMONWEALTH OF VIRGINIA'S GA FLEET MIX (2019-2044)

CAGR	Year 2019-2044
Single Engine	0.00%
Multi-Engine	0.10%
Business Jet	3.00%
Helicopter	2.20%
Other	1.10%
Total	0.30%

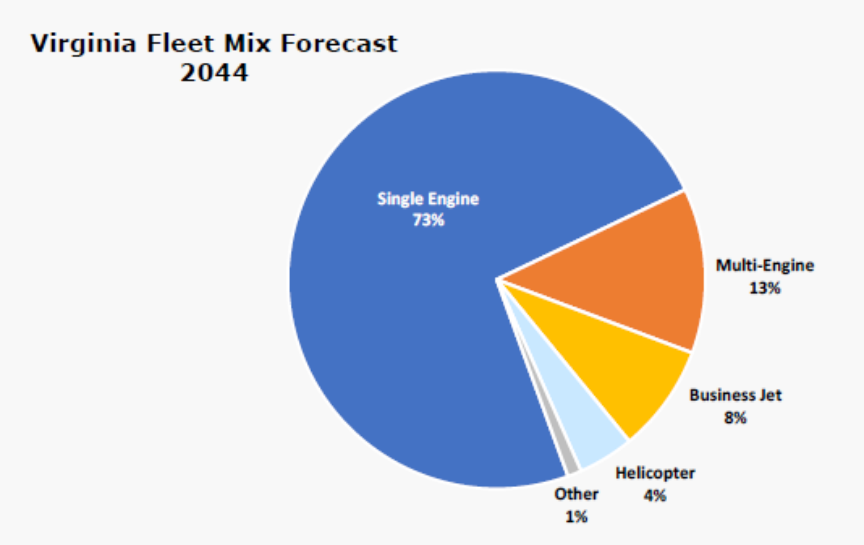
Source: Virginia Air Transportation System Plan (VATSP) 2021

FIGURE 2-6
COMMONWEALTH OF VIRGINIA'S BASED AIRCRAFT FORECAST



Source: Virginia Air Transportation System Plan (VATSP) 2021

FIGURE 2-7
COMMONWELATH OF VIRGINIA'S FLEET MIX FORECAST (2044)



Source: Virginia Air Transportation System Plan (VATSP) 2021

2.6 2021 AVIATION ACTIVITY FORECASTS

The following details the analysis and final forecasts of operations and based aircraft that will be carried forward within this Master Plan Update and used to determine facility requirement needs for HEF.

2.6.1 Aircraft Operations Forecast

The operations forecast is broken down by categories which include itinerant air carrier and itinerant air taxi operations, itinerant GA and local GA operations, and military operations. The military forecasts are

equal to the last year of the FAA TAF 2022. The sum of each of these operation subcategories provides the Base Case Forecast of total operations as well as High and Low Growth scenarios.

2.6.1.1 Itinerant Air Carrier and Air Taxi Operations Forecast

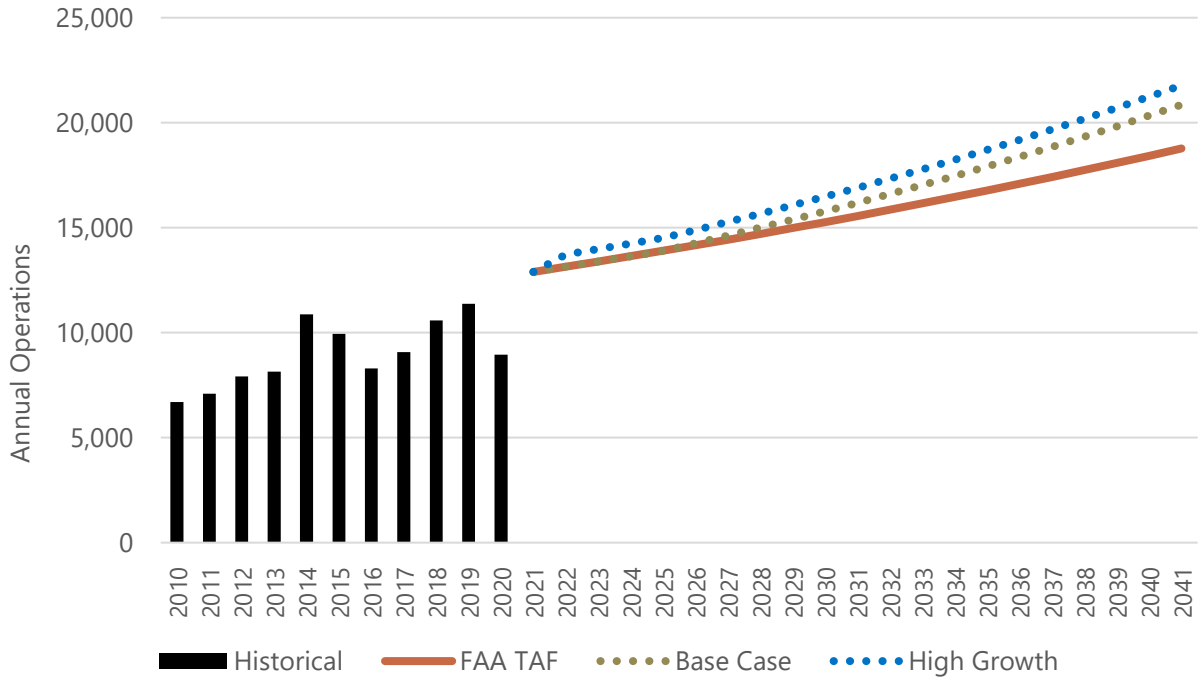
The projections of itinerant air carrier and air taxi operations over the forecast horizon are consistent. **Table 2-12** shows the Base Case Forecast for itinerant air carrier and itinerant air taxi operations from 2021-2041. **Figure 2-8** shows the projected itinerant air carrier and itinerant air taxi operations forecasts. A historical analysis of the HEF service area showed that the AAGR for PCPI increased at a rate of 2.57 percent. The Base Case Forecast is projected to increase at an AAGR of 2.43 percent for 2021-2041 based on the projected PCPI for the HEF service area. Key location and projections for service area's economy provide the rationale for potentially higher than normal growth. In reviewing Traffic Flow Management System Counts (TFMSC) data for 2019, 17 percent of total annual operations were business aviation operations which account for corporate business travel. Conversations with FBOs indicate that HEF will see more business aviation in the future and believes more corporations and companies will base their aircraft at HEF in the next five years. The AAGR for itinerant operations at HEF is 1.90 percent from 2021-2041 based on the 2022 TAF. HEF experienced a resurgence in traffic due to chartered flights such as residents chartering private planes to go on vacation. Corporate travel also saw a slight uptick, and the Airport's flight schools cleared the backlog of business that was suspended when operations were shut down in the spring.

TABLE 2-12
FORECAST ITINERANT AIR CARRIER AND AIR TAXI OPERATIONS (2021-2041)

Year	FAA TAF	Base Case	Low Growth	High Growth
2019	11,379	11,379	11,379	11,379
2020	8,950	8,950	8,950	8,950
2021	12,891	12,891	12,891	12,891
2026	14,161	14,255	14,161	14,887
2031	15,558	16,182	15,558	16,899
2041	18,773	20,854	18,773	21,778
AAGR				
2021-2026	1.90%	2.03%	1.90%	2.94%
2027-2031	1.90%	2.57%	1.90%	2.57%
2032-2041	1.90%	2.57%	1.90%	2.57%
2021-2041	1.90%	2.43%	1.90%	2.66%

Note- Air Carrier represents aircraft with more than 60 seats. Source: RS&H, 2022; FAA TAF, 2022

FIGURE 2-8
FORECAST ITINERANT AIR CARRIER AND AIR TAXI SCENARIOS (2021-2041)



Source: RS&H, 2022; FAA TAF, 2022

2.6.1.2 Based Aircraft Fleet

The 2021 based aircraft total was taken from the Airport's 2021 inventory. The TAF projects a total of 344 aircraft in 2021 while Airport records indicate a total of 410 based aircraft. Each of the forecast scenarios incorporated growth rates associated with **Table 2-5** and **Figure 2-4**.

There was a discrepancy in the based aircraft count listed in the FAA TAF 2021. The FAA TAF 2021 indicated that HEF had a total of 344 based aircraft in 2021 and growing at an AAGR of 1.31 percent over the planning horizon. However, the Airport confirmed that in 2021 it had a total of 410 based aircraft. As a result, the 410 based aircraft were used.

The Base Case Forecast projected a 0.13 percent AAGR for single engine piston from 2021-2026 and overall a 0.19 percent AAGR from 2021-2041. The single engine pistons in the FAA Aerospace Forecast FY 2021-2041 are projected to decrease -0.9 percent AAGR during that time. The based aircraft forecast then adopted a 1.32 percent AAGR for jet aircraft from 2021-2041 to account the projections seen in the FAA Aerospace Forecast and to reflect anticipated growth based on Airport tenant conversations. The Based Aircraft fleet forecast was developed on assumptions based on Airport tenant interviews and industry trends rather than relying completely on TAF projections which analysis deemed too aggressive. Conversations with Airport tenants including a flight training center, reported the flight school purchased multi-engine piston aircraft and anticipates increasing their single-engine aircraft fleet by two aircraft every two-to- five years. The High Growth Forecast has a 0.56 percent AAGR and the Low Growth Scenario Forecast has a 0.36 percent AAGR from 2021-2041. Due to the pandemic, pilot training activity

has seen substantial growth and projects linear growth into the future. Conversations with FBOs anticipate more corporations and companies will base their aircraft at HEF in the next five years. **Table 2-13** shows each of the forecast scenarios for based aircraft from 2021-2041.

TABLE 2-13
FORECAST BASED AIRCRAFT SCENARIOS (2021-2041)

Base Case							
Year	**SEP[1]**	**MEP[2]**	**METP[3]**	**Jet**	**Rotor[4]**	**Other**	**Total**
2021	312	35	16	27	18	2	410
2026	314	35	16	30	18	2	415
2031	319	36	16	32	18	2	424
2036	322	37	17	33	19	2	431
2041	324	37	18	35	20	2	436
High Growth							
Year	**SEP[1]**	**MEP[2]**	**METP[3]**	**Jet**	**Rotor[4]**	**Other**	**Total**
2021	312	35	16	27	18	2	410
2026	317	36	18	31	20	2	424
2031	320	38	19	34	21	2	433
2036	324	39	20	38	22	2	445
2041	328	41	21	42	23	3	458
Low Growth							
Year	**SEP[1]**	**MEP[2]**	**METP[3]**	**Jet**	**Rotor[4]**	**Other**	**Total**
2021	312	35	16	27	18	2	410
2026	313	35	16	28	18	2	413
2031	316	36	17	30	18	2	420
2036	318	37	17	32	19	2	425
2041	321	37	17	33	19	2	430

Note: 1-SEP=Single engine piston aircraft; 2-MEP=Multi-engine piston aircraft; 3-METP=Multi-engine turboprop aircraft; Jet=Turbojet aircraft; 4-Rotor=Helicopter/Rotorcraft
Source: RS&H, 2022; FAA TAF, 2022

2.6.1.3 Itinerant GA and Local GA Operations Forecast

The FAA TAF projects the GA operations to increase by nearly 6,000 operations from the 2021-2041 with a 0.21 percent AAGR from 2021-2026. Through interviews with flight schools at the Airport it was clear HEF tenants are expecting and planning for an increase in students and resulting additional based aircraft. This activity will reflect in an increase beyond historic numbers of annual operations at HEF. The FAA TAF 2022 indicated that HEF will have a total of 90,210 GA operations in 2041 and is projected to grow at an AAGR of 0.35 percent from 2021-2041.

A review of historic data yielded a high statistical correlation between airport operations and population growth within the HEF service area. As such, the Base Case Forecast was determined considering a 1.19 percent AAGR which is similar to the projected AAGR of HEF's service area. The projected GA operations distribution average is applied to each of the forecasts to generate projected civil and itinerant GA

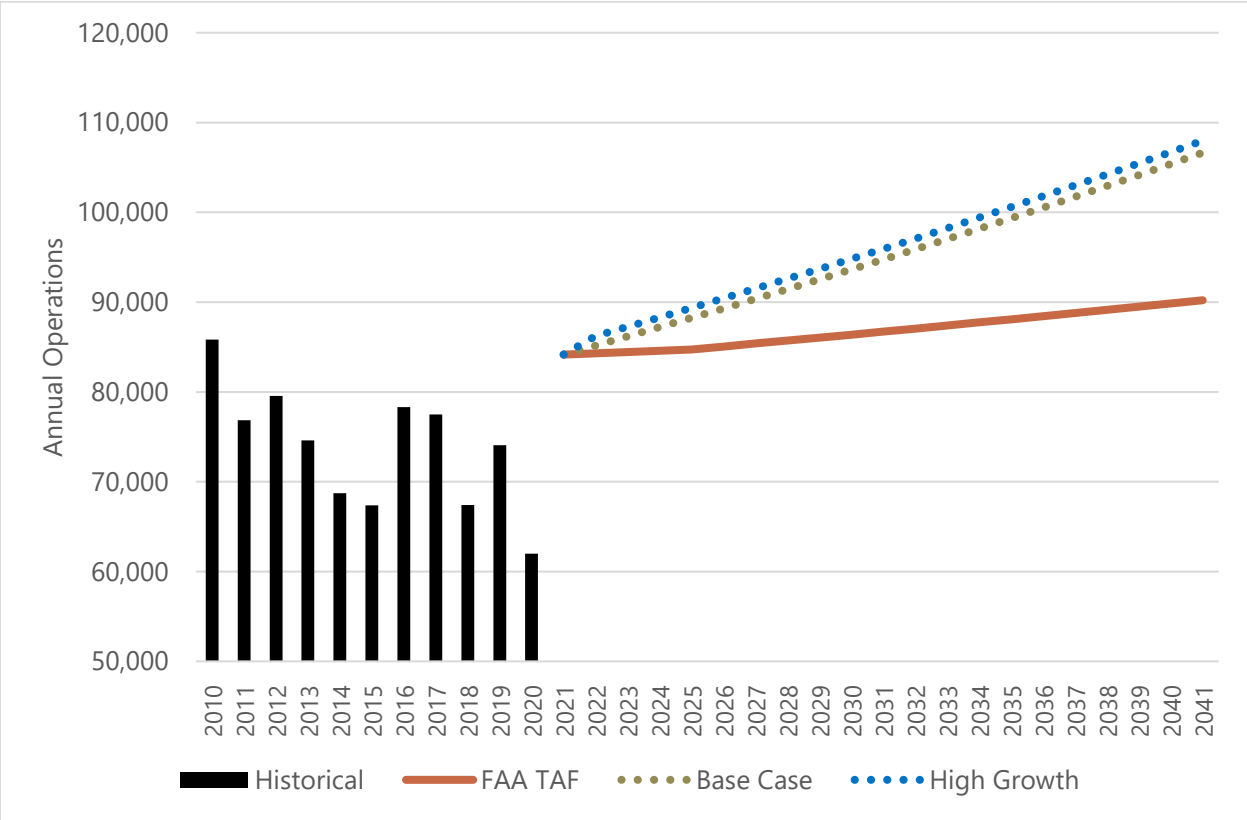
operations. Although the TAF shows GA itinerant operations with a flat growth at 37,375 operations through 2041, the applied growth factor to the Base Case indicates a forecasted growth in GA itinerant and local operations due to GA operations correlation to population growth. Comparatively, the GA operations of the Commonwealth of Virginia general aviation operations are forecasted to grow through 2044 at 0.60 percent per year. **Table 2-14** and **Figure 2-9** provide the GA operations projections by forecast from 2021-2041.

TABLE 2-14
FORECAST GA OPERATIONS SCENARIOS (2021-2041)

Year	FAA TAF	Base Case	Low Growth	High Growth
2019	74,085	74,085	74,085	74,085
2020	62,005	62,005	62,005	62,005
2021	84,162	84,162	84,162	84,162
2026	85,059	89,293	85,059	90,416
2031	86,717	94,736	86,717	95,928
2041	90,210	106,638	90,210	107,980
AAGR				
2021-2026	0.21%	1.19%	0.21%	1.45%
2027-2031	0.39%	1.19%	0.39%	1.19%
2032-2041	0.40%	1.19%	0.40%	1.19%
2021-2041	0.35%	1.19%	0.35%	1.25%

Source: RS&H, 2022; FAA TAF, 2022

FIGURE 2-9
FOREAST GA OPERATIONS SCENARIOS (2021-2041)



Source: RS&H, 2022; FAA TAF, 2022

2.6.1.4 Military Operations

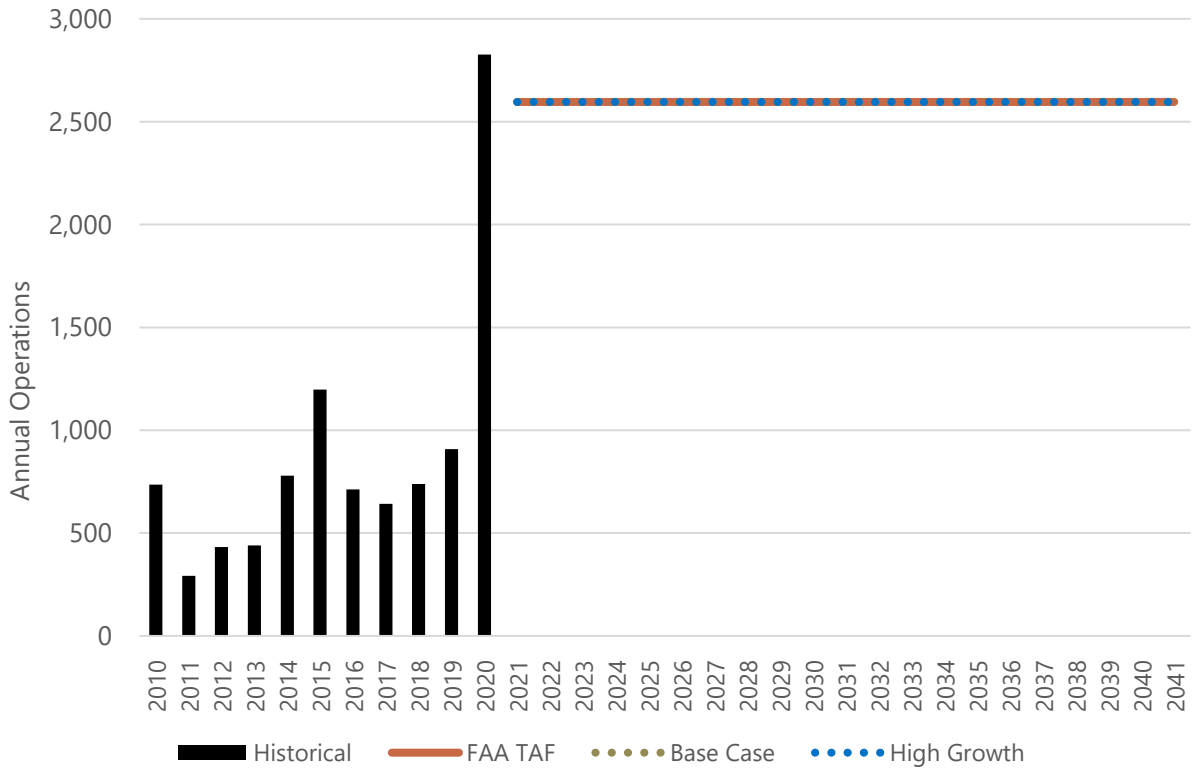
The itinerant and local military aircraft that operate out of HEF represented only 2.6 percent of all 99,949 operations as identified within FAA TAF 2022. This forecast does not make any changes to the number of local or itinerant military operations. Instead, as is a customary practice and done within FAA TAF's numbers, it holds the existing count of 2,596 operations for local and itinerant military operations constant from 2021-2041. **Table 2-15** and **Figure 2-10** shows the military operations and represents military operations forecasts for the Base Case, High Growth, and Low Growth Forecasts.

TABLE 2-15
FORECAST MILITARY OPERATIONS (2021-2041)

Year	FAA TAF	Base Case	Low Growth	High Growth
2019	2,596	2,596	2,596	2,596
2020	2,596	2,596	2,596	2,596
2021	2,596	2,596	2,596	2,596
2026	2,596	2,596	2,596	2,596
2031	2,596	2,596	2,596	2,596
2041	2,596	2,596	2,596	2,596
AAGR				
2021-2026	0.00%	0.00%	0.00%	0.00%
2027-2031	0.00%	0.00%	0.00%	0.00%
2032-2041	0.00%	0.00%	0.00%	0.00%
2021-2041	0.00%	0.00%	0.00%	0.00%

Source: RS&H, 2022; FAA TAF, 2022

FIGURE 2-10
FORECAST- MILITARY OPERATIONS (2021-2041)



Source: RS&H, 2022; FAA TAF, 2022

2.6.1.5 Total Operations

The forecast total operations for the Airport are a summation of the air taxi, GA, and military operation forecasts presented in previous sections. **Table 2-16** and **Figure 2-11** show the projected totals from 2021-2041 for each scenario. The FAA TAF 2022 projects an AAGR of 0.57 percent from 2021-2041 to increase total annual operations to 111,579 by 2041. This rate was also used for the Low Growth Forecast. The Base Case Forecast projects a slightly greater trend in the growth of the Airport's total annual operations over the planning horizon increasing to a total of 130,088 by 2041, at an AAGR of 1.34 percent.

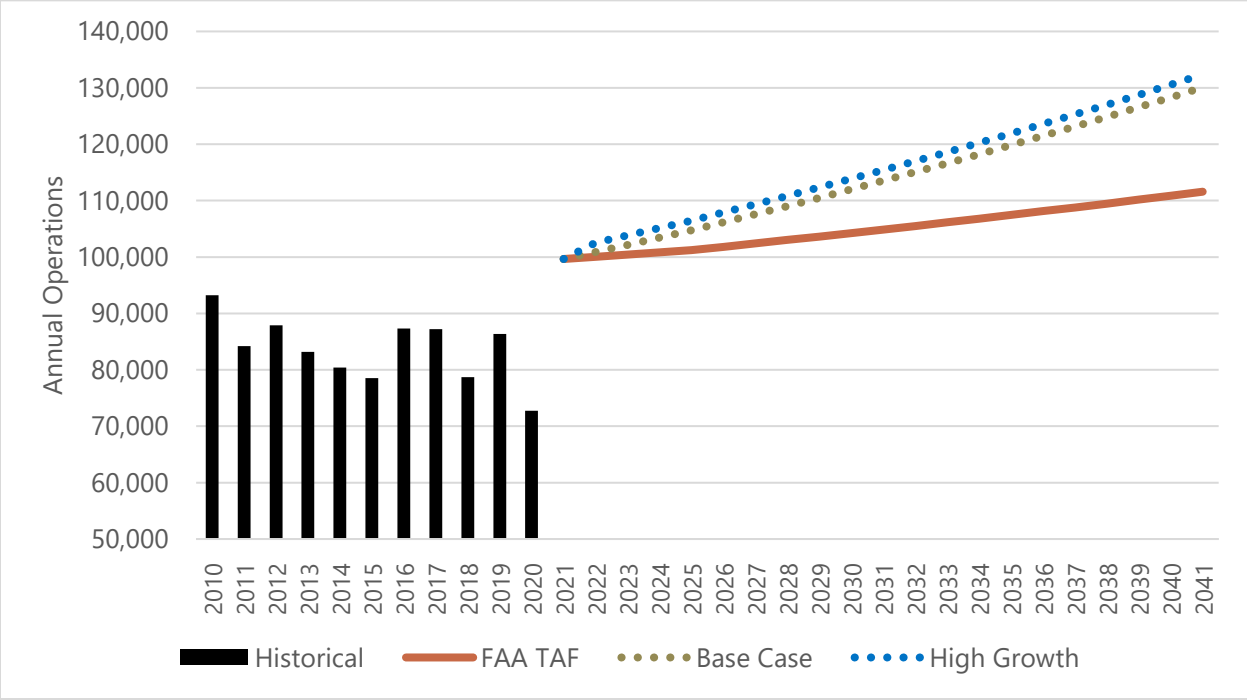
TABLE 2-16
FORECAST TOTAL OPERATIONS SCENARIOS (2021-2041)

Year	Historical	FAA TAF	Forecasts		
			Base Case	Low Growth	High Growth
2010	93,246	93,246	93,246	93,246	93,246
2011	84,226	84,226	84,226	84,226	84,226
2012	87,905	87,905	87,905	87,905	87,905
2013	83,177	83,177	83,177	83,177	83,177
2014	80,391	80,391	80,391	80,391	80,391
2015	78,515	78,515	78,515	78,515	78,515
2016	87,312	87,312	87,312	87,312	87,312
2017	87,189	87,189	87,189	87,189	87,189
2018	78,720	78,720	78,720	78,720	78,720
2019	86,372	86,372	86,372	86,372	86,372
2020	72,747	72,747	72,747	72,747	72,747
2021	99,649	99,649	99,649	99,649	99,649
2022		100,041	100,896	100,041	102,550
2023		100,432	102,159	100,432	103,837
2024		100,828	103,438	100,828	105,140
2025		101,228	104,735	101,228	106,462
2026		101,816	106,144	101,816	107,899
2027		102,410	107,573	102,410	109,358
2028		103,013	109,024	103,013	110,840
2029		103,627	110,498	103,627	112,344
2030		104,245	111,994	104,245	113,872
2031		104,871	113,514	104,871	115,424
2032		105,507	115,058	105,507	117,000
2033		106,148	116,625	106,148	118,601
2034		106,798	118,217	106,798	120,227
2035		107,457	119,834	107,457	121,878
2036		108,121	121,477	108,121	123,556
2037		108,795	123,145	108,795	125,261
2038		109,475	124,840	109,475	126,992
2039		110,167	126,562	110,167	128,751
2040		110,869	128,311	110,869	130,539

Year	Historical	FAA TAF	Forecasts		
			Base Case	Low Growth	High Growth
2041		111,579	130,088	111,579	132,354
AAGR					
2021-2026		0.43%	1.27%	0.43%	1.61%
2027-2031		0.59%	1.35%	0.59%	1.36%
2032-2041		0.62%	1.37%	0.62%	1.38%
2021-2041		0.57%	1.34%	0.57%	1.43%

Source: RS&H, 2022; FAA TAF, 2022

FIGURE 2-11
TOTAL OPERATIONS FORECAST COMPARISON (2021-2041)



Source: RS&H, 2022; FAA TAF, 2022

2.7 CRITICAL AIRCRAFT

Critical aircraft are defined by the use within specific areas of the Airport to determine appropriate airfield design requirements. The FAA defines a critical aircraft as the most demanding aircraft with 500 or more operations annually. A representative group type can be used in some cases if no single aircraft model has sufficient operations to achieve the threshold. A critical aircraft must be determined for each runway, and sometimes for specific portions of the terminal/hangar area. Ultimately, the critical aircraft provides details for airport design which include Aircraft Approach Category (AAC), Airplane Design Group (ADG), and Taxiway Design Group (TDG). The AAC (see **Table 2-17**), depicted by a letter, relates to aircraft landing speeds. The ADG (see **Table 2-18**), depicted by a Roman numeral, relates to airplane wingspan and height. The TDG (see

Table 2-19), classified by number, relates to the outer-to-outer main gear width and the distance between the cockpit and main gear. These parameters serve as the basis of the design and construction of airport infrastructure.

2.7.1 Existing Critical Aircraft

The 2012 Master Plan identified the critical aircraft for Runway 16L-34R as the Gulfstream V and the Dash 8 as the critical aircraft for Runway 16R-34L. The Gulfstream V is a business jet that is an AAC–C, ADG–III, and TDG –2B aircraft. The Dash 8 is a turboprop aircraft that is an AAC–B, ADG –III, and a TDG–3. The latest ALP update completed in 2021 following the 16R-34L Rehabilitation Project identifies the critical aircraft for Runway 16R-34L as the Citation Sovereign while the critical aircraft for Runway 16L-34R remained the same, the Gulfstream V. The Citation Sovereign is a business jet that is an AAC-B, ADG-II, and TDG-1B. Forecasting the future critical aircraft will assist in identifying triggering events that would cause specific development to be required.

TABLE 2-17
AIRCRAFT APPROACH CATEGORY

AAC	Approach Speed
A	Approach speed less than 91 knots
B	Approach speed 91 knots or more but less than 121 knots
C	Approach speed 121 knots or more but less than 141 knots
D	Approach speed 141 knots or more but less than 166 knots
E	Approach speed 166 knots or more

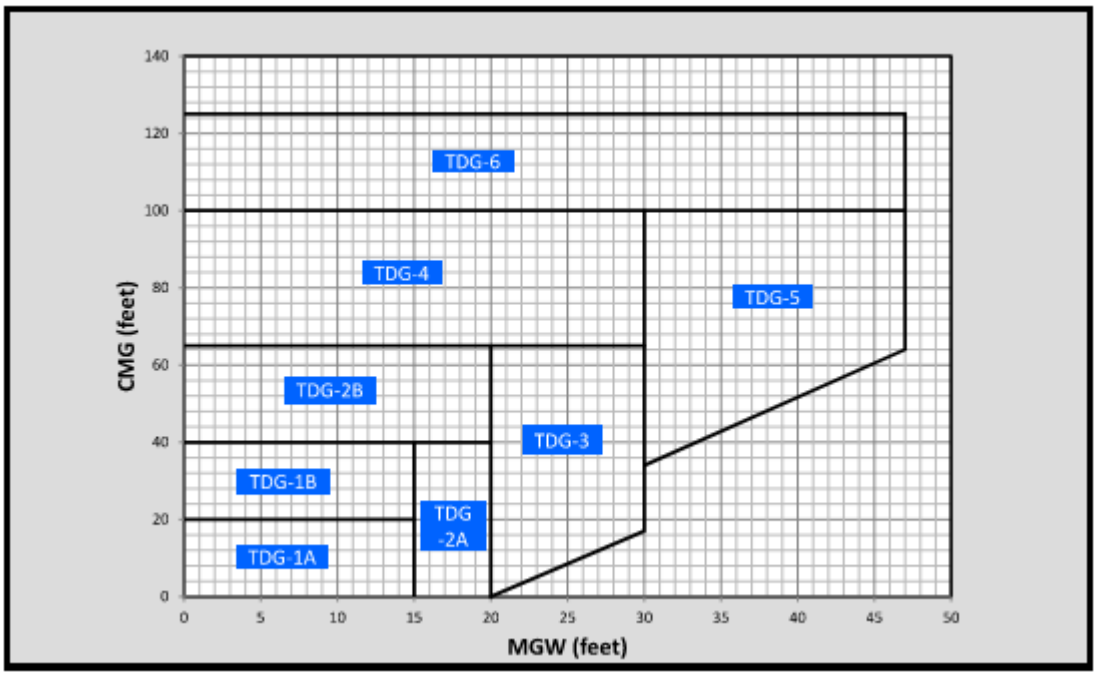
Source: FAA AC 150/5300-13A, Change 1, Airport Design

TABLE 2-18
AIRCRAFT DESIGN GROUP

Group #	Tail Height (ft)	Wingspan (ft)
I	< 20'	< 49'
II	20' - < 30'	49' - < 79'
III	30' - < 45'	79' - < 118'
IV	45' - < 60'	118' - < 171'
V	60' - < 66'	171' - < 214'
VI	66' - < 80'	214' - < 262'

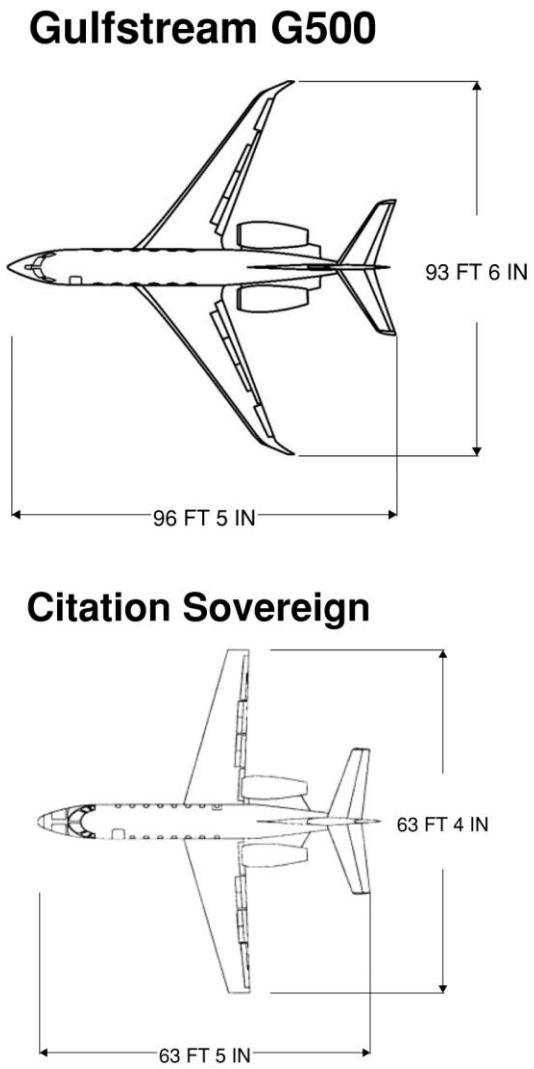
Source: FAA AC 150/5300-13A, Change 1, Airport Design

TABLE 2-19
TAXIWAY DESIGN GROUP



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

FIGURE 2-12
EXISTING CRITICAL AIRCRAFT



2.7.2 Future Critical Aircraft

Advisory Circular 150/5000-17 (Critical Aircraft and Regular Use Determination) defines the critical aircraft as the most demanding aircraft type, or grouping of aircraft with similar characteristics, that make regular use of the airport. Regular use is 500 annual operations, including both itinerant and local operations but excluding touch-and-go operations.

For the purpose of identifying a Critical Aircraft, "similar characteristics" refers to the practice of grouping aircraft by comparable operational performance and/or physical dimensions. The composite aircraft will represent a group of aircraft with the most demanding Aircraft Approach Category (AAC) and Airplane Design Group (ADG). To define the airport's future critical aircraft, grouping aircraft with similar characteristics together instead of identifying a single aircraft type is necessary.

Table 2-20 shows the composite grouping of operations which will define the future critical aircraft for Runway 16L-34R. The data was obtained from the airport's operations tracking software VirTower which allows tracking of all airport operations, inclusive of government operations typically omitted from FAA offload data.

TABLE 2-20
2021 OPERATIONS ON RWY 16L-34R BY AIRCRAFT TYPE

AAC/ADG	Aircraft	CY 2021 Operations
A-III	Boeing Douglas DC-3	20
B-III	Bombardier Global Express 6000	24
C-III	Bombardier Dash 8 Q300 Bombardier Dash 8 Q400 Embraer 190 Gulfstream V	731
D-III	Gulfstream VI	30

Source: HEF VirTower Data, 2021

Aircraft classified as C-III account for over 700 operations in 2021, with the Gulfstream V (305 operations) making up nearly half of those operations, making it the largest category to exceed the 500 annual operations threshold. While aircraft in the D-III category occasionally operate at HEF, their total operations do not currently exceed the operations threshold to constitute regular use. For this reason, the future critical aircraft will remain the C-III Gulfstream V.

With the Airport preparing for expected growth and development on the west side during the forecast period coupled with aircraft becoming faster and more complex (pistons to turbine and jets), it's prudent to plan for a facility that aligns with the existing critical aircraft for RWY 16R-34L. As stated in the Virginia Air Transportation System Plan draft, business jet share for the Commonwealth's fleet mix is forecasted to increase from four percent in 2019 to eight percent in 2044. Business jets are growing the quickest with no growth seen for single engine and multi-engine aircraft. Therefore, the future critical aircraft will remain the Citation Sovereign as identified in the latest ALP update.

2.8 FORECAST COMPARISON TABLES

This section compares the FAA TAF 2022 published March 2022 with the Base Case Forecast. In accordance with FAA Order 5050.4B, National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions, paragraph 706.b(3), the FAA uses the following parameters to assess aviation forecasts, including those prepared for airport master plans. To be consistent with the FAA TAF:

- The 5-year forecast should be within 10 percent of the TAF; and,
- The 10-year forecast should be within 15 percent of the TAF.

Each of the forecasts used fiscal years for enplanements and operations to be directly comparable with the FAA TAF.

The Base Case Forecast was generated through extensive analysis of regional socioeconomic statistics, trends, and existing data sources, as well as through in-depth interviews with key stakeholders within the Manassas regional area. Based on these inputs, a best-fit model was produced. In addition to the Base Case Forecast, alternative High and Low Growth Forecasts were developed to provide varying levels of activity due to unanticipated local or national events. The existing military operations from TAF 2022 are projected to remain constant over the 20-year planning horizon.

Table 2-21 shows the comparison of the preferred Base Case Forecast with the FAA TAF 2022. In all cases the preferred Base Case Forecast meets the five year and 10-year percent parameters established by the FAA for assessing forecast differences.

The summary of aviation forecasts as it relates to itinerant operations, local operations, based aircraft, and instrument approach operations is provided in **Table 2-22**.

TABLE 2-21
BASE CASE FORECAST COMPARISON WITH FAA TAF 2021

	2021		2026		2031		2041	
Category	**Base Case**	**TAF 2021**	**Base Case**	**TAF 2021**	**Base Case**	**TAF 2021**	**Base Case**	**TAF 2021**
Air Carrier & Air Taxi Operations	12,891	12,891	14,255	14,161	16,182	15,558	20,854	18,773
GA & Local GA Operations	84,162	84,162	89,293	85,059	94,736	86,717	106,638	90,210
Military Operations	2,596	2,596	2,596	2,596	2,596	2,596	2,596	2,596
Total Operations	99,649	99,649	106,144	101,816	113,514	104,871	130,088	111,579
GA Based Aircraft	410	410	415	412	424	396	436	446
Comparison with FAA TAF 2021 (percent different)								
Air Carrier & Air Taxi Operations	0.00%		0.66%		3.86%		9.98%	
GA & Local GA Operations	0.00%		4.74%		8.46%		15.41%	
Military Operations	0.00%		0.00%		0.00%		0.00%	
Total Operations	0.00%		4.08%		7.61%		14.23%	
GA Based Aircraft	0.00%		0.72%		6.60%		-2.29%	

Source: RS&H, 2022; FAA TAF, 2022

TABLE 2-22
AVIATION FORECASTS SUMMARY

	Base Yr. Level	Base Yr.+5yrs.	Base Yr.+10yrs.	Base Yr.+20yrs.	Average Annual Compound Growth Rates		
					Base Yr. to +5	Base Yr. to +10	Base Yr. to +20
	2021	2026	2031	2041	2026	2031	2041
Operations							
Itinerant							
Air carrier	1	5	5	5	37.97%	17.46%	8.38%
Commuter/air taxi	12,890	14,250	16,177	20,849	2.03%	2.30%	2.43%
General aviation	37,396	39,676	42,094	47,383	1.19%	1.19%	1.19%
Military	2,425	2,425	2,425	2,425	0.00%	0.00%	0.00%
Local							
General aviation	46,766	49,617	52,642	59,255	1.19%	1.19%	1.19%
Military	171	171	171	171	0.00%	0.00%	0.00%
TOTAL OPERATIONS	99,649	106,144	113,514	130,088	1.27%	1.31%	1.34%
Based Aircraft							
Single Engine	312	314	319	324	0.13%	0.22%	0.19%
Multi Engine	51	51	52	55	0.00%	0.19%	0.38%
Jet Engine	27	30	32	35	2.13%	1.71%	1.31%
Helicopter	18	18	18	20	0.00%	0.00%	0.53%
Other	2	2	2	2	0.00%	0.00%	0.00%
TOTAL	410	415	423	436	0.24%	0.31%	0.31%
Instrument Operations	8,985	9,581	10,319	12,013	1.29%	1.39%	1.46%