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ROANOKE-BLACKSBURG REGIONAL AIRPORT

Roanoke–Blacksburg Regional Airport
Master Plan Update
Working Paper 3

RS&H

Working Paper 3
Aviation Activity Forecast

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RS&H

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CHAPTER 3

AVIATION ACTIVITY FORECAST

3.1 INTRODUCTION

This chapter presents projections of aviation activity at the Roanoke-Blacksburg Regional Airport. These projections are used for evaluating the capability of the existing Airport facilities to meet current and future demand and to estimate the extent to which facilities should be provided in the future.

After the submission of the forecasts to the FAA, the COVID-19 pandemic virtually shut down aviation in the United States and most of the world. The forecasts developed in this report do not assess the ultimate impact of this event which, at the time of issuance of this document, is still unfolding. A reevaluation of the forecast data may be conducted in the future depending on the timeline of implementation of upcoming airport improvements.

Aviation activity forecasting is an analytical and subjective process. Actual activity that develops in future years may differ from the forecasts developed in this chapter as a result of future changes in local conditions, the dynamics of the commercial and general aviation industry, as well as economic and political changes for the service area and the nation as a whole. Future facility improvements should be implemented as demand warrants rather than at set future timeframes. This will allow the Airport to respond to changes in demand, either higher or lower than the forecast, regardless of the year in which those changes take place.

3.1.1 FAA Forecast Guidance and Purpose

FAA Advisory Circular (AC) 150/5070-6B Change 2 to *Airport Master Plans*, provides the rationale for a properly constructed aviation activity forecast. The AC states that:

> "Forecasts of future levels of aviation activity are the basis for effective decisions in airport planning. These projections are used to determine the need for new or expanded facilities. In general, forecasts should be realistic, based upon the latest available data, be supported by information in the study, and provide an adequate justification for airport planning and development. Any activity that could potentially create a facility need should be included in the forecast. Planners should prepare a reliable activity baseline, select an appropriate forecast methodology, develop a forecast, compare it to other forecasts for reasonableness, and submit the forecasts to the FAA for approval. The planning agency should use appropriate statistical techniques to estimate activity where actual operations counts are not available"

3.1.2 Forecast Framework

ROA's forecast uses 2019 as the Baseline Year, and makes projections beginning in 2020 and continues over the 20-year (long-term) forecast period which ends in 2039.

- Baseline Year: 2019
- Short-Term Forecast Period: 2020-2024
- Intermediate-Term Forecast Period: 2025-2029
- Long-Term Forecast Period: 2030-2039

The framework of this chapter discusses the following topics:

- Historical aviation activity at ROA
- Review of previous forecasts and studies at ROA
- Factors that affect aviation demand
- Forecast development for the following categories:
  - Passenger Enplanements
  - Air Cargo Tonnage
  - Aircraft Operations
  - Design Hour Activity
  - Critical Aircraft
- Forecast comparison with the current FAA Terminal Area Forecast

3.2 HISTORICAL AVIATION ACTIVITY

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 reviews historical aviation activity data from 2005 or more recent, depending on the analysis and the data that was available. It also identifies conditions of the Baseline Year 2019. The historical review contains multiple data sources including the Airport's records, the BTS T-100 segment data, and the FAA TAF 2018.

3.2.1 Enplanements

An enplanement indicates passenger boarding a commercial aircraft at an airport. Given ROA's role as a regional airport, it is assumed that the enplanements are primarily origin & destination (O&D) by type, meaning that passengers generally begin and end their destination in Roanoke, rather than connect there as a middle segment of a trip.

3.2.1.1 Annual Enplanements

Over the past 15 years ROA has seen a compound annual growth of 0.4% for total enplanements. The Airport has fluctuated during that time staying above or near 300,000 enplanements, with its peak year being 2019, and lowest year in 2016. Some of the notable events that the Airport experienced during this time are identified below.

- 2007- Allegiant Airlines began service at ROA with two new non-stop Florida markets which include Sanford/Orlando (SFB) and St. Petersburg/Clearwater (PIE). This event had a noticeable impact on the Airport's air carrier and total enplanements from FY 2006 to 2007.
- 2008- The Cincinnati, Ohio (CVG) non-stop market was terminated causing a decrease in enplanements from FY 2008 to 2009.
- 2009- The impacts of the 2009 Economic Recession decreased Airport's enplanements from FY 2008 to 2009.

- 2014- The Detroit, Michigan (DTW) non-stop market was terminated decreasing enplanements from FY 2014 to 2015.
- 2018- Advanced Auto Parts moved its corporate headquarters from Roanoke, Virginia to Raleigh, North Carolina, which caused an impact on the local economy.

Table 1 and *Figure 1* provide the historical enplanements of ROA from FY 2005-2019.

TABLE 1
HISTORICAL-ENPLANEMENTS (2005-2019)

FY	Air Carrier[2]	Commuter[3]	Total Enplanements
2005	3,921	323,855	327,776
2006	6,328	311,639	317,967
2007	27,340	320,497	347,837
2008	32,897	290,470	323,367
2009	31,669	268,637	300,306
2010	29,295	277,656	306,951
2011	32,637	287,907	320,544
2012	33,399	283,939	317,338
2013	54,248	254,493	308,741
2014	60,460	247,950	308,410
2015	74,276	226,779	301,055
2016	75,607	223,874	299,481
2017	77,756	229,305	307,061
2018	80,897	240,746	321,643
2019[1]	87,707	261,014	348,721
CAGR			
2005-2014	31.5%	-2.6%	-0.6%
2015-2019	3.4%	0.9%	2.5%
2005-2019	23.0%	-1.4%	0.4%

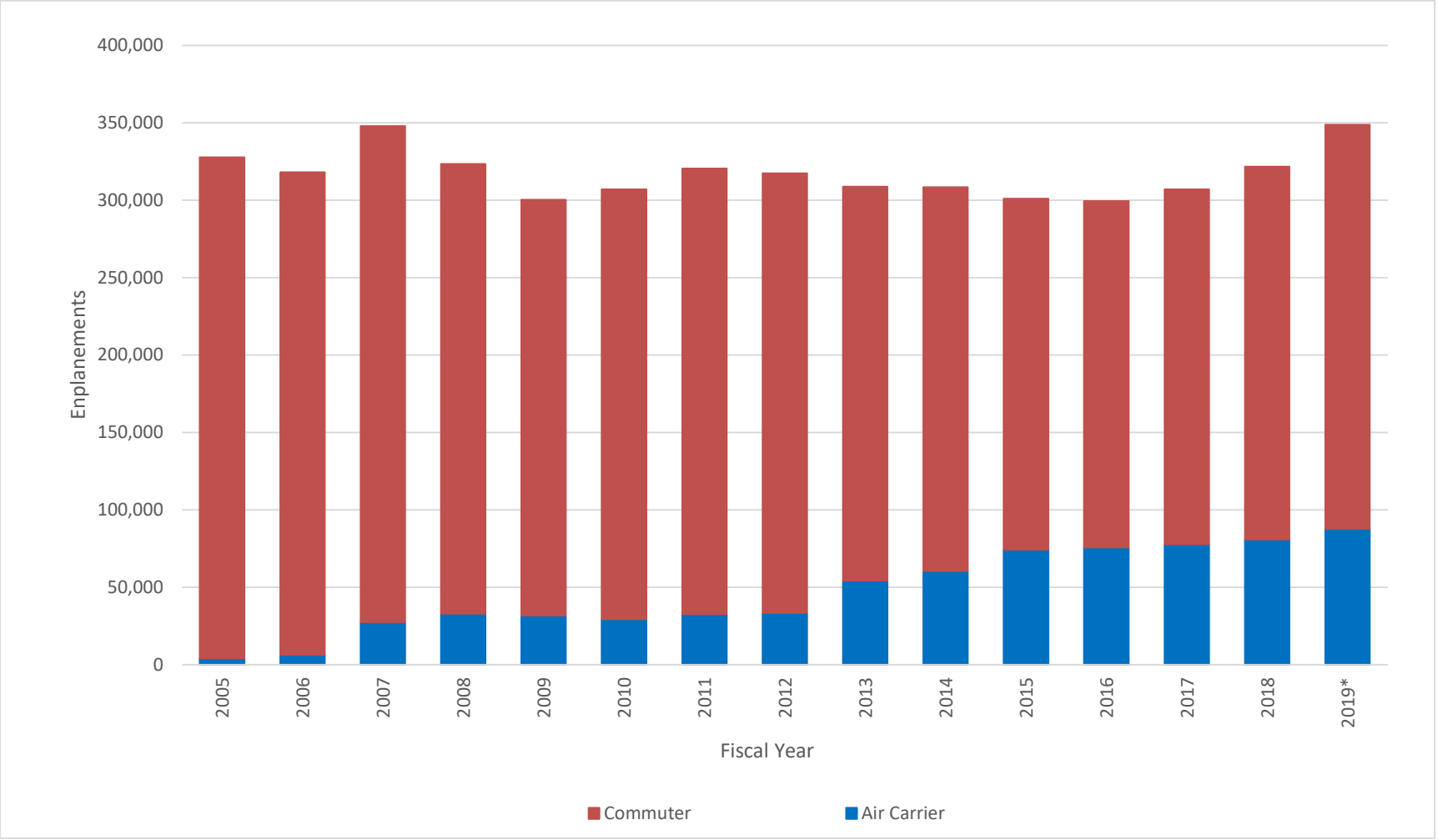
Note: 1- FY 2019 is interpolated using T-100 data for August and September 2019; 2-Air Carrier represents aircraft with more than 60 seats; 3-Commuter represents aircraft with less than 60 seats
Source: FAA TAF, 2018; RS&H, 2019; T-100 segment data, 2019

3.2.1.2 Peak Month Enplanements

A review of enplanements by month over the past five fiscal years (FY 2014-2018) shows that October has repeatedly been the most active month for enplanements. The Airport has also seen consistently high enplanement totals in May, June, and July during those same years.

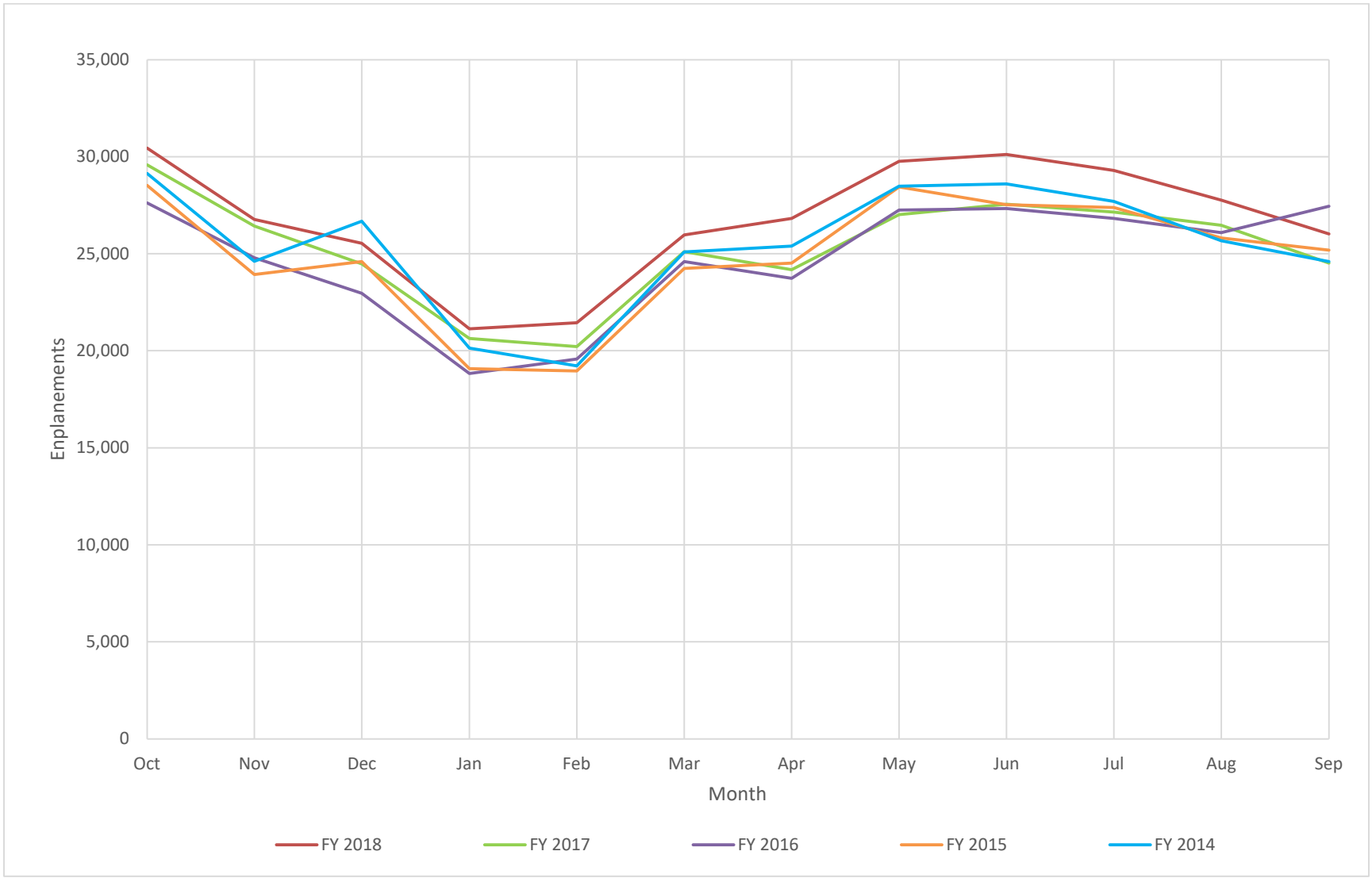
Figure 2 shows a comparison of monthly enplanements by fiscal year from 2014-2018.

FIGURE 1
HISTORICAL-ENPLANEMENTS (2005-2019)



Note: *FY 2019 is interpolated using T-100 data for August and September 2019
Source: FAA TAF, 2018; RS&H, 2019; Bureau of Transportation Statistics T-100 Segment data, 2019

FIGURE 2
HISTORICAL-ENPLANEMENTS BY MONTH (2014-2018)



Source: Bureau of Transportation Statistics T-100 Segment data, 2019

3.2.1.3 Airlines Serving ROA

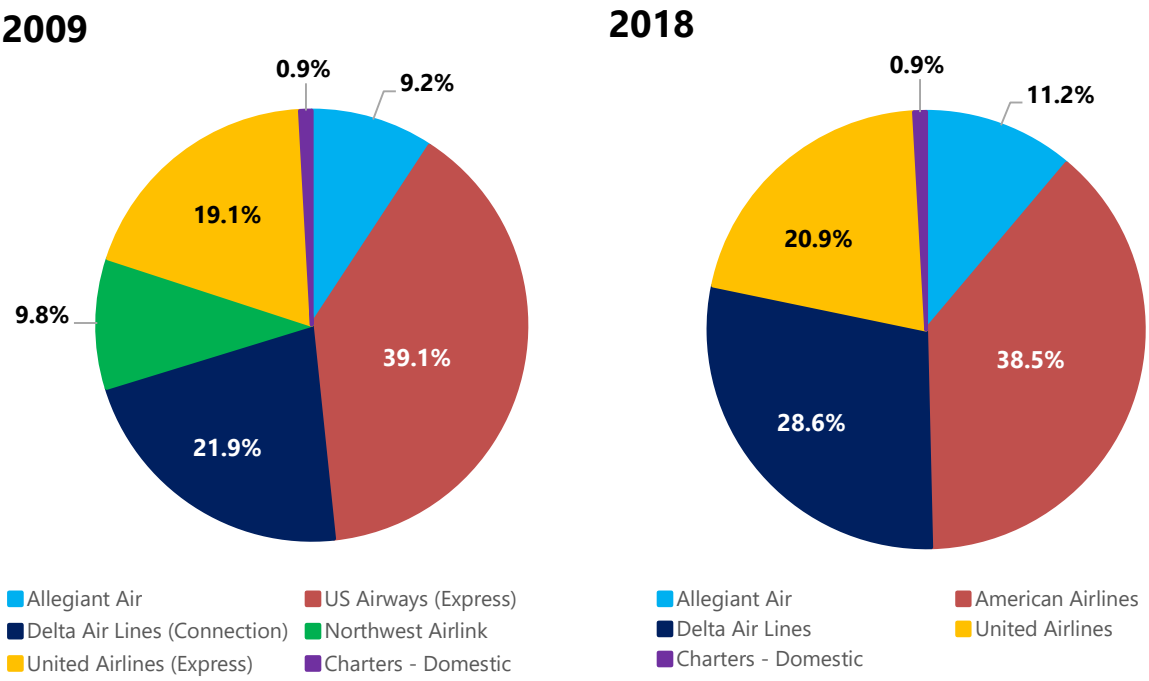
Over the past decade the mainline carriers and their regional affiliates that have operated at ROA have been consistent in sustaining their share of enplanements. The most noticeable difference from 2009 to 2018 was a change in carrier names due to the merging of carriers. During that time three major mainline mergers took place for airlines serving ROA:

- Delta Air Lines and Northwest Airlines, now operating as Delta Air Lines
- United Airlines and Continental Airlines, now operating as United Airlines
- American Airlines and US Airways, now operating as American Airlines

The largest share of enplanements at the Airport in 2009 was US Airways Express at 39.1%. Similarly, the largest share in 2018 was represented by American Airlines and its regional carriers who retained a nearly identical share of the ROA enplanements at 38.5%. Likewise, the 2008 combined shares of Delta Air Lines Connection (21.9%) and Northwest Airlink (9.8%) closely matched the Delta Air Lines share of 28.6% in 2018.

Figure 3 shows a comparison of the airlines operating at ROA and their enplanement shares from CY 2009 and 2018.

FIGURE 3
OPERATING AIRLINES (2009 & 2018)



Source: ROA, 2019; RS&H, 2019

3.2.1.4 Non-stop ROA Markets

ROA has sustained six of its eight current non-stop markets since 2005. The Cincinnati, Ohio market was cut in 2008, and the Detroit, Michigan market was cut in 2014. However, ROA gained the Sanford/Orlando, Florida and St. Petersburg/Clearwater, Florida markets with the arrival of Allegiant Airlines.

Table 2 shows a comparison of the non-stop markets out of ROA in 2005 and 2019. *Figure 4* shows a map of the 2019 non-stop markets with reference to ROA.

TABLE 2
COMPARISON OF ROA NON-STOP MARKETS (2005 & 2019)

2005 ROA Non-stop Markets	2019 ROA Non-stop Markets
1. ATL-Atlanta, Georgia	1. ATL-Atlanta, Georgia
2. CLT-Charlotte, North Carolina	2. CLT-Charlotte, North Carolina
3. IAD-Washington D.C. (Dulles, Virginia)	3. IAD-Washington D.C. (Dulles, Virginia)
4. LGA-New York, New York (La Guardia)	4. LGA-New York, New York (La Guardia)
5. PHL-Philadelphia, Pennsylvania	5. PHL-Philadelphia, Pennsylvania
6. ORD-Chicago, Illinois (O'Hare)	6. ORD-Chicago, Illinois (O'Hare)
7. CVG-Cincinnati, Ohio	7. SFB-Sanford/Orlando, Florida
8. DTW-Detroit, Michigan	8. PIE-St. Petersburg/Clearwater, Florida

Source: Roanoke-Blacksburg Regional Airport, 2019; ROA MPU, 2008

FIGURE 4
NON-STOP MARKETS (2019)

3.2.1.5 Load Factors and Seats Available

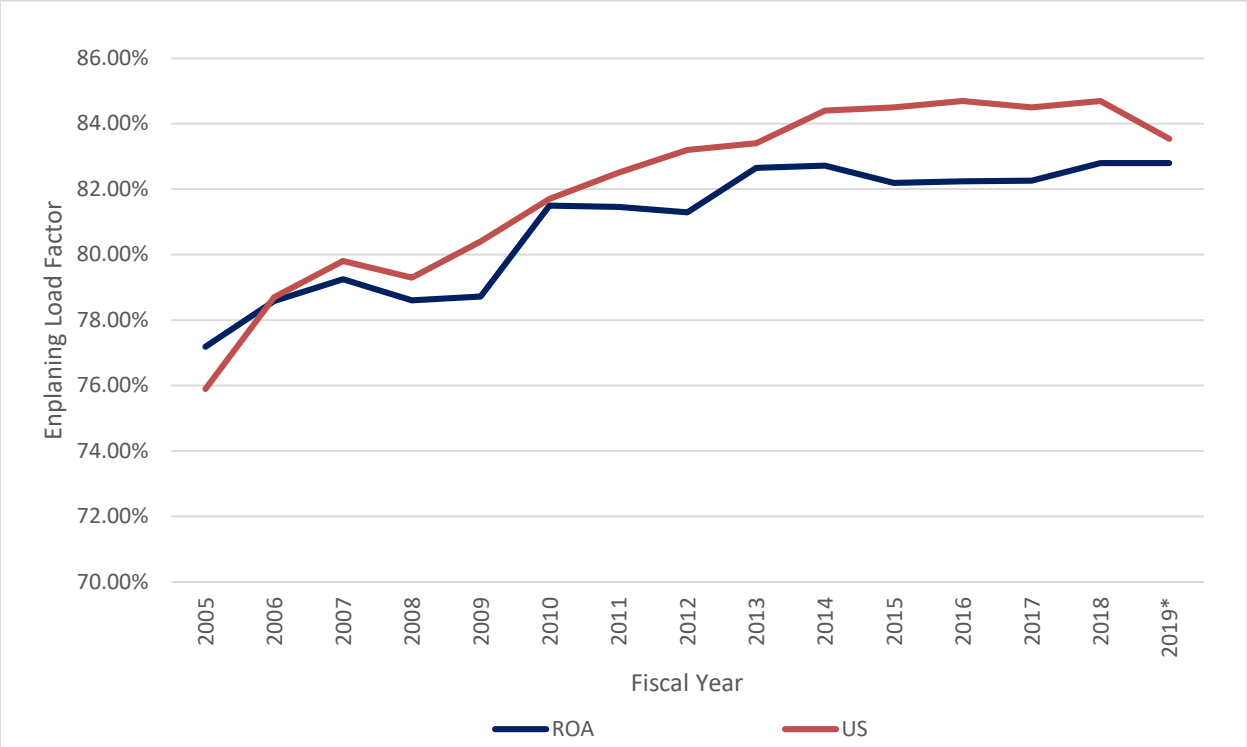
Load factors indicate the percentage of passengers on an enplaning or deplaning aircraft as a ratio between the number of passengers and the number of seats on the aircraft they're traveling in. Load factors often differ by airlines and can fluctuate by time of day or market. *Figure 5* shows the Airport's average load factor from FY 2005 to 2019.

Since FY 2010, the average enplaning load factor at ROA has been 82.2%, which is just below the national average of 83.7% for domestic commercial aircraft[1]. The ROA enplaning load factor has increased at an annual average growth (AAGR) of 0.6% from FY 2005-2019, reaching 82.8% in 2019[2].

The Airport has also experienced growth in its annual available seats that is aligned with the enplanements for each year, indicating that the airlines are increasing flights available for passengers as the load factors used by each airline also increase.

Figure 6 shows the Airport's annual seats available compared to the total enplanements from FY 2005-2019.

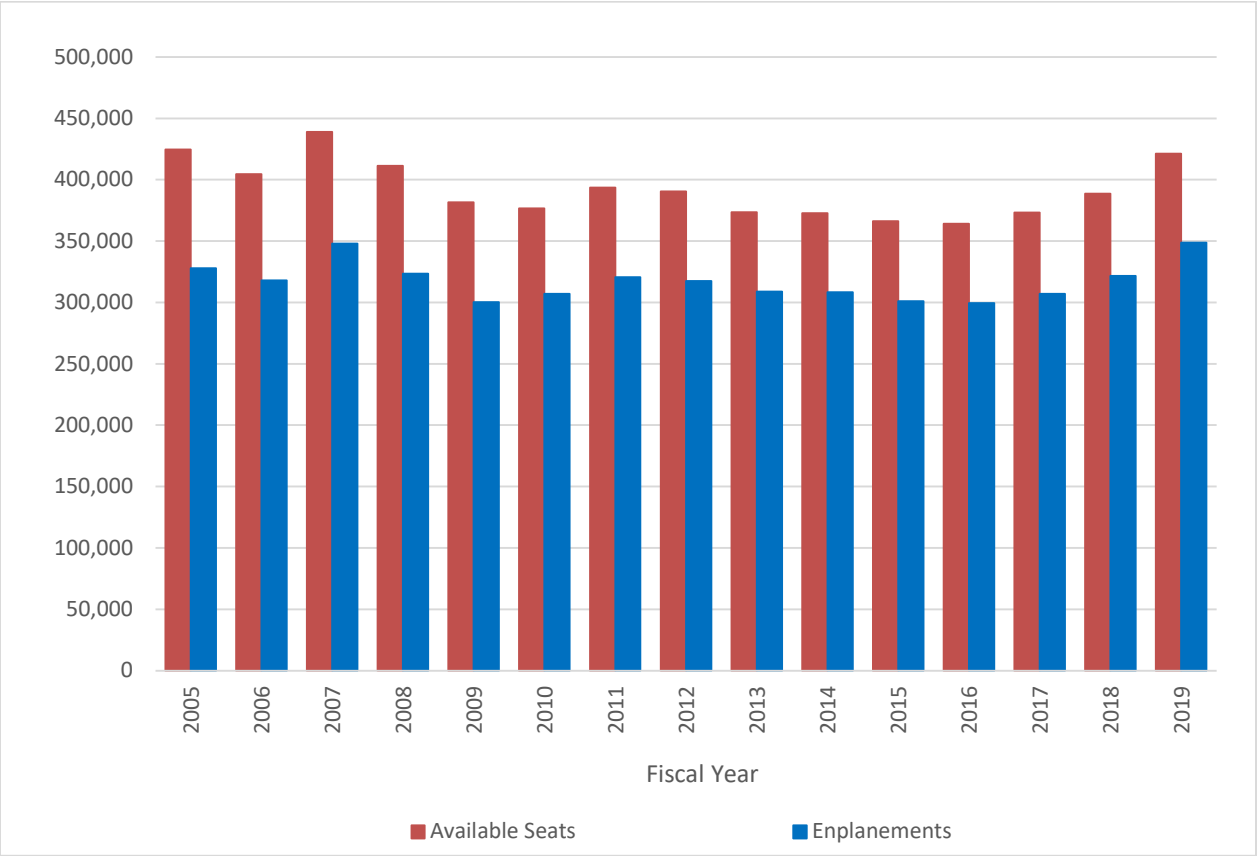
FIGURE 5
HISTORICAL-ENPLANING LOAD FACTORS (2005-2019)



Note: 1-The 2019 load factors were extrapolated for the months of August and September 2019
Source: FAA Aerospace Forecast, 2019; Bureau of Transportation Statistics T-100 Segment data, 2019

[1] U.S. average includes both mainline and regional carriers.
[2] The FY 2019 average load factor was extrapolated for the months of August and September.

FIGURE 6
HISTORICAL-ANNUAL DEPARTING SEATS AVAILABLE AND ENPLANEMENTS (2005-2019)



Source: RS&H, 2019; FAA T-100 Airline Segment Data, 2019

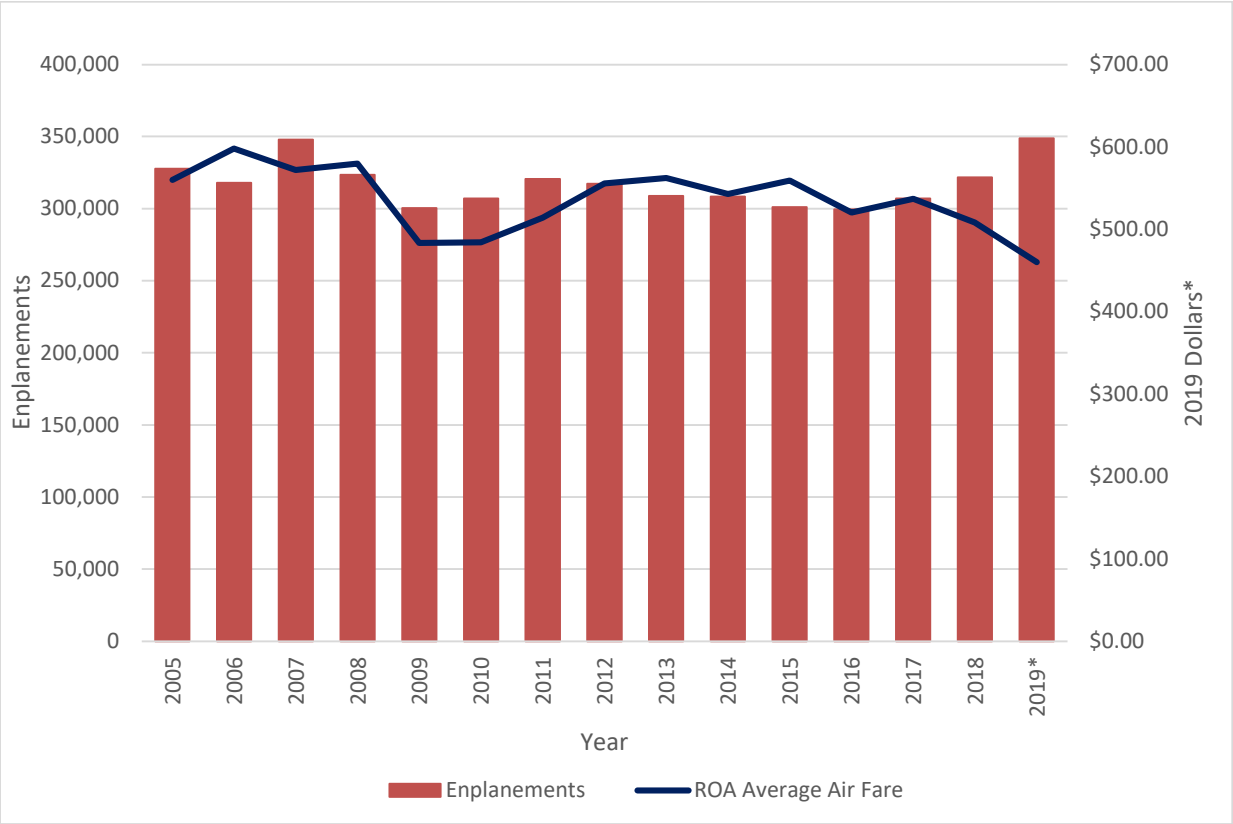
3.2.1.6 Average Air Fares

The Bureau of Transportation Statistics (BTS) provides monthly and annual average air fares by airport on domestic itinerary fares, round-trip or one-way. The fares include the total cost of a ticket with any added taxes or fees at the time of each purchase. To understand the value of the ticket in past years, the average air fares in this analysis use the BTS inflated to 2019 dollars prices for each historical year.

After two quarters of CY 2019, the average air fares for ROA ($460) show that it is on track to be the lowest it's been in 25 years or longer. The last time ticket prices neared current levels was in 2009 ($483) and 2010 ($484).

Figure 7 shows a comparison of the annual enplanements with the annual average air fares in 2019 dollars from 2005-2019.

FIGURE 7
HISTORICAL-AVERAGE AIR FARE AND ENPLANEMENTS (2005-2019)



Note: Average air fares are inflated to 2019 dollars. 2019 is an average of only quarters one and two; *The 2019 enplanements total is extrapolated for the months of August and September
Source: RS&H, 2019; FAA TAF, 2018; BTS, Airline Origin & Destination Survey (10%) Sample, DB1B, 2019

While the trend of average air fare has been decreasing since 2010, ROA has typically maintained the highest annual average compared to some of the other competitive airports in the region from 2010-2018. However, for 2019 ROA's average air fare through two quarters has noticeably decreased even further reaching its lowest average in over 10 years.

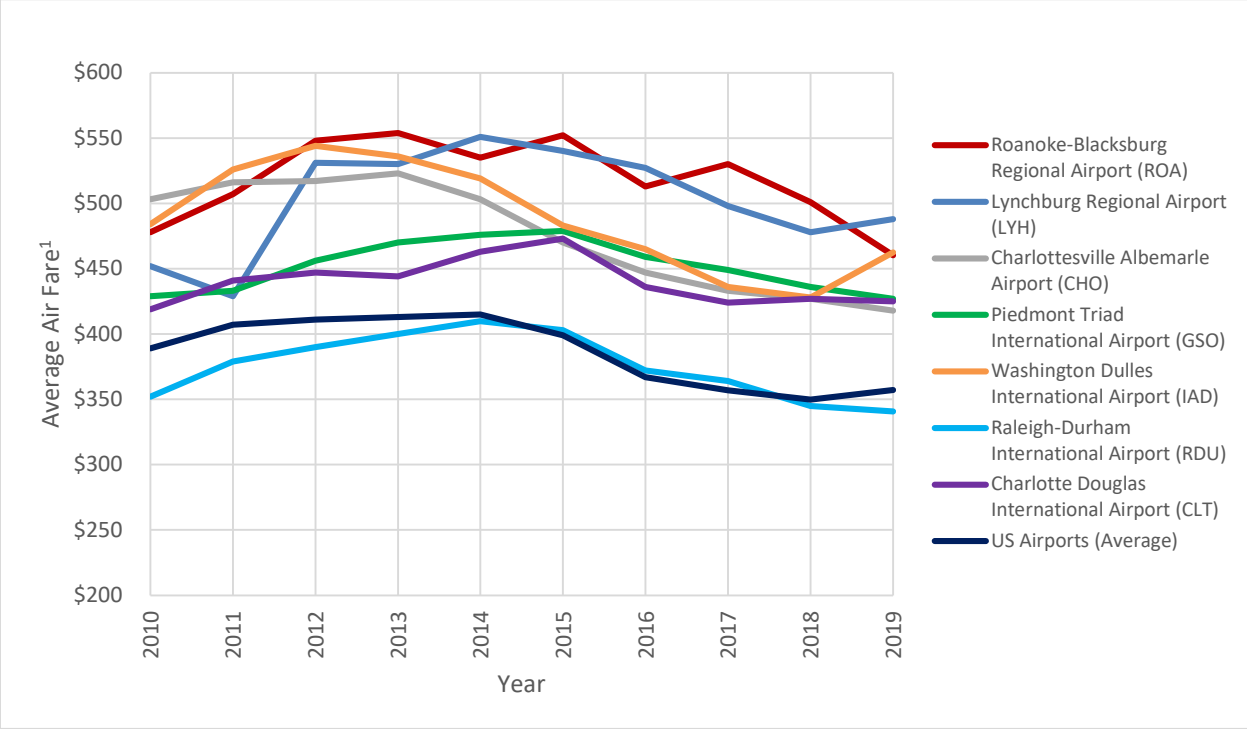
Table 3 and *Figure 8* show a comparison of the average air fare for some of the other airports in the region from 2010-2019.

TABLE 3
AVERAGE AIR FARE COMPARISON WITH OTHER AIRPORTS IN REGION (2010-2019)

Year	Roanoke-Blacksburg Regional Airport (ROA)	Lynchburg Regional Airport (LYH)	Charlottesville Albemarle Airport (CHO)	Piedmont Triad International Airport (GSO)	Washington Dulles International Airport (IAD)	Raleigh-Durham International Airport (RDU)	Charlotte Douglas International Airport (CLT)	US Airports Average
2010	$478	$452	$503	$429	$484	$352	$419	$389
2011	$507	$429	$516	$433	$526	$379	$441	$407
2012	$548	$531	$517	$456	$544	$390	$447	$411
2013	$554	$530	$523	$470	$536	$400	$444	$413
2014	$535	$551	$503	$476	$519	$410	$463	$415
2015	$552	$540	$470	$479	$483	$403	$473	$399
2016	$513	$527	$447	$459	$465	$372	$436	$367
2017	$530	$498	$433	$449	$436	$364	$424	$357
2018	$501	$478	$427	$436	$428	$345	$427	$350
2019	$460	$488	$418	$427	$462	$341	$425	$357

Note: Average air fares are inflated to 2019 dollars. 2019 is an average of only quarters one and two
Source: RS&H, 2019; Bureau of Transportation Statistics, 2019

FIGURE 8
AVERAGE AIR FARE COMPARISON WITH OTHER AIRPORTS IN REGION (2010-2019)



Note: 1-Average air fares are inflated to 2019 dollars. 2019 is an average of only quarters one and two
Source: RS&H, 2019; Bureau of Transportation Statistics, 2019

3.2.2 Air Cargo

3.2.2.1 Air Cargo Tonnage

Over the past 15 years cargo at ROA has been made up of 47% enplaned cargo and 53% deplaned cargo on average. The Airport hit a low of 10,634 tons in 2011 but has rebounded since then growing at a 2.1% CAGR through 2019.

Some specific events that have likely impacted the air cargo both locally and nationally include:

- 2003-DHL purchased the ground network of Airborne Express, at that time Airborne Express Air (ABX) became an independent company and began contracts with DHL to continue service.[3]
- 2008- Based on Airport records, ABX cut its service sometime around October 2008. This resulted in a significant loss to the total cargo processed at ROA, which was at that time listed as one of the ABX regional hubs.
- 2009- The impacts of the 2009 Economic Recession potentially decreased some of the Airport's tonnage processed.

Table 4 and *Figure 9* show the enplaned, deplaned and total cargo tonnage by year from 2005-2019.

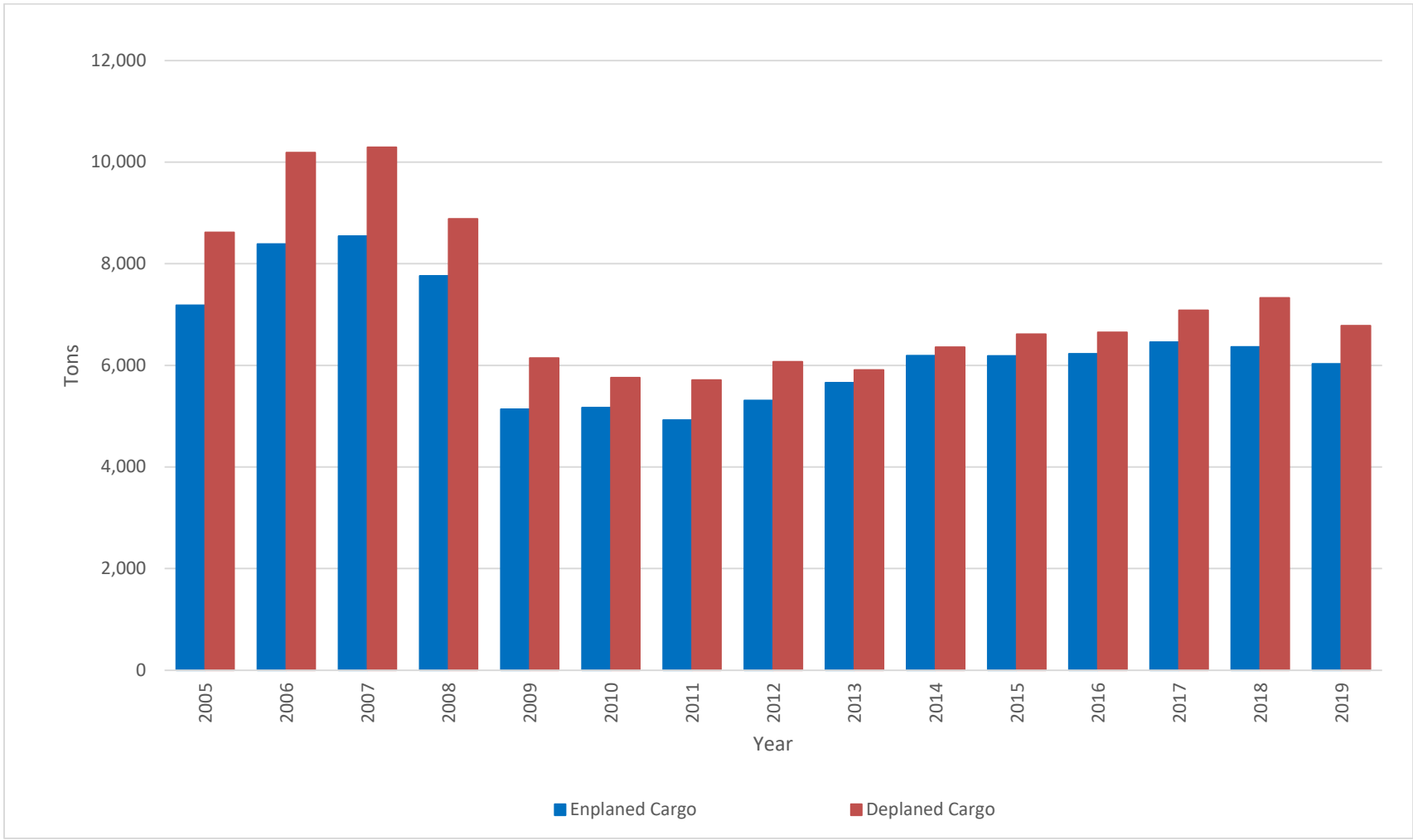
TABLE 4
HISTORICAL-AIR CARGO TONNAGE (2005-2019)

Calendar Year	Enplaned Cargo (Tons)	Deplaned Cargo (Tons)	Total Cargo (Tons)
2005	7,185	8,617	15,802
2010	5,170	5,756	10,926
2015	6,186	6,615	12,801
2016	6,229	6,651	12,880
2017	6,459	7,083	13,542
2018	6,365	7,331	13,696
2019[1]	6,027	6,783	12,810
CAGR			
2005-2014	-1.5%	-3.0%	-2.3%
2015-2019	-0.5%	0.5%	0.0%
2005-2019	-3.5%	-2.4%	-1.4%

Note: 1-Air cargo tonnage was extrapolated for the months of August through December 2019
Source: RS&H, 2019; Roanoke-Blacksburg Regional Airport Records, 2019

[3] Source: ABX air, 2015. Retrieved online at: https://www.abxair.com/about/history.cfm/airpark-history.cfm (2019)

FIGURE 9
HISTORICAL-AIR CARGO TONNAGE (2005-2019)



Note: 1-Air cargo tonnage was extrapolated for the months of August through December 2019
Source: RS&H, 2019; Roanoke-Blacksburg Regional Airport Records, 2019

3.2.2.2 Air Cargo Distribution and Carriers

Historically, most of the air cargo processed out of ROA has been freight, with a minimal percentage making up air mail. The air mail is carried via belly cargo, and it has significantly decreased in percentage since 2007. The freight has rebounded over the past five years after a noticeable decrease in 2008 which was likely caused by the 2009 recession and the loss of the ABX service from the Airport in 2008.

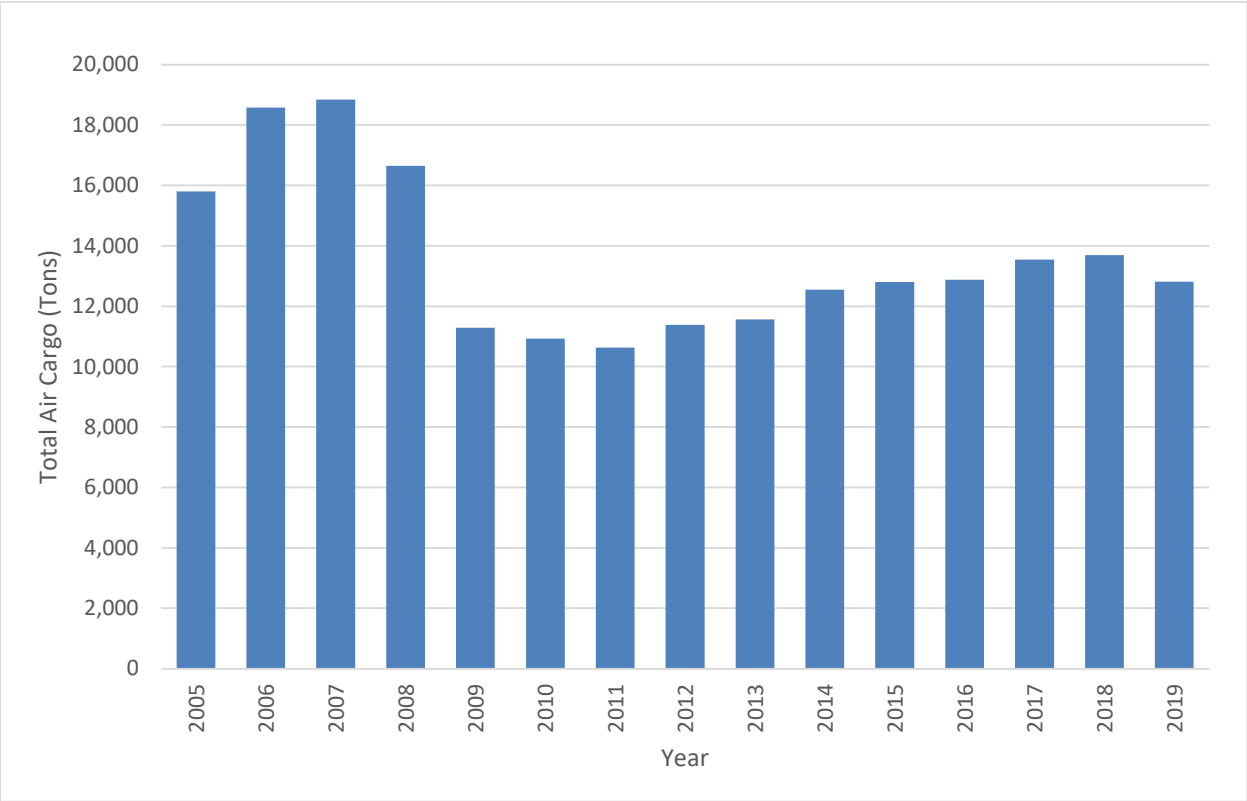
Table 5 shows the historical air mail and freight from 2005 to 2019. *Figure 10* shows total air cargo tonnage from 2005 to 2019.

TABLE 5
HISTORICAL-AIR MAIL AND FREIGHT (2005-2019)

Calendar Year	Air Mail (Tons)	Freight (Tons)	Air Cargo (Tons)
2005	28	15,774	15,802
2010	1	10,925	10,926
2015	1	12,800	12,801
2016	2	12,878	12,880
2017	1	13,542	13,542
2018	1	13,694	13,696
2019	1	12,808	12,810
CAGR			
2005-2014	-24.0%	-2.3%	-2.3%
2015-2019	13.2%	0.0%	0.0%
2005-2019	-18.5%	-1.4%	-1.4%

Notes: 1-Totals are rounded and may not add up exactly; 2- CY 2019 Air cargo tonnage was extrapolated for the months of August-December; 3-Air mail and freight totals were extrapolated for 2018 and 2019
Source: RS&H, 2019; Roanoke-Blacksburg Regional Airport Records, 2019

FIGURE 10
HISTORICAL-AIR CARGO TONNAGE (2005-2019)

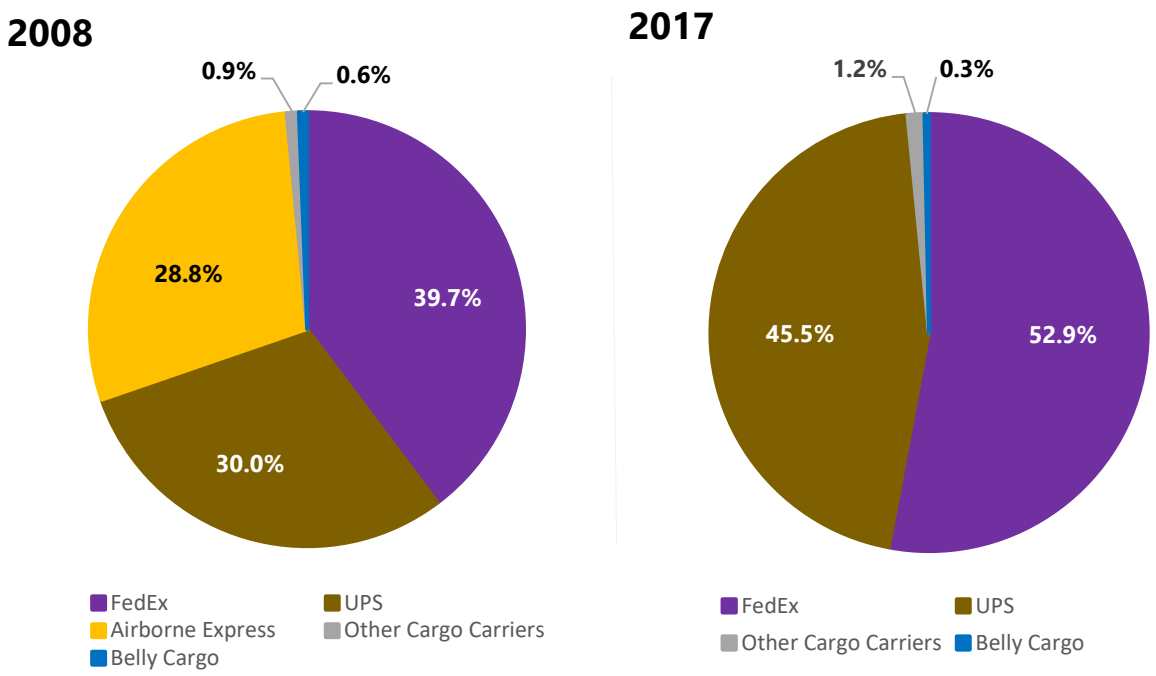


Notes: 1- Values were extrapolated for 2018 and 2019
Source: RS&H, 2019; Roanoke-Blacksburg Regional Airport Records, 2019

Freight tonnage has been dominated by FedEx and UPS sustaining a strong share of the Airport's total tonnage over the past 10+ years. Other cargo carriers in 2008 included Ameriflight, Quest Diagnostics, Mountain Air Cargo, and Ram Air Freight. Other cargo carriers in 2017 included Quest Diagnostics.

Figure 11 shows a comparison of the air cargo carriers shares between 2008 and 2017.

FIGURE 11
OPERATING CARGO CARRIERS (2008 & 2017)



Note: 1-Percentages may not add exactly due to rounding. 2- Because data was inaccessible for 2018 and Airborne Express had a significant share, CY 2008 and 2017 were compared
Source: RS&H, 2019; Roanoke-Blacksburg Regional Airport, 2019

3.2.3 Based Aircraft

The Airport's based aircraft include all FAA registered aircraft at an airport. The number of based aircraft at ROA fluctuated but remained between 112 and 125 through 2012. Based aircraft began to decline in 2013 through 2017 to 88 aircraft. Based aircraft have begun increasing slowly since 2017 to its current level of 93 aircraft in 2019. The pattern of based aircraft decline and growth art ROA is similar to that experienced by the general aviation community as a whole both in Virginia and the United States overall.

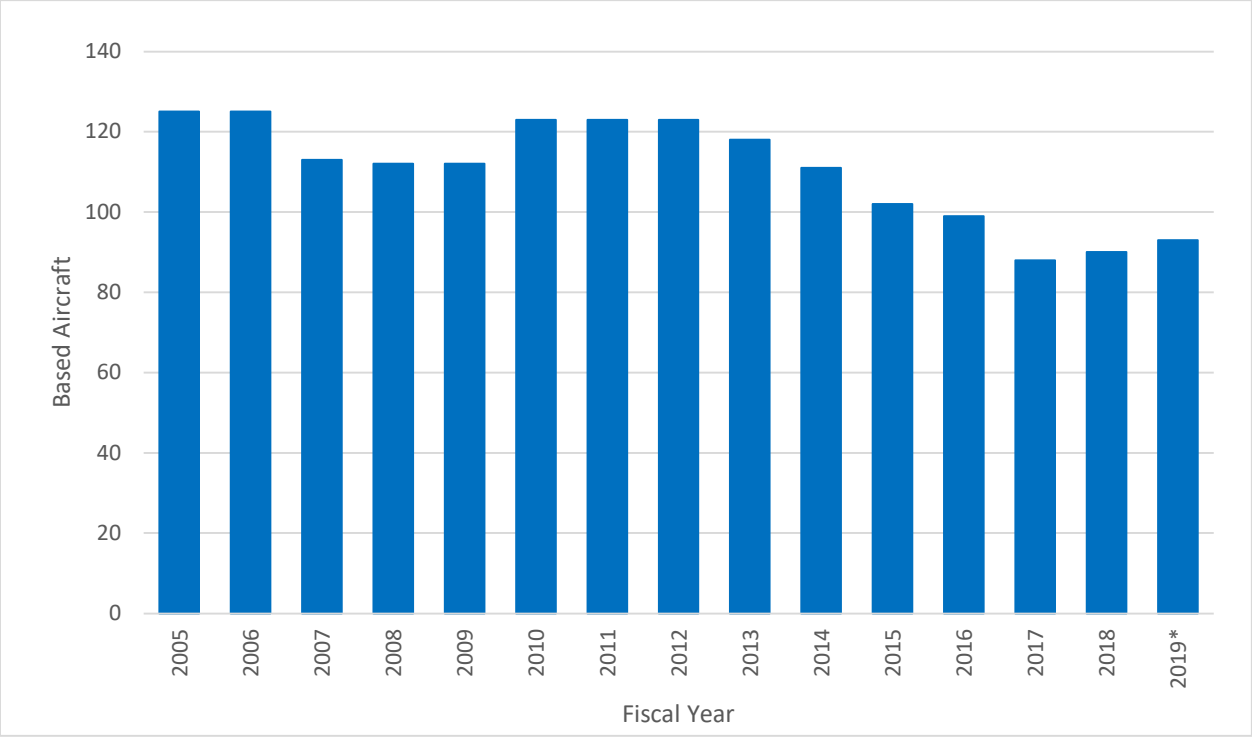
Table 6 shows a comparison of the based aircraft at ROA, Commonwealth of Virginia, and the U.S. from 2005-2019. *Figure 12* shows the based aircraft at ROA from 2005-2019.

TABLE 6
HISTORICAL-BASED AIRCRAFT (2005-2019)

FY	Based Aircraft		
	ROA	Virginia	US
2005	125	2,546	197,057
2010	123	2,550	165,396
2015	102	2,418	163,959
2016	99	2,551	173,860
2017	88	2,328	167,140
2018	90	2,338	168,615
2019*	93	2,357	169,988
CAGR			
2005-2014	-1.2%	0.0%	-1.5%
2015-2019	-1.8%	-0.5%	0.7%
2005-2019	-2.0%	-0.5%	-1.0%
2017-2019	2.8%	0.6%	0.8%

Note: *- In addition to the Airport's based aircraft inventory, two additional aircraft were added to 2019 based on information received from the flight school.
Source: RS&H, 2019; FAA TAF, 2018

FIGURE 12
HISTORICAL-BASED AIRCRAFT (2005-2019)



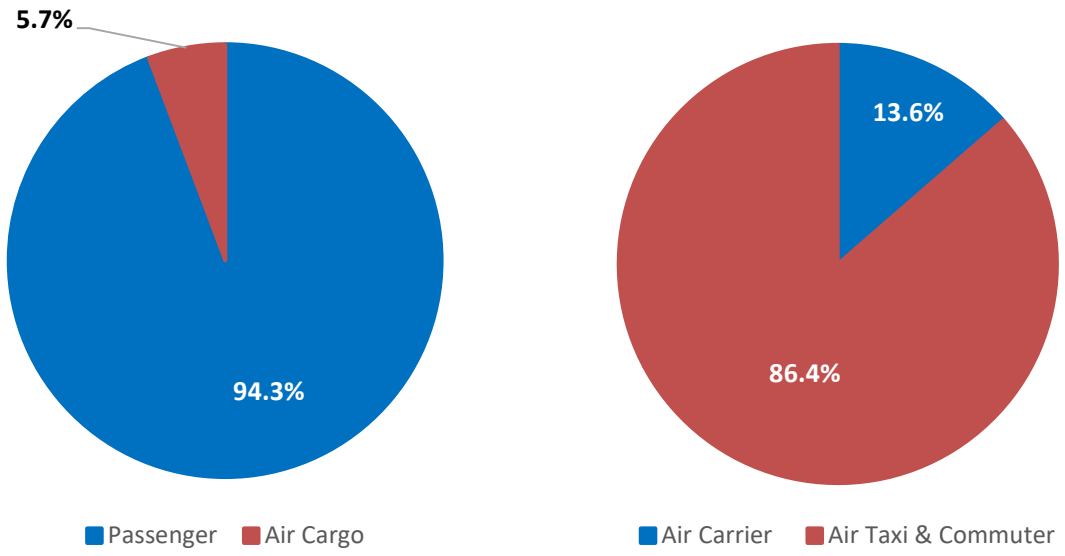
Note: *- In addition to the Airport's based aircraft inventory, two additional aircraft were added to 2019 based on information received from the flight school.
Source: RS&H, 2019; FAA TAF, 2018

3.2.4 Aircraft Operations

3.2.4.1 Commercial Operations

Commercial operations are made up of the sum of air carrier and air taxi & commuter operations. These classifications are distinguished by the size of the aircraft being used with air carrier operations having more than 60 seats, and air taxi & commuter having 60 seats or less. Commercial operations are also classified as passenger or air cargo operations. The historical average distribution among the two classifications are shown in *Figure 13*.

FIGURE 13
ROA HISTORICAL-DISTRIBUTION OF COMMERCIAL OPERATIONS (2010-2019)



Source: RS&H, 2019; FAA TFMSC, 2019

Table 7 shows the Airport's historical commercial operations classified as air carrier and air taxi & commuter from 2005 to 2019. *Figure 14* compares the distribution of these two classifications from 2005 to 2019.

3.2.4.1.1 Passenger Operations

Passenger operations are the commercial operations designated for paying passengers. They may be air carrier or air taxi & commuter types and include scheduled charter service operations.

3.2.4.1.2 Air Cargo Operations

Air cargo operations are commercial operations that are designated for carrying cargo. They may be air carrier or air taxi & commuter types.

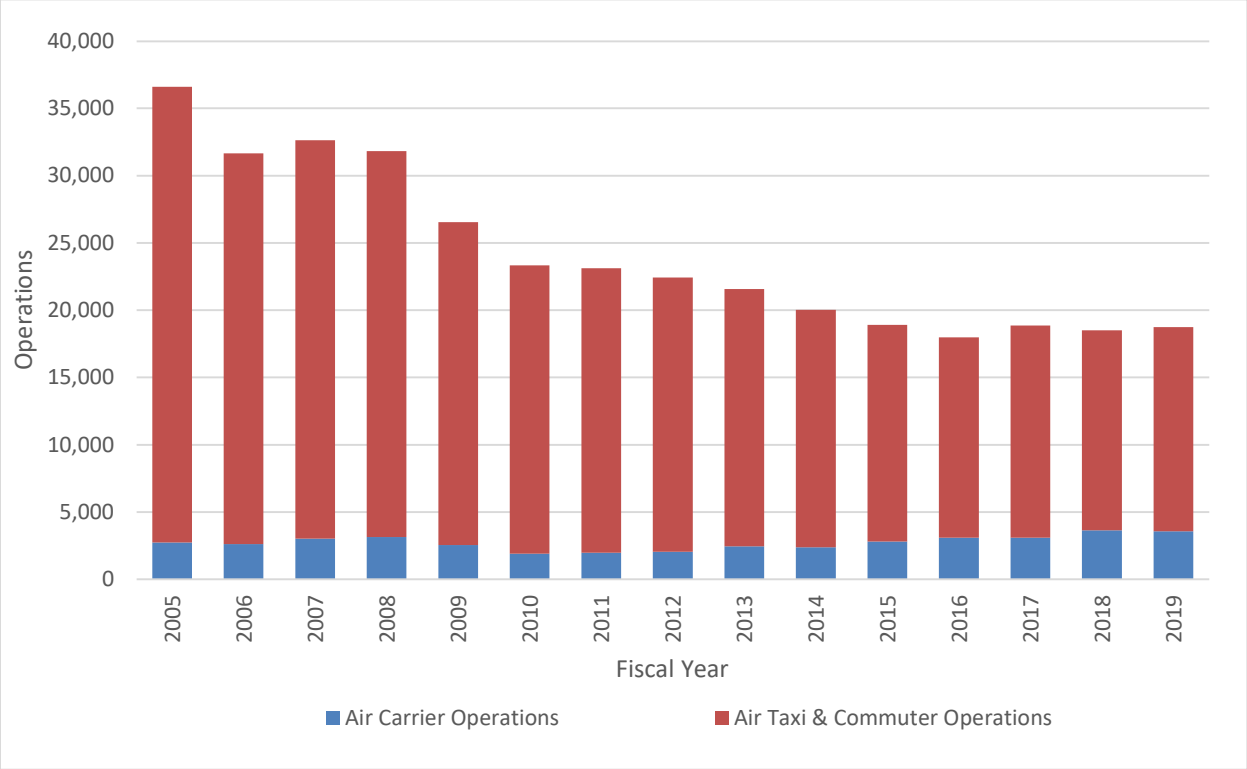
Table 8 and *Figure 15* shows the Airport's historical passenger and air cargo operations from 2005 to 2019.

TABLE 7
HISTORICAL-COMMERCIAL OPERATIONS (2005-2019)

FY	Air Carrier Operations	Air Taxi & Commuter Operations	Total Commercial Operations
2005	2,731	33,880	36,611
2010	1,910	21,433	23,343
2015	2,804	16,102	18,906
2016	3,088	14,887	17,975
2017	3,091	15,772	18,863
2018	3,641	14,854	18,495
2019	3,569	15,172	18,741
CAGR[1]			
2005-2015	0.2%	-6.5%	-5.8%
2016-2019	3.7%	0.5%	1.1%
2005-2019	1.8%	-5.2%	-4.4%

Notes: 1-The CAGR range of years for this table differs slightly from other tables to identify the growth the Airport experienced recently.
Source: RS&H, 2019; FAA TAF, 2018

FIGURE 14
HISTORICAL-COMMERCIAL OPERATIONS (2005-2019)



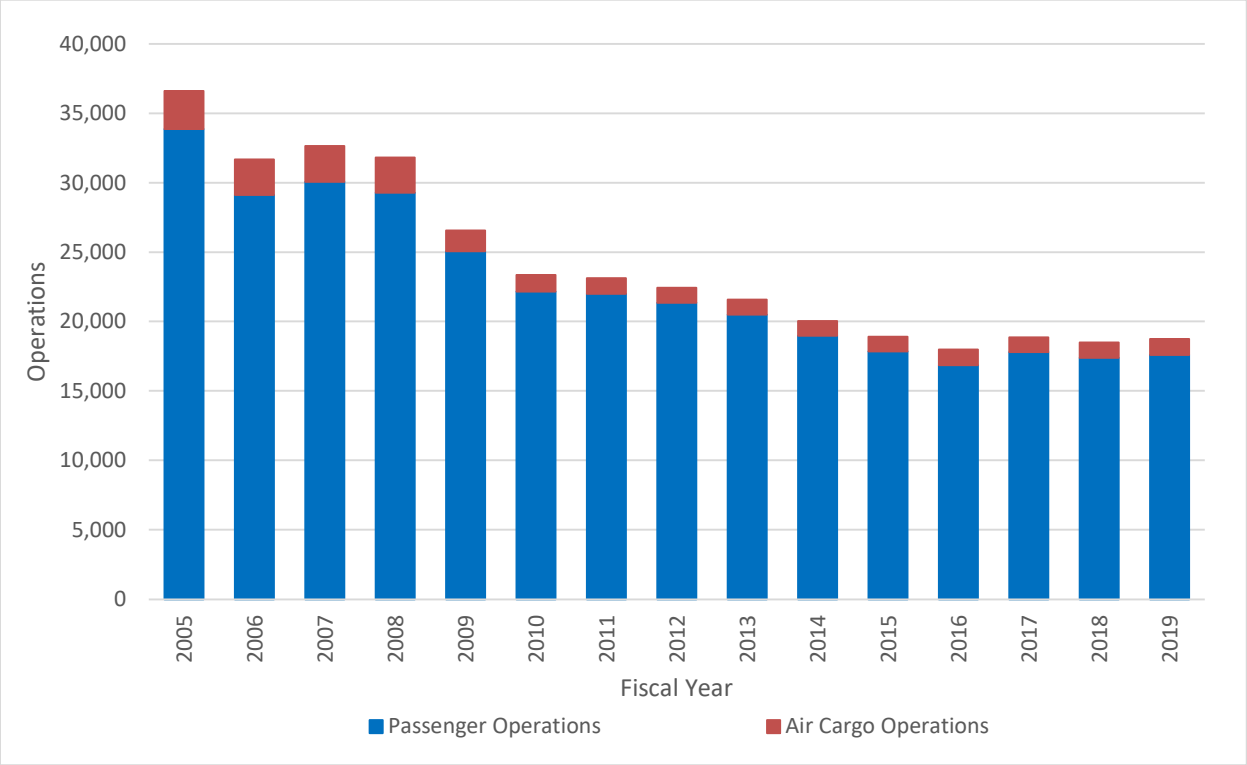
Source: RS&H, 2019; FAA TAF, 2018

TABLE 8
HISTORICAL-PASSENGER AND AIR CARGO OPERATIONS (2005-2019)

FY	Passenger Operations	Air Cargo Operations	Total Commercial Operations
2005	33,857	2,754	36,611
2010	22,162	1,181	23,343
2015	17,838	1,068	18,906
2016	16,859	1,116	17,975
2017	17,791	1,072	18,863
2018	17,387	1,108	18,495
2019	17,595	1,146	18,741
CAGR			
2005-2014	-5.6%	-9.1%	-5.9%
2015-2019	-0.3%	1.4%	-0.2%
2005-2019	-4.3%	-5.7%	-4.4%

Source: RS&H, 2019; FAA TAF, 2018; FAA TFMSC, 2019

FIGURE 15
HISTORICAL-PASSENGER AND AIR CARGO OPERATIONS (2005-2019)



Source: RS&H, 2019; FAA TAF, 2018; FAA TFMSC, 2019

3.2.4.2 GA Operations

General Aviation activity refers to all aircraft operations that do not fall under commercial (passenger/air cargo) classification or military. GA operations are further identified as either itinerant or local[4]. Itinerant operations are identified as those operations that occur when an aircraft arrives from outside of the Airport area or departs from the Airport and lands somewhere outside of the area. Local GA operations are defined by the FAA as those that take place within a 20-mile radius of an airport, usually involving flight training, pleasure flights, or sightseeing. Between 2005 and 2019, the average distribution of itinerant and local aircraft operations at ROA has been 60.1 and 39.9 percent, respectively.

While both itinerant and local GA operations have decreased overall since 2005, both have increased over the past five years. Itinerant GA operations have increased slightly from 2015-2019 with a CAGR of 0.6%, and local GA operations have more than double resulting in a CAGR of 16.1%. Comparatively, the GA operations in the Commonwealth of Virginia have also increased, but at lesser rates with itinerant GA operations at a CAGR of 0.05%, and local GA operations at a CAGR of 1.8% from 2015-2019.

Table 9 shows the historical GA operations at ROA from 2005-2019. *Figure 16* shows the combination of Itinerant and local GA operations at ROA from 2005 to 2019.

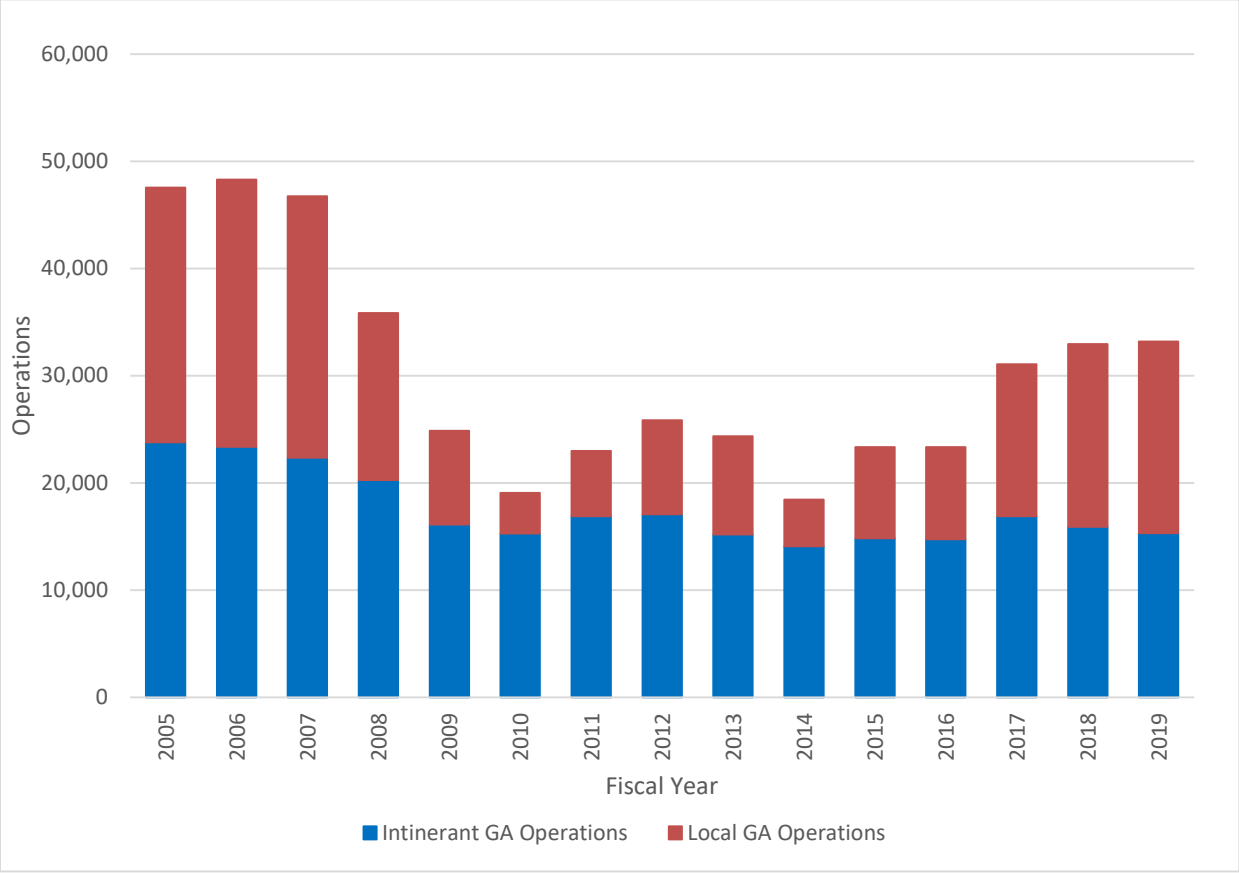
[4] Local GA operations are identified as civil in the FAA TAF.

TABLE 9
HISTORICAL-GA OPERATIONS (2005-2019)

FY	Itinerant GA Operations	Local GA Operations	Total GA Operations
2005	23,782	23,778	47,560
2010	15,276	3,782	19,058
2015	14,844	8,495	23,339
2016	14,745	8,584	23,329
2017	16,883	14,189	31,072
2018*	15,899	17,052	32,951
2019*	15,316	17,883	33,199
CAGR			
2005-2014	-5.1%	-15.6%	-9.0%
2015-2019	0.6%	16.1%	7.3%
2005-2019	-2.9%	-1.9%	-2.4%

Note: *Projected
Source: RS&H, 2019: FAA TAF, 2018

FIGURE 16
HISTORICAL-GA OPERATIONS (2005-2019)



Source: RS&H, 2019: FAA TAF, 2018

3.2.4.2.1 Operations Per Based Aircraft

An Operations Per Based Aircraft (OPBA) ratio is a metric that is calculated by taking the sum of the annual GA operations (both itinerant and civil) and dividing them by the total based aircraft for that year. The resulting OPBA is then compared with previous years and forecast years and used to establish forecasted growth for both itinerant and civil activity. The OPBA at ROA over the past 15 years has decreased with a CAGR of -0.4%, but it has increased since 2015 with a CAGR of 9.3% during that time.

Table 10 shows the OPBA at ROA from 2005 to 2019.

TABLE 10
HISTORICAL-OPBA (2005-2019)

FY	Total GA Operations	Based Aircraft	Operations Per Based Aircraft
2005	47,560	125	380
2010	19,058	123	155
2015	23,339	102	229
2016	23,329	99	236
2017	31,072	88	353
2018	32,951	90	366
2019*	33,199	93	357
CAGR			
2005-2014	-9.0%	-1.2%	-8.0%
2015-2019	7.3%	-1.8%	9.3%
2005-2019	-2.4%	-2.0%	-0.4%

Note: *- In addition to the Airport's based aircraft inventory, two additional aircraft were added to 2019 based on information received from the flight school.
Source: RS&H, 2019; FAA TAF, 2018

3.2.4.3 Military Operations

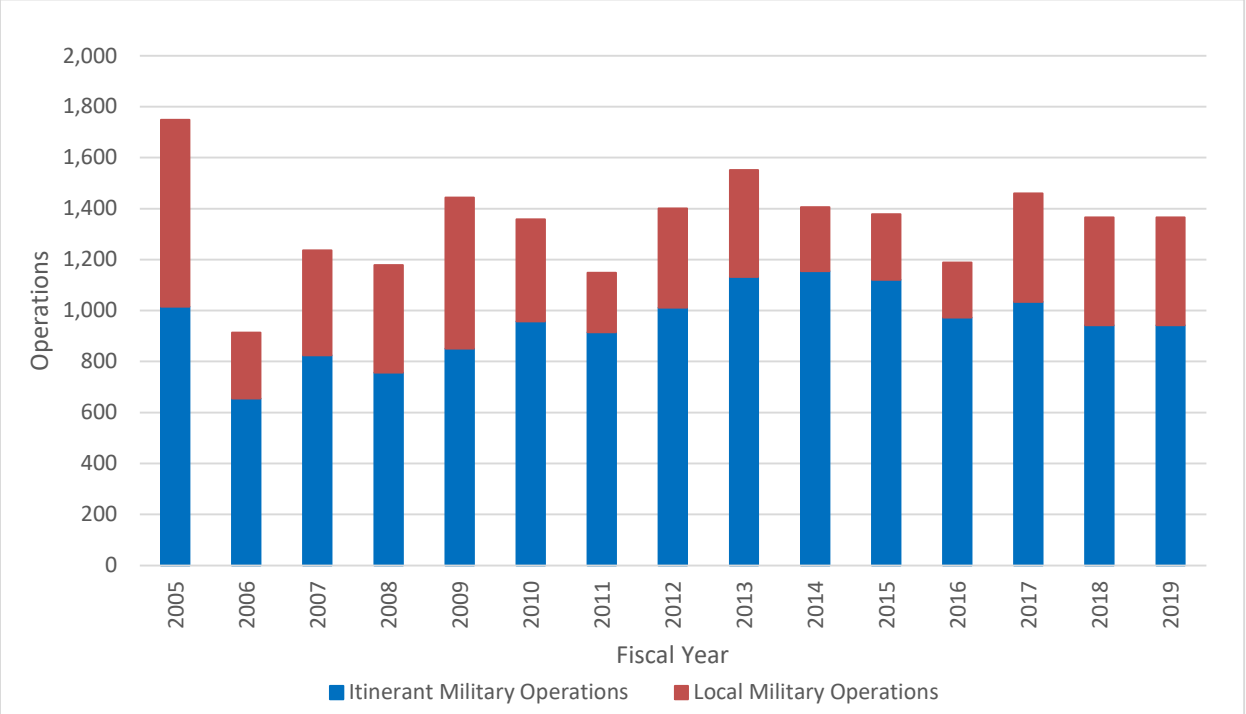
Military operations are identified as either itinerant or local. *Table 11* shows the Airport's historical military operations from 2005-2019.

TABLE 11
HISTORICAL-MILITARY OPERATIONS (2005-2019)

FY	Itinerant Military Operations	Local Military Operations	Total Military Operations
2005	1,015	734	1,749
2010	958	400	1,358
2015	1,121	257	1,378
2016	972	217	1,189
2017	1,034	426	1,460
2018*	943	423	1,366
2019*	943	423	1,366
CAGR			
2005-2014	1.3%	-10.1%	-2.2%
2015-2019	-3.4%	10.5%	-0.2%
2005-2019	-0.5%	-3.6%	-1.6%

Note: *Projected
Source: RS&H, 2019; FAA TAF, 2018

FIGURE 17
HISTORICAL-MILITARY OPERATIONS (2005-2019)



Source: RS&H, 2019: FAA TAF, 2018

3.2.4.4 Total Operations

The total operations for the Airport are the sum of annual passenger, air cargo, GA, and military operations. Over the past 15 years air carrier operations are the only type of operation listed that has increased, with a 1.8% CAGR. This is primarily the result of the 4.9% CAGR over the past five years. Similarly, over the past five years GA operations have increased the greatest with a CAGR of 7.3%.

In general, the Airport's total operations are decreasing since 2005 (-3.1% CAGR), but the growth in air carrier and GA operations over the past five years have increased the total operations overall at the Airport over that period.

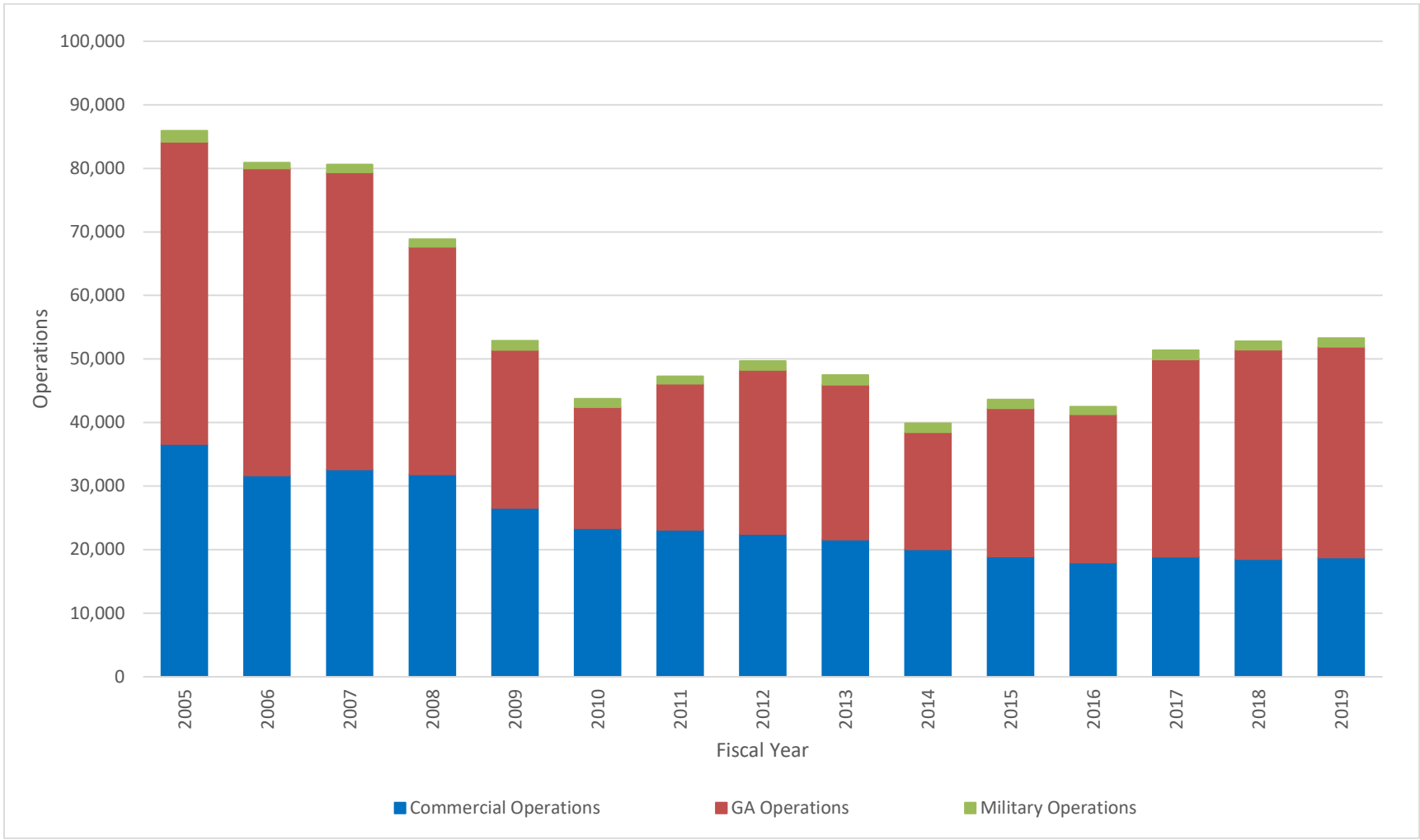
Table 12 and *Figure 18* show the distribution of the Airport's total annual operations by type from 2005 to 2019.

TABLE 12
HISTORICAL-TOTAL OPERATIONS (2005-2019)

FY	Commercial Operations	GA Operations	Military Operations	Total Operations
2005	36,611	47,560	1,749	85,920
2006	31,662	48,304	913	80,879
2007	32,635	46,735	1,236	80,606
2008	31,816	35,852	1,178	68,846
2009	26,549	24,875	1,443	52,867
2010	23,343	19,058	1,358	43,759
2011	23,127	22,982	1,148	47,257
2012	22,430	25,834	1,401	49,665
2013	21,579	24,353	1,551	47,483
2014	20,037	18,453	1,406	39,896
2015	18,906	23,339	1,378	43,623
2016	17,975	23,329	1,189	42,493
2017	18,863	31,072	1,460	51,395
2018*	18,495	32,951	1,366	52,812
2019*	18,741	33,199	1,366	53,306
CAGR				
2005-2014	-5.9%	-9.0%	-2.2%	-7.4%
2015-2019	-0.2%	7.3%	-0.2%	1.4%
2005-2019	-4.4%	-2.4%	-1.6%	-3.1%

Note: *Projected
Source: RS&H, 2019: FAA TAF, 2018

FIGURE 18
HISTORICAL-TOTAL OPERATIONS (2005-2019)



Source: RS&H, 2019: FAA TAF, 2018

3.3 REVIEW OF PREVIOUS FORECASTS AND STUDIES

Several relevant forecasts were reviewed for historical trends and patterns as well as anticipated growth at the Airport, state, and national level. These studies include the 2008 ROA Master Plan Update, the Virginia Air Transportation System Plan (VATSP) Update, the National Plan of Integrated Airport Systems FY 2019-2023, the 2018 ROA Leakage Study, and the FAA TAF, 2018.

3.3.1 2008 ROA Master Plan Update

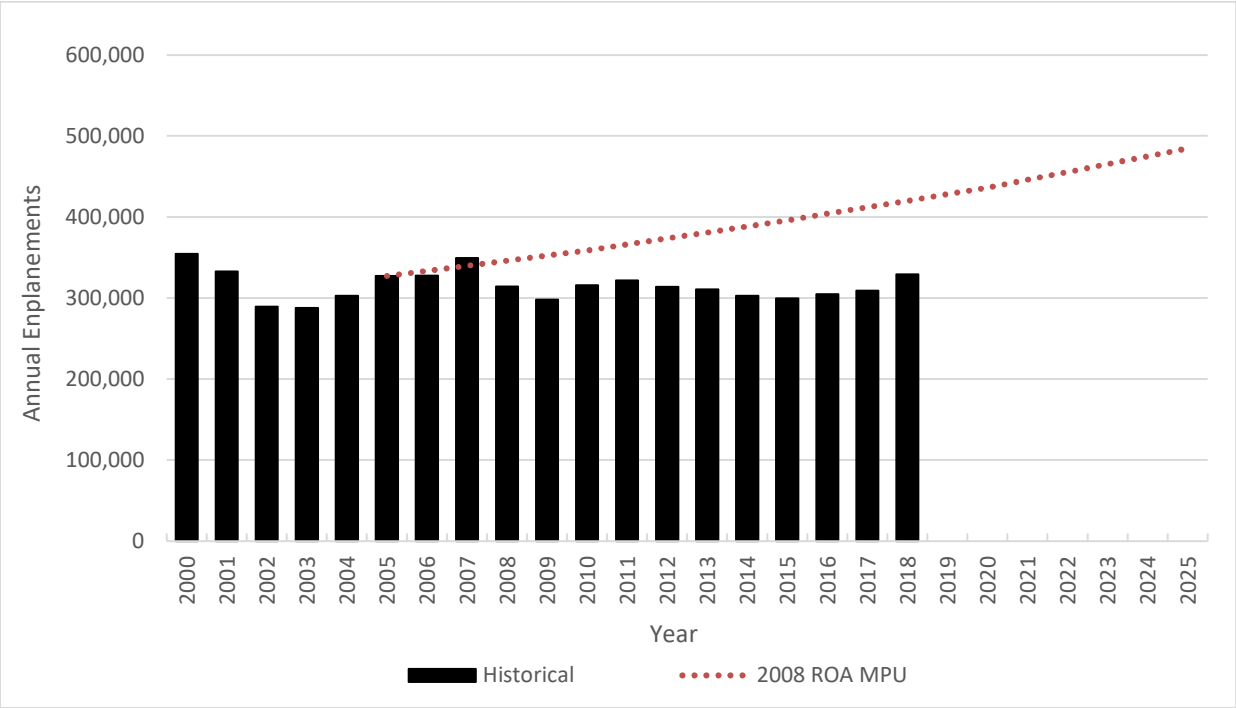
The 2008 ROA Master Plan Update was completed in June of 2008, it included 20-year forecasts with a base year of 2005 for enplanements, air cargo, and operations among other statistics. The 2008 Master Plan Update forecast assumed annual passenger enplanements increasing from 327,000 in 2005 to 485,000 in 2025, a 50 percent increase. Air cargo activity was forecast to increase from 15,800 annual tons to 18,300 annual tons, a 16 percent increase. Finally, annual aircraft operations were forecast to grow from about 86,000 in 2005 to 106,300 in 2025, a 24 percent increase[5].

Six alternative forecast scenarios were also produced to reflect a potential range of activity levels based on economic variations from regional growth, aviation fuel prices, and economic recession, and on aviation industry variations such as low fare service entering the ROA market and airline consolidation.

Figure 19 through *Figure 22* show a comparison between the 2008 MPU forecast for enplanements, air cargo, aircraft operations, and based aircraft with historical activity in those categories at ROA through 2019. The 2008 MPU projected the Boeing 757-200 to remain as the critical aircraft for the Airport from 2005-2025. This has been confirmed using 2019 Traffic Flow Management System Count (TFMSC) totals.

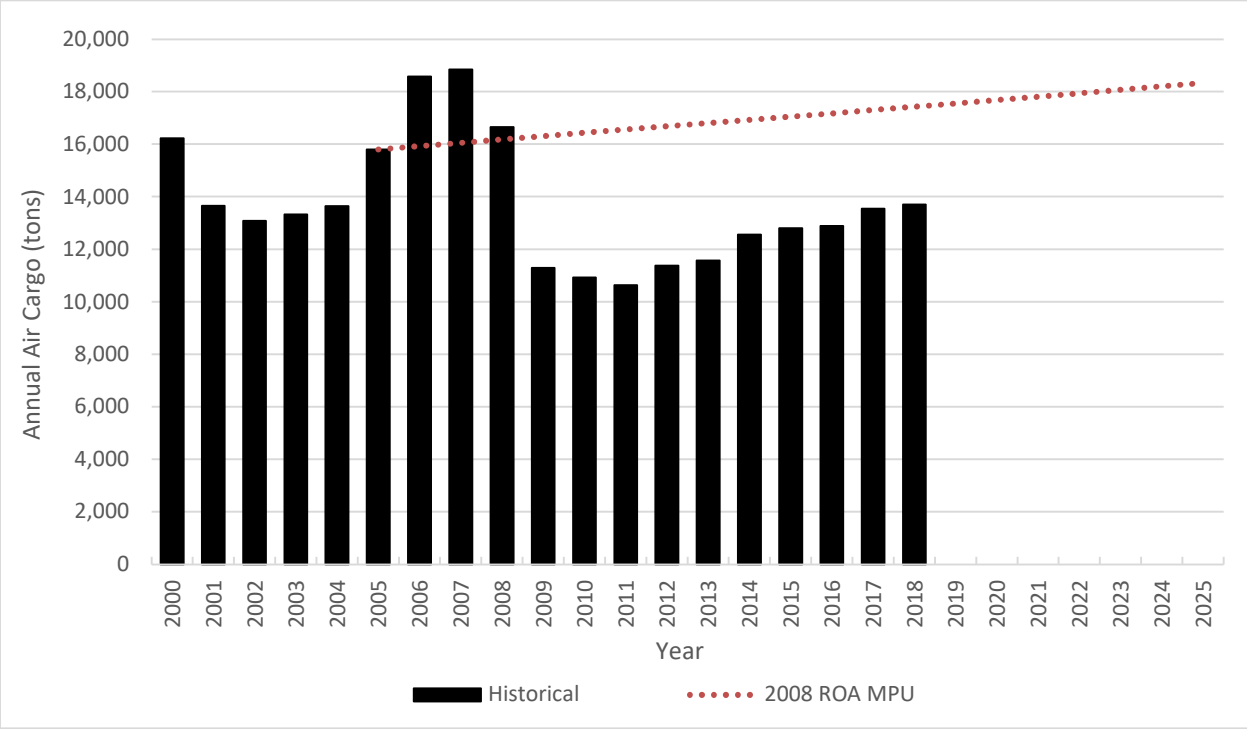
[5] Roanoke Regional Airport, Airport Master Plan Update, Executive Summary, June 2008, HNTB.

FIGURE 19
2008 MPU ENPLANEMENTS FORECAST



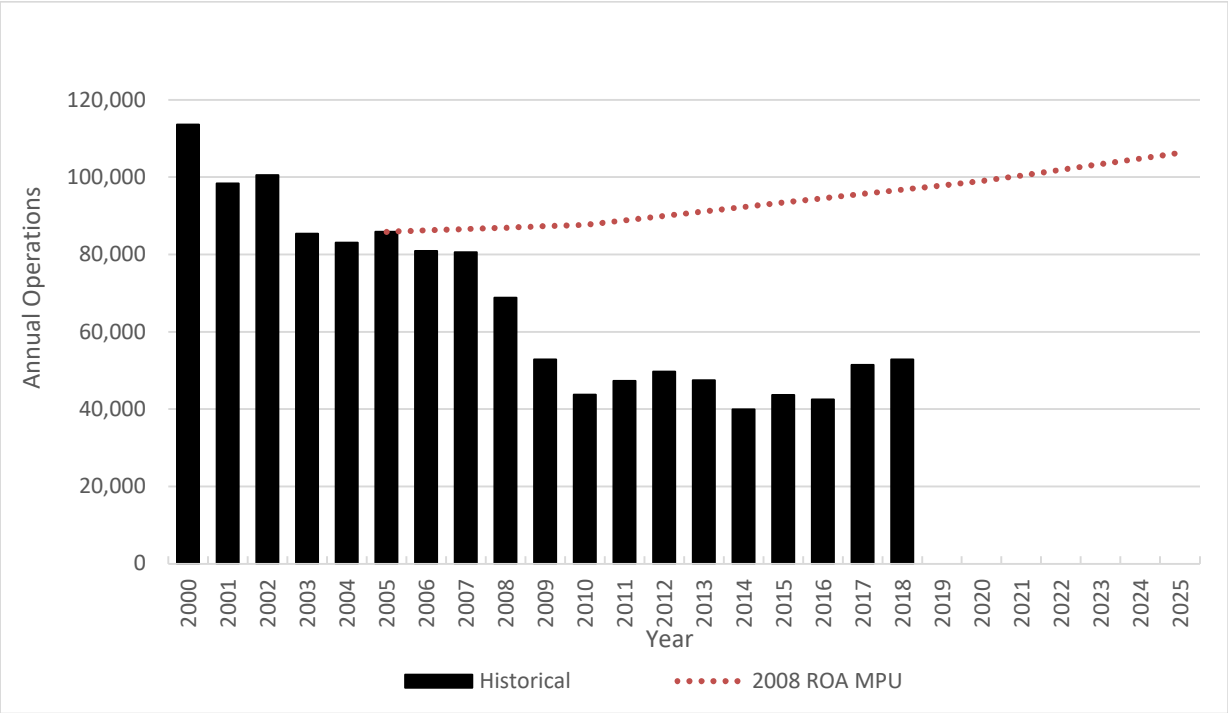
Source: RS&H, 2019; ROA MPU, 2008

FIGURE 20
2008 MPU AIR CARGO FORECAST



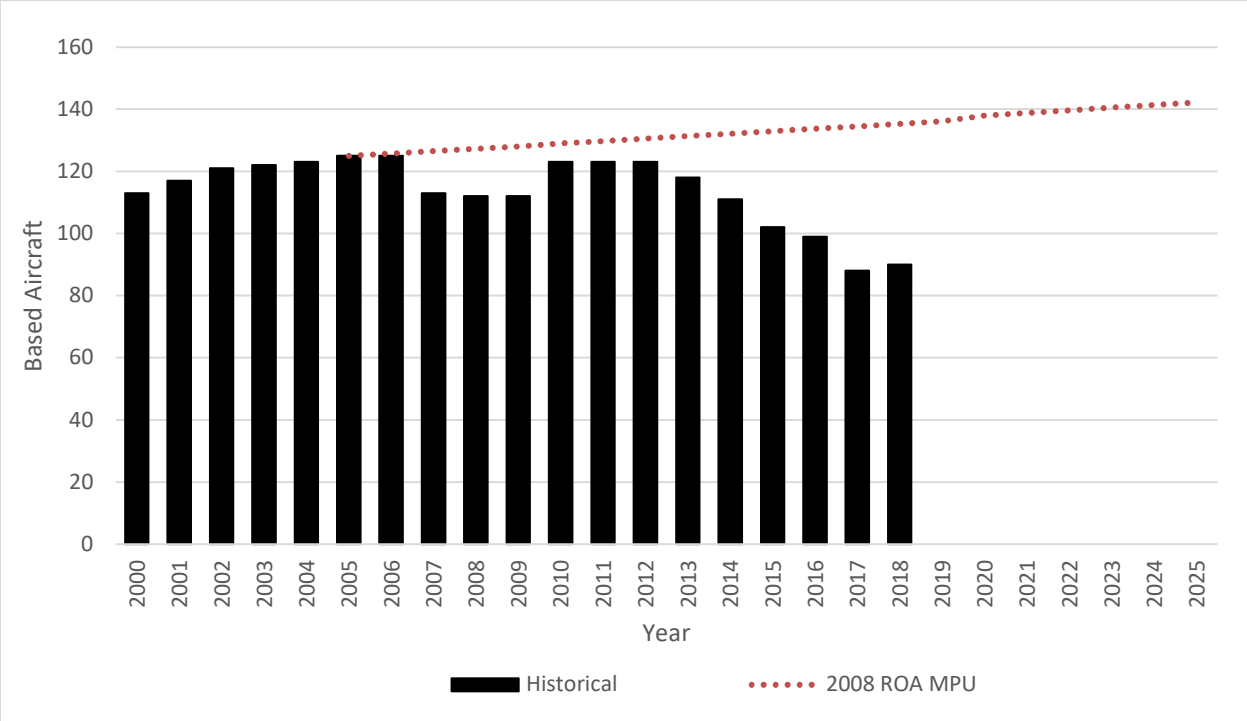
Source: RS&H, 2019; ROA MPU, 2008

FIGURE 21
2008 MPU OPERATIONS FORECAST



Source: RS&H, 2019; ROA MPU, 2008

FIGURE 22
2008 MPU BASED AIRCRAFT FORECAST



Source: RS&H, 2019; ROA MPU, 2008

3.3.2 Virginia Air Transportation System Plan 2016

The Virginia Air Transportation System Plan (VATSP) 2016 Update, much like a master plan, is an aviation plan of the entire Commonwealth's airport system that is updated to provide guidance so that the facilities can serve the ongoing growing aviation demand. It is developed by the Virginia Department of Aviation (DOAV) and was most recently updated in 2016. The VATSP identifies ROA as one of its nine commercial airports. The other eight airports are listed below:

- Charlottesville-Albemarle (CHO)
- Lynchburg Regional Airport (LYH)
- Newport News-Williamsburg (PHF)
- Norfolk International Airport (ORF)
- Richmond International Airport (RIC)
- Ronald Reagan Washington National Airport (DCA)
- Shenandoah Valley Regional Airport (SHD)
- Washington Dulles International Airport (IAD)

3.3.2.1 Enplanements

The VATSP 2016 Update assumed that the changes due to mergers between 2007 and 2012 along with growth in low-cost carriers (LCCs) at larger airports would create the tendency of passengers driving further distances for commercial service. Thus, it was anticipated that enplanements at non-Metropolitan Washington Aviation Authority (MWAA)[6] airports would increase at a slower rate than in the past.

The ROA enplanements forecast in the VATSP 2016 Update, increased 314,000 enplanements in 2012 to 428,000 in 2037. The VATSP was very similar to the FAA TAF it was being compared. Both forecasts had an AAGR of 1.2%.

3.3.2.2 Operations

The VATSP projected the commercial passenger operations at ROA to increase at an annual rate of 0.7% from 2012-2037.

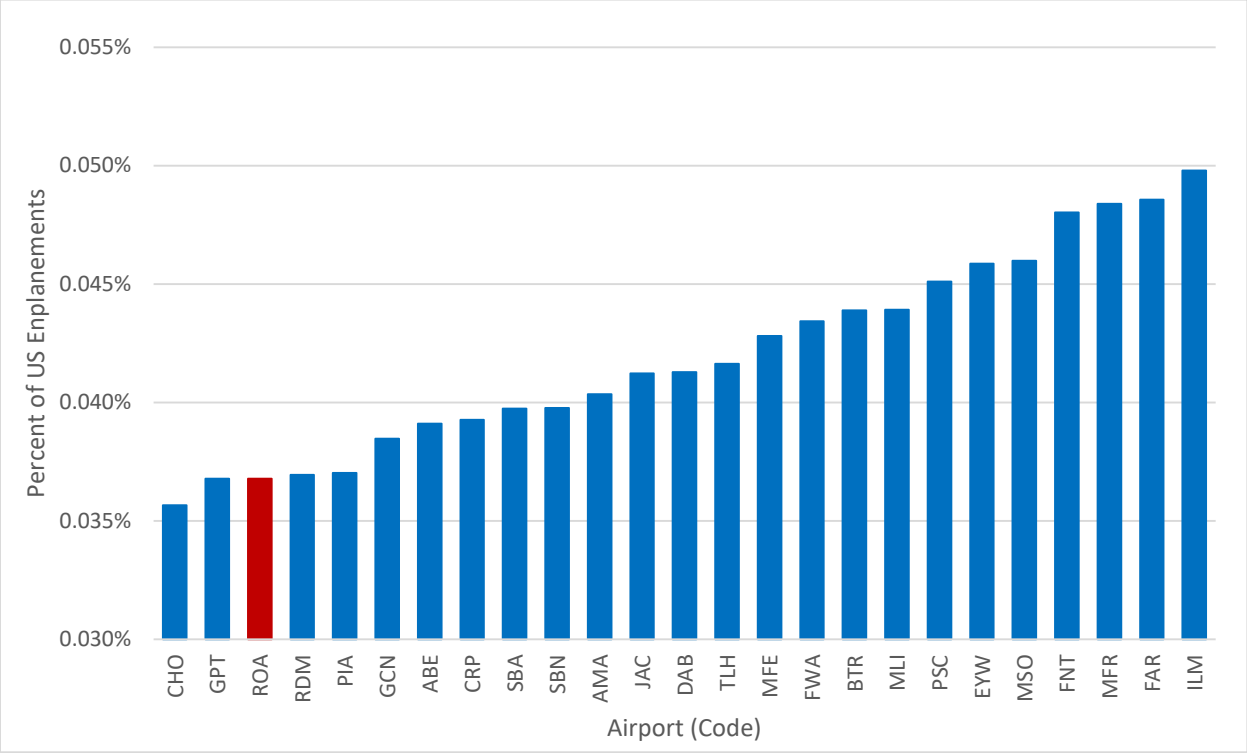
[6] For this forecast, Non-MWAA airports indicates all commercial airports in Virginia except IAD and DCA.

3.3.3 National Plan of Integrated Airport Systems (NPIAS)

The FAA's National Plan of Integrated Airport Systems (NPIAS) for 2019-2023 identifies the roles for each of the 3,328 airports included within the national airport system, as well as the federal funding each airport is eligible to receive under the Airport Improvement Program (AIP). Each time the NPIAS is updated, all NPIAS airports are categorized as either primary or non-primary, based on their enplaned passenger totals. For the evaluation of each airport within the 2019-2023 NPIAS, passenger enplanement totals for CY 2017 were used. Of all NPIAS airports, there were a total of 380 primary airports receiving scheduled service with 10,000 or more enplaned passengers annually, while there were 2,941 non-primary airports that received less than 10,000 enplaned passengers. Roanoke-Blacksburg Regional Airport is a primary airport, since it does enplane more than 10,000 passengers.

Each primary airport is then further classified as a large hub, medium hub, small hub, or non-hub airport based on the percentage of total U.S. enplanements it handles. In the 2019-2023 NPIAS, there were 30 large hub airports each accounting for 1 percent or more of the U.S. total, 31 medium hub airports each accounting for 0.25 to 1 percent of the U.S. total, 72 small hub airports each accounting for 0.05 to 0.25 percent of the U.S. total, and 249 non-hub airports each accounting for less than 0.05 percent of the U.S. total, but still receiving more than 10,000 enplanements annually. Based on ROA's enplanement total of 305,212 it accounts for 0.037% of the U.S. total, ranking as the 23rd busiest non-hub airport in terms of passenger enplanements in the 2019-2023 NPIAS Report. *Figure 23* shows a comparison of the top 25 non-hub airports in the 2019-2023 NPIAS based on enplanements, with ROA identified in red.

FIGURE 23
NPIAS TOP 25 PRIMARY NON-HUB AIRPORTS (2019-2023)



Source: RS&H, 2019; FAA NPIAS, 2019-2023

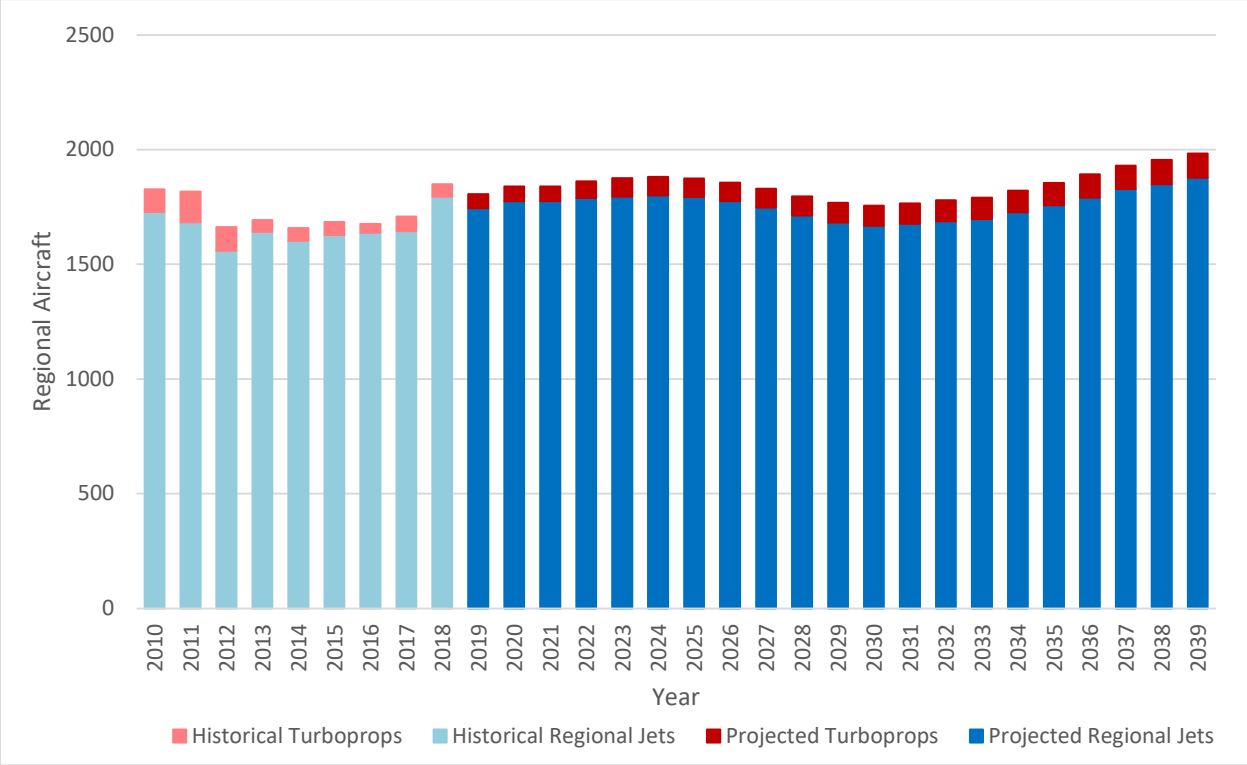
3.3.4 FAA Aerospace Forecast Fiscal Years 2019-2039

The *FAA Aerospace Forecast for Fiscal Years 2019-2039* is an extensive forecast that indicates long-term projections and trends that airports depending on their size and role can consider. As stated in the NPIAS section, ROA is a primary, non-hub airport that provides mainline and regional service to ticketed passengers. Therefore, there are a large number of regional jets in use at ROA. Even though the number of seats per aircraft is increasing in general, the Aerospace Forecasts anticipates aircraft with less than 50 seats will be very few by 2030. Under this assumption some of the regional aircraft in service at ROA will experience upgauging by that time.

Jets with more than 40 seats are forecast to increase at an AAGR of 0.4%, and turboprops with more than 40 seats are forecast to increase at an AAGR of 2.8% from 2019-2039.

Figure 24 shows the FAA Aerospace Forecast for passenger aircraft with more than 40 seats from 2019-2039.

FIGURE 24
U.S. REGIONAL CARRIERS PASSENGER AIRCRAFT FORECAST 2019-2039)



Notes: 1-Graph shows regional aircraft with more than 40 seats.
Source: RS&H, 2019; FAA Aerospace Forecast 2019-2039, Table 27

3.3.5 ROA 2018 Leakage Study

In August 2018, a leakage analysis was done on ROA[7]. The results of the analysis stated that the leakage and retention rates have nearly switched, showing a greater amount of leakage and lesser amount of retention compared to previous studies. This is likely because of the lack of low-cost carrier (LLC) and ultra-low-cost carrier (ULCC) data. The conclusion of the study was that ROA leaks 66% of traffic that would be derived from its "primary" territory. The primary area leaks 71% of inbound visitor traffic and 61% of outbound traffic. Most of the passengers lost are those individuals who are willing to drive to-and-from Raleigh-Durham International Airport (RDU), Charlotte-Douglas International Airport (CLT) and the two Metropolitan Washington Airports Authority (MWAA) airports[8].

The study also looks at out-of-Airport markets that would attract passengers from the primary area, causing them to select competitor airports because of non-stop options not available at ROA. The number one market identified was Boston, Massachusetts (BOS), in terms of terms of inbound and outbound leakage. Two other western markets were also identified—Denver, Colorado (DEN) and Dallas/Ft. Worth, Texas. The report stated that service to these two destinations would also decrease some of the inbound leakage being experienced by ROA.

Table 13 shows the top 25 ROA domestic markets from the study.

[7] Study was completed by Crawford, Murphy, & Tilly, 2018.

[8] The two MWAA airports include Dulles International Airport (IAD) and Reagan National Airport (DCA).

TABLE 13
TOP 25 ROA DOMESTIC MARKETS

DOT Rank	IATA Code	Destination	ROA PDEW[1]
1	ATL	Atlanta, GA	56.3
2	SFB	Orlando, FL (Sanford)	45.7
3	PIE	St. Pete/Clearwater, FL	44.8
4	LGA	New York, NY (LaGuardia)	32.1
5	ORD	Chicago, IL (O'Hare)	21.6
6	DFW	Dallas/Ft. Worth, TX	20.2
7	PHL	Philadelphia, PA	19.4
8	DEN	Denver, CO	15.7
9	LAX	Los Angeles, CA	14.2
10	SFO	San Francisco, CA	13.8
11	MCO	Orlando, FL (Orlando Int.)	13.3
12	BOS	Boston, MA	13.1
13	LAS	Las Vegas, NV	12.0
14	PHX	Phoenix, AZ (Sky Harbor)	11.4
15	MSP	Minneapolis/St. Paul, MN	10.8
16	IAH	Houston, TX (George Bush Intercontinental)	10.6
17	CLT	Charlotte, NC	10.2
18	SEA	Seattle, WA	9.8
19	SAN	San Diego, CA	9.3
20	TPA	Tampa, FL	9.3
21	SLC	Salt Lake City, UT	7.9
22	STL	St. Louis, MO	7.1
23	MCI	Kansas City, MO	7.1
24	AUS	Austin, TX	7.1
25	FLL	Ft. Lauderdale, FL	7.0

Notes:1-PDEW indicates passengers daily each way
Source: Crawford, Murphy & Tilly, 2018

3.3.6 FAA TAF 2018

The FAA TAF is the official forecast produced annually by the FAA for U.S. airports. TAF forecasts are prepared to assist in planning efforts and needs of the FAA. Because the TAF is updated annually, a specific forecast may differ from previous years. The TAF is based on the federal fiscal year (FY) which goes from October 1 through September 30, as opposed to calendar year (CY) which begins January 1 and ends December 31.

Over the next 20 years, the FAA TAF 2018, projects the Airport to grow minimally in all areas. The enplanements are projected to have a CAGR of 0.8%. The total operations are projected to have a CAGR of 0.2%. However, based aircraft are projected to increase at a CAGR of 2.3%, which is more than double that of the past 10 years.

Table 14 shows many of the categories used in the FAA TAF, by comparing the historical CAGRs from 2010-2019 with the TAF projections for 2020-2039.

TABLE 14
HISTORICAL AND FORECAST AAGR FOR ROA (2010-2039)

	Historical (FY 2010-2019)	Forecast (FY 2020-2039)
	CAGR	CAGR
Enplanements	**0.7%**	**0.8%**
Air Carrier	10.1%	0.8%
Commuter	-1.0%	0.8%
Total Operations	**2.0%**	**0.2%**
Total Itinerant Operations	-1.2%	0.2%
Air Carrier	6.5%	2.5%
Air Taxi & Commuter	-3.4%	-0.7%
Itinerant GA	0.0%	0.1%
Itinerant Military	-0.2%	0.0%
Total Local Operations	15.9%	0.2%
Civil	16.8%	0.2%
Local Military	0.6%	0.0%
Based Aircraft	**-2.9%**	**2.3%**

Note: FY 2018 and 2019 are projected
Source: RS&H, 2019; FAA TAF, 2018

3.4 FACTORS AFFECTING AVIATION DEMAND

The qualitative and quantitative factors that could influence future aviation activity at the Airport are discussed in this section. These factors were considered, either directly or indirectly, in developing the aviation activity forecasts for ROA.

3.4.1 Airport Service Area

The ROA Service Area is defined as the maximum boundary from which Airport customers are anticipated to travel through ROA, giving consideration for drive time, cost, and the types of services that are unique to ROA 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.

While the entire ROA Service Area reflects the extent of anticipated Airport passengers, it has been divided into a primary and secondary service area based on the primary bookings area from the 2018 leakage study, as well as the counties and independent cities that are within metropolitan statistical areas (MSA)s. The primary service area[9] contains the entire Roanoke Metropolitan Statistical Area (MSA), the entire Blacksburg-Christiansburg MSA and Bedford County which is a part of the Lynchburg MSA. These counties make up a majority of the Service Area's population.

The counties and independent cities[10] included in the ROA Service Area are listed in *Table 15* and shown in a map in *Figure 25*.

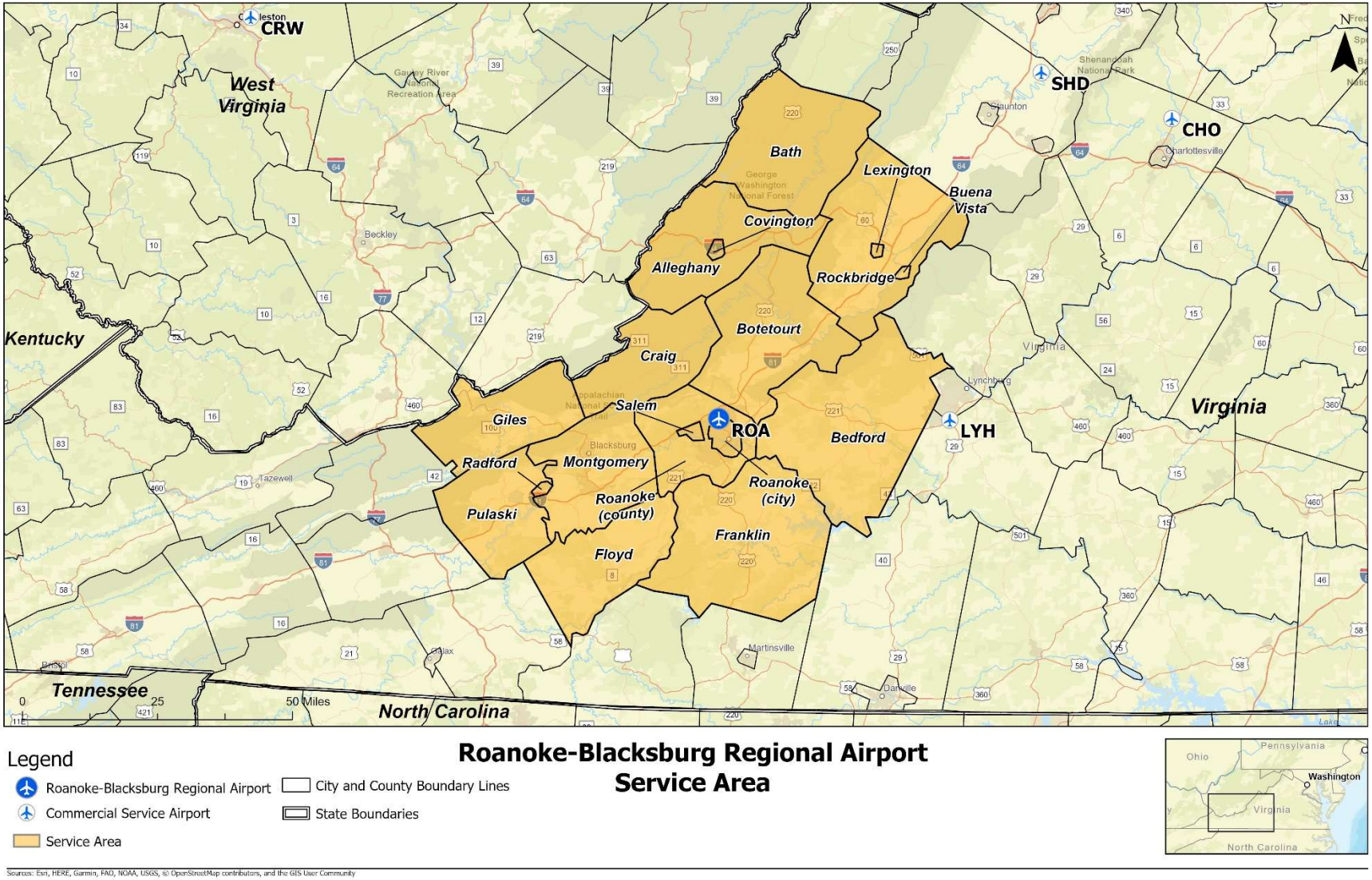
TABLE 15
ROA SERVICE AREA COUNTIES AND INDEPENDENT CITIES

Primary Service Area	***Secondary Service Area***
County/Independent City	***County/Independent City***
Botetourt County[1]	Alleghany County
Craig County[1]	Bath County
Franklin County[1]	City of Covington
City of Roanoke[1]	City of Buena Vista
Roanoke County[1]	City of Lexington
City of Salem[1]	Floyd County
Giles County[2]	Rockbridge County
Montgomery County[2]	
Pulaski County[2]	
City of Radford[2]	
Bedford County[3]	

Notes: 1- Part of Roanoke MSA; 2-Part of Blacksburg-Christiansburg MSA; 3-Part of Lynchburg MSA
Source: RS&H, 2019; Woods & Poole, Inc., 2019

[9] Data for statistics and regression analyses was taken from the primary service area only.
[10] Independent cities are identified by the US Census Bureau as places that are treated equivalent to counties for statistical purposes.

FIGURE 25
ROA SERVICE AREA MAP



3.4.2 Local Socioeconomic Trends

The local socioeconomic statistics for the ROA Service Area were taken from Woods & Poole, Inc., 2019. The statistics focus on historical trends over the past 25 years to see how the area has grown and compares them with the projected growth rates of the MPU forecast horizon.

The following four socioeconomic variables were analyzed:

- Population
- Employment
- Personal Income Per Capita (PIPC)
- Gross Regional Product (GRP)

3.4.2.1 Historical Socioeconomic Trends

A historical analysis of the ROA Service Area showed that while the annual average growth rate (AAGR) for population, employment, PIPC, and GRP each increased from 1995-2019, their growth rates were less than that of the Commonwealth of Virginia, and U.S. Of the four variables analyzed the one with the greatest AAGR was GRP which increased at a rate of 1.7%.

Table 16 and *Figure 26* compares the historical socioeconomic growth rates of the Roanoke Service Area, the Commonwealth of Virginia, and the U.S. from 1995-2019.

3.4.2.2 Future Socioeconomic Trends

Similarly, a projected socioeconomic analysis of the ROA Service Area showed that while the annual average growth rate (AAGR) for population, employment, PIPC, and GRP each increased from 2020-2039, their growth rates were less than that of the Commonwealth of Virginia, and U.S. Of the four variables analyzed the greatest AAGR was PIPC which is projected to increase at a rate of 1.1%.

Table 16 and *Figure 27* compare the projected socioeconomic growth rates of the Roanoke Service Area, the Commonwealth of Virginia, and the U.S. from 2020-2039.

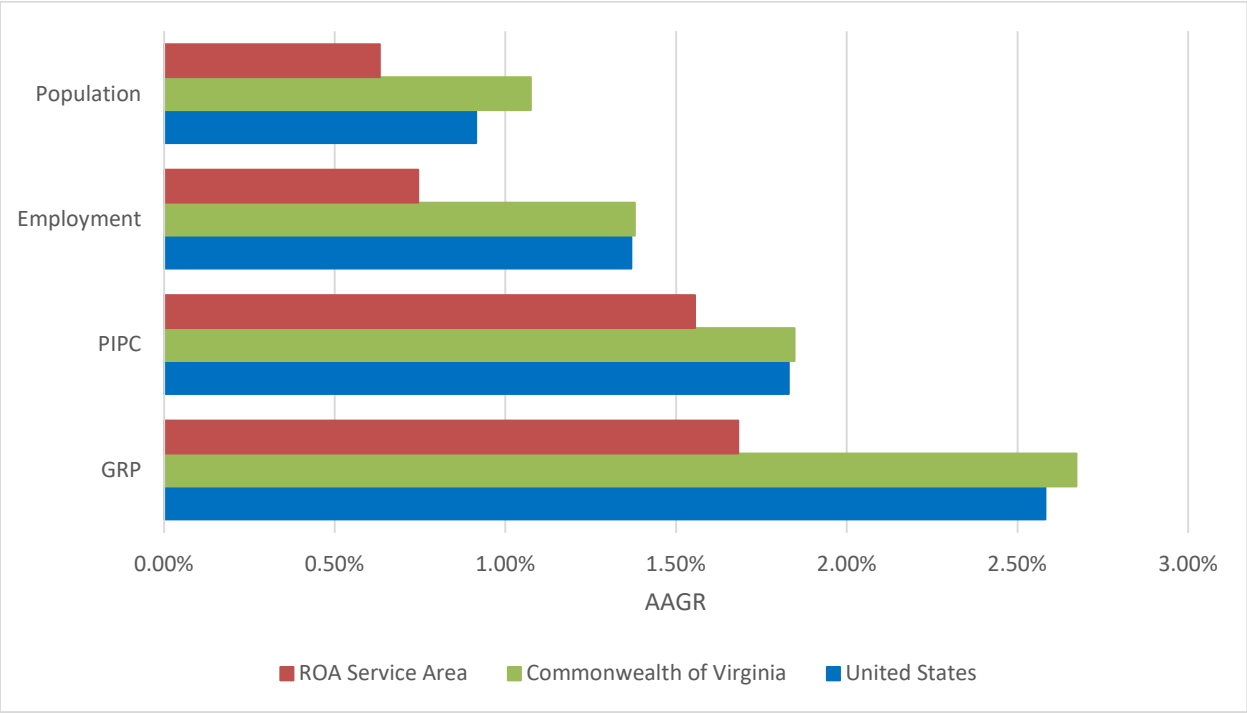
Table 17 shows the projected socioeconomic values for baseline year 2019, and the three forecast years 2024, 2029, and 2039.

TABLE 16
COMPARISON OF SOCIOECONOMIC GROWTH RATES

	Historical (1995-2019)	Projected (2020-2039)
ROA Service Area		
Total Population	0.6%	0.4%
Total Employment	0.7%	0.7%
Personal Income Per Capita	1.6%	1.1%
Gross Regional Product	1.7%	0.9%
Commonwealth of Virginia		
Total Population	1.1%	0.8%
Total Employment	1.4%	1.2%
Personal Income Per Capita	1.8%	1.3%
Gross Regional Product	2.7%	1.6%
United States		
Total Population	0.9%	0.6%
Total Employment	1.4%	1.1%
Personal Income Per Capita	1.8%	1.2%
Gross Domestic Product	2.6%	1.7%

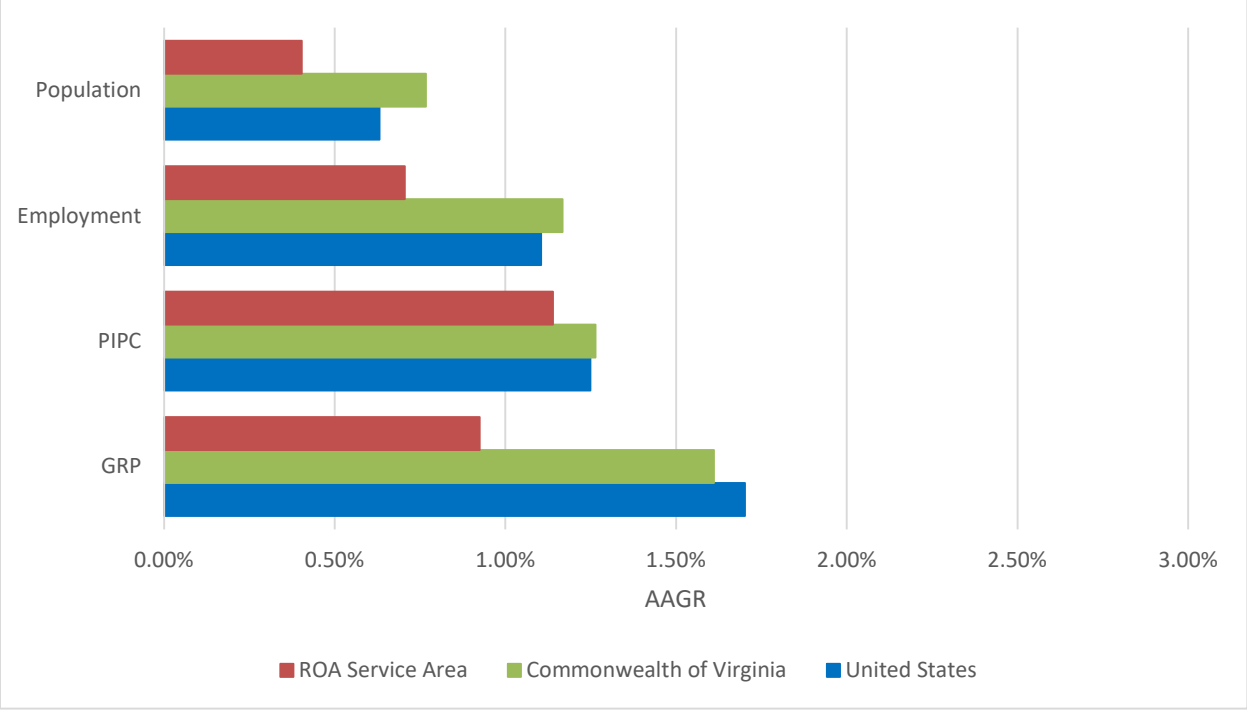
Note: 1-Percentages are rounded
Source: RS&H, 2019; Woods & Poole, Inc., 2019

FIGURE 26
HISTORICAL-GROWTH RATES OF SOCIOECONOMIC PREDICTORS (1995-2019)



Source: RS&H, 2019; Woods & Poole, Inc., 2019

FIGURE 27
FORECAST-GROWTH RATES OF SOCIOECONOMIC PREDICTORS (2020-2039)



Source: RS&H, 2019; Woods & Poole, Inc., 2019

TABLE 17
FORECAST-KEY SOCIOECONOMIC VARIABLES (2019-2039)

	2019	2024	2029	2039	2019-2039 AAGR
ROA Service Area					
Total Population	565,268	579,365	592,392	612,720	0.4%
Total Employment	322,410	336,532	349,926	371,106	0.7%
Personal Income Per Capita	$45,942	$49,281	$52,537	$57,619	1.2%
Gross Regional Product (millions)	$23,254	$24,560	$25,831	$27,953	0.9%
Commonwealth of Virginia					
Total Population	8,613,415	8,973,881	9,336,862	10,035,583	0.8%
Total Employment	5,361,602	5,714,970	6,074,926	6,762,245	1.2%
Personal Income Per Capita	$60,032	$64,551	$69,085	$77,170	1.3%
Gross Regional Product (millions)	$500,568	$545,624	$592,937	$689,018	1.6%
United States					
Total Population	330,393,265	341,996,829	353,468,845	374,692,158	0.6%
Total Employment	202,179,143	215,040,115	227,983,784	251,866,173	1.1%
Personal Income Per Capita	$56,017	$60,297	$64,559	$71,808	1.3%
Gross Domestic Product (millions)	$19,040,145	$20,854,808	$22,769,890	$26,683,405	1.7%

Notes: 1 – Personal Income Per Capita and Gross Regional/Domestic Product are shown in 2012 dollars; 2 - AAGRs are rounded to the nearest 0.1%
Source: Woods & Poole, Inc., 2019; RS&H, 2019

3.5 ENPLANEMENTS FORECAST

This section presents forecasts of enplaned passengers at the Airport, which were developed with consideration of several factors and methodologies, including the following:

- Local socioeconomic and demographic factors
- ROA's historical and projected market share of regional enplaned passengers
- Known industry trends

The enplanements forecast methodology considered several approaches including market share and multiple regression analysis methods. After comparing the results obtained from these methods, a preferred Base Case Forecast was selected, as well as high growth and low growth scenarios.

3.5.1 Market Share Analysis

The market share analysis forecast approach takes the Airport's enplanement share as a ratio within the total enplanements of a select group of airports that are relevant to ROA's market. A constant market share approach was used, taking that ratio and holding it constant over the forecast horizon multiplying it by the projected enplanements that the group of airports is anticipated to have in the future.

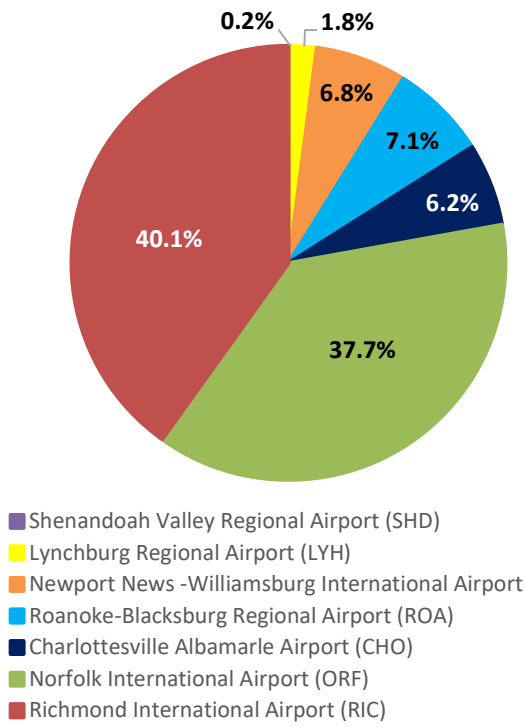
Four constant market share forecasts were developed based on the forecasted future enplanements included in the VATSP and the 2018 ROA Leakage Study:

- Market Share #1 – Historical share (2010-2019) of non-MWAA commercial service airports in Virginia
- Market Share #2 – Historical share (2010-2019) of airports included in the 2018 ROA Leakage Study
- Market Share #3 – Projected share (2020-2039) of non-MWAA commercial service airports in Virginia
- Market Share #4 – Projected share (2020-2039) of airports included in the 2018 ROA Leakage Study

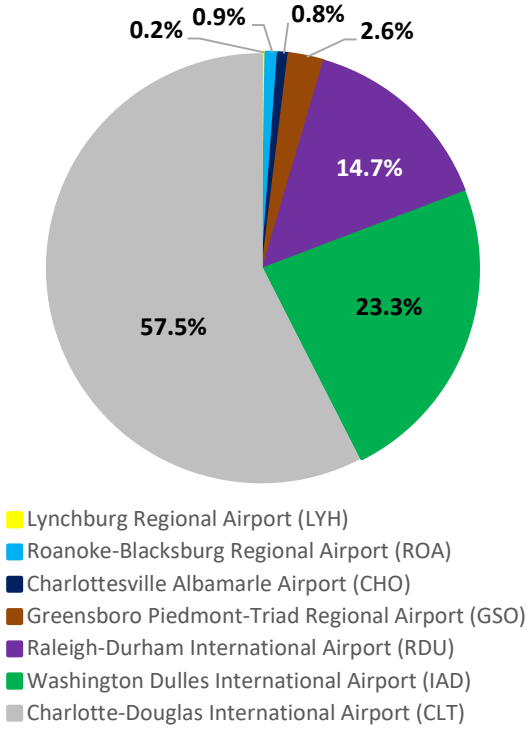
Market share forecasts #3 and #4 were not shortlisted because of unrealistic short-term reductions in passenger traffic they produce, which is not indicated in current trends at ROA. Market share forecasts #1 and #2 were shortlisted for consideration and are summarized below. *Figure 28* shows the ROA market share percentages for both shortlisted forecast options.

FIGURE 28
MARKET SHARE ANALYSIS #1 & #2

Market Share 1: Historical Share of Non-MWAA Commercial Airports in Virginia (Average Share: 2010-2019)



Market Share 2: Historical Share of Airports in 2018 ROA Leakage Study (Average Share: 2010-2019)



Source: ROA 2018 Leakage Study; RS&H analysis, 2019.

3.5.2 Multiple Regression Analysis

Historical passenger enplanements were analyzed to identify relationships with socioeconomic variables at the ROA Service Area level as well as other relevant economic indicators as explanatory variables. Multiple regression analysis was used to identify predictive relationships between passenger demand and these independent variables. The independent variables that were tested and selected for the model ranged from:

- Socioeconomic characteristics unique to the ROA service area
- Economic indicators such as national jet fuel prices, average airfare, and airline yield
- Qualitative variables[11] , which are unique events that have a noticeable impact on aviation activity locally at ROA or nationally.

A wide variety of independent variables were considered. *Table 18* shows a list of the variables tested and of them which ones were selected based on the selected model.

[11] For this forecast qualitative variables are also known as "binomial" or "dummy' variables.

TABLE 18
FORECAST-ENPLANEMENTS REGRESSION MODEL VARIABLES

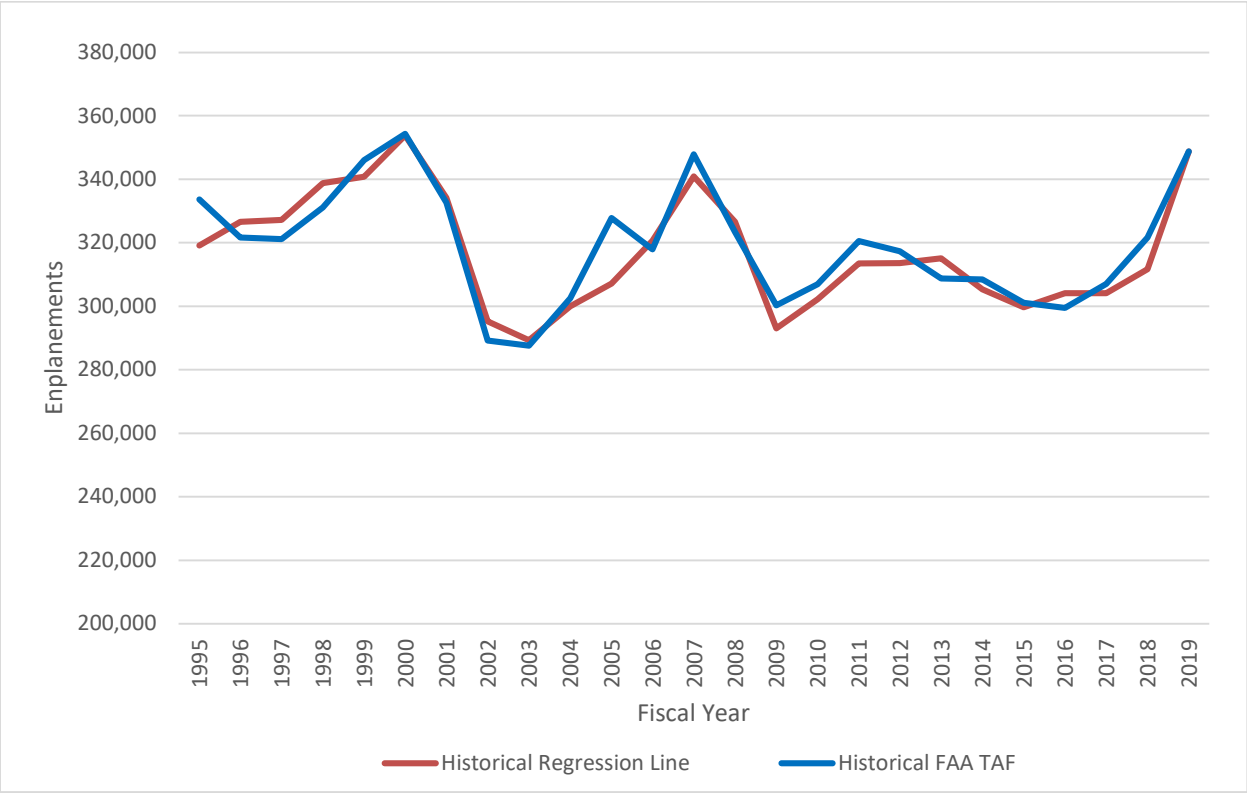
Variables Tested	Selected
ROA Service Area Population	
ROA Service Area Employment	**X**
ROA Service Area PIPC	
ROA Service Area GRP	**X**
ROA Load Factors	
ROA Average Air Fare	
Average Annual Jet Fuel Prices	
Advanced Auto Parts Corporate Office Relocation (Qualitative)	**X**
Loss of DTW Service Market (Qualitative)	**X**
Recession of 2009 (Qualitative)	**X**
Loss of CVG Service Market (Qualitative)	
Allegiant Air Service (Qualitative)	**X**
Terrorist Attacks of 9/11 (Qualitative)	**X**

Source: RS&H, 2019

A standard measure of how well a regression equation explains the target dependent variable is the coefficient of determination, or R-squared. A result of 100 percent is the maximum possible value and represents a perfect fit between the variables analyzed. The selected regression model for deriving projected passenger enplanements yielded an R-squared value of 94.1 percent.

In order to check the accuracy and precision of the regression model, historical inputs were used and carried from 1995-2019. As shown in *Figure 29* the results follow a similar trend as seen in the historical enplanement totals of the FAA TAF 2018.

FIGURE 29
HISTORICAL-REGRESSION MODEL AND HISTORICAL ENPLANEMENTS COMPARISON (1995-2019)



Source: RS&H, 2019; FAA TAF 2018.

3.5.3 Base Case Enplanement Forecast

Table 19 and *Figure 30* show the projected enplanement totals of the two Market Share forecasts and the Regression Model forecast presented in the previous sections from 2020-2039 compared to the FAA TAF.

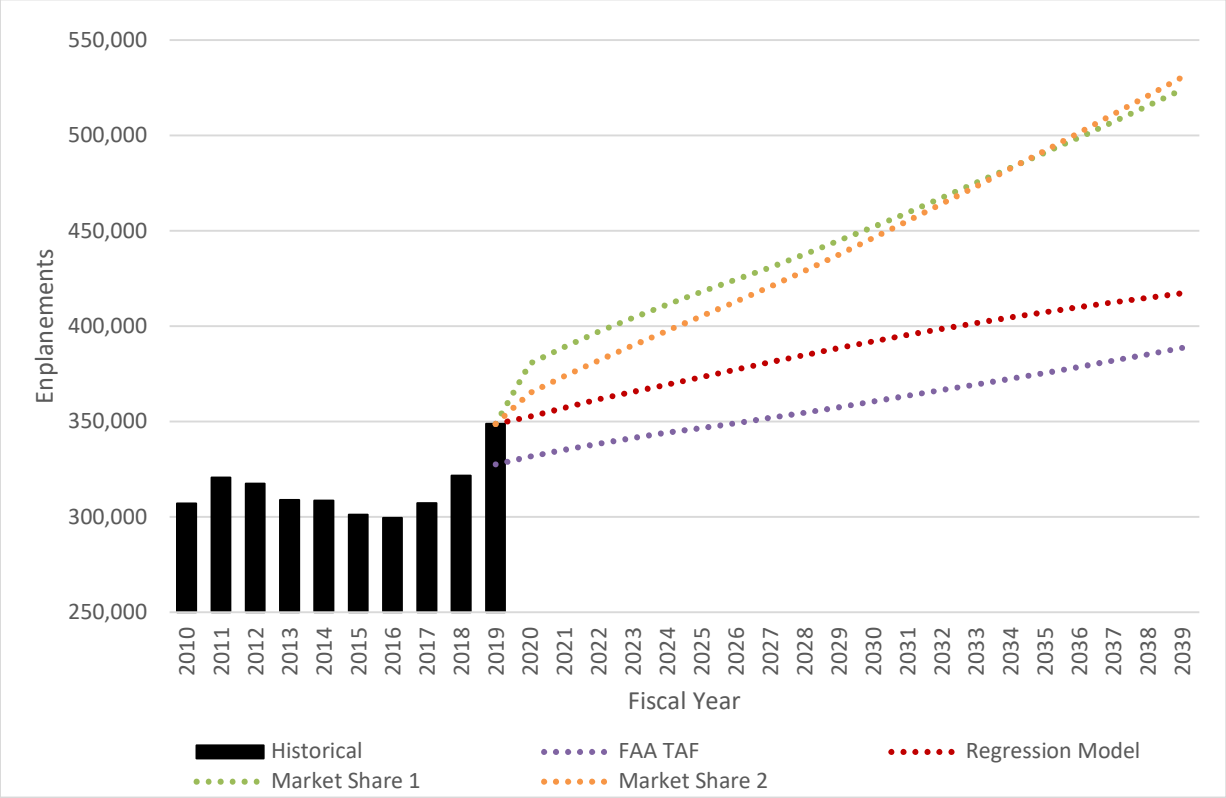
The Regression Model forecast was selected as the passenger enplanement Base Case forecast for the Master Plan. Of the three forecast options, the Regression Model is the most similar in terms of growth rates to the FAA Terminal Area Forecast. The major difference between the Regression Model and the TAF is the growth projected to occur in the short-term portion (2020-2024) of the forecast, with the Regression Model being slightly more aggressive than the TAF. The two Market Share forecasts are similarly aggressive in the short-term time horizon, however, with average annual growth rates of 4 to 4.8 percent, they are considered overly optimistic for the baseline forecast option.

TABLE 19
FORECAST-MARKET SHARE AND REGRESSION MODEL ANALYSES (2020-2039)

FY	FAA TAF 2018	Market Share 1	Market Share 2	Regression Model
2019[1]	327,492	327,492	327,492	348,721
2020	331,585	380,437	365,102	352,666
2024	344,189	411,319	397,625	369,337
2029	357,451	444,836	437,463	388,466
2039	388,582	524,038	530,565	417,260
AAGR				
2020-2024	1.0%	4.8%	4.0%	1.2%
2025-2029	0.8%	1.6%	1.9%	1.0%
2030-2039	0.8%	1.7%	1.9%	0.7%
2020-2039	0.9%	2.4%	2.5%	0.9%

Notes: 1-Because the TAF was used as the data set for the projections after the market share was established, the 2019 enplanement total of 327,492 which was listed in the FAA TAF, 2018 was used instead of the 348,721 total that was extrapolated.
Source: Virginia Air Transportation System Plan; ROA 2018 Leakage Study; RS&H analysis, 2019; FAA TAF, 2018

FIGURE 30
FORECAST-BASE CASE ENPLANEMENT OPTIONS



Source: ROA 2018 Leakage Study; RS&H analysis, 2019; FAA TAF, 2018

3.5.4 High Growth Scenario Enplanement Forecast:

The High Growth Scenario Forecast was stablished using the regression analysis model used as to determine the Base Case Scenario. For the High Growth Scenario their model assumes an increase in the projected employment and GRP of the ROA Service Area above those established by Woods and Poole. The assumption is based on important economic developments within the ROA service spurred by the growth of Carilion and the Mahindra Group, who recently joined the Virginia Tech University Corporate Research Center in 2018 among others.

This Scenario also assumes the start of air service to a new market within the next five years; the market would have the same weight as the DTW market which was lost in 2014. All other variables would remain constant over the forecast horizon, which projects enplanements to increase at an AAGR of 1.26%.

3.5.5 Low Growth Scenario Enplanement Forecast:

The Low Growth Scenario Forecast was established using the regression analysis model used as to determine the Base Case Scenario, though under this scenario a decrease in the projected employment and GRP growth rates of the ROA Service Area is used to simulate a decrease in the expected development of projects that would stimulate sustained growth of the economy in ROA's Service Area. This scenario also assumes the loss of Allegiant air service at ROA. All other variables would remain constant over the forecast horizon, which projects enplanements to only increase at an AAGR of 0.76%.

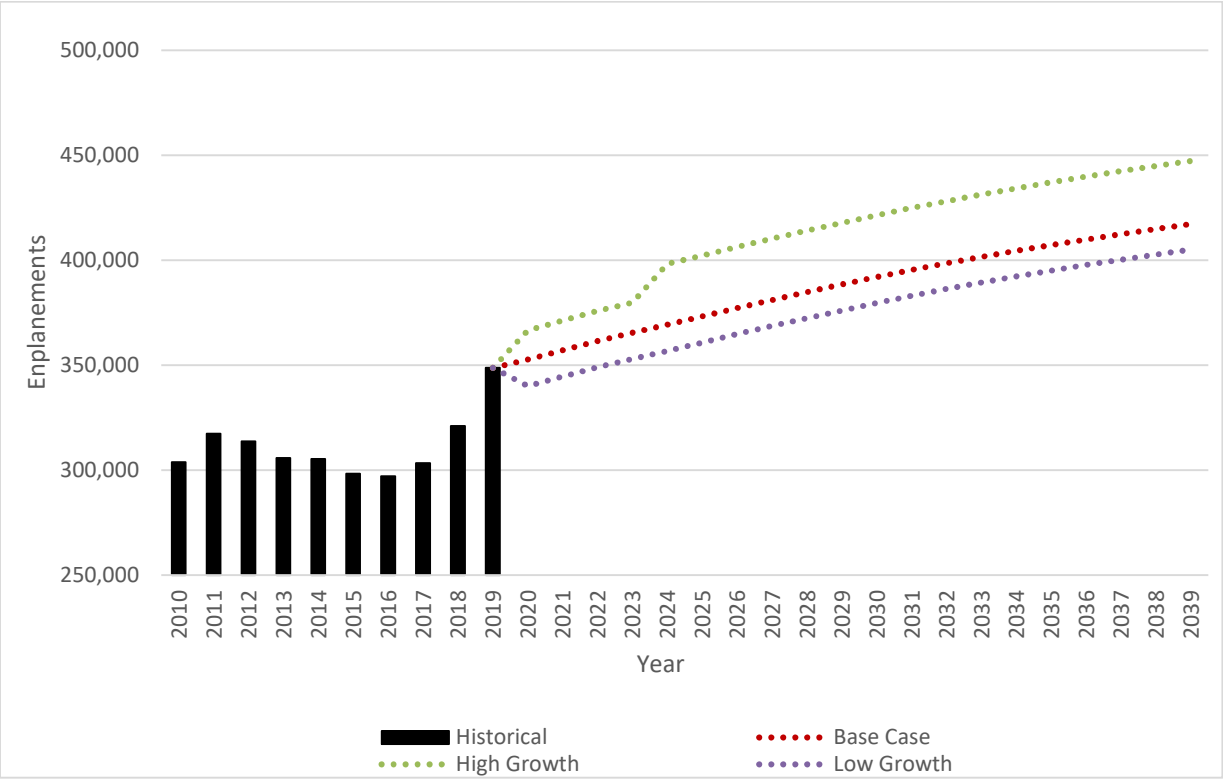
Table 20 and *Figure 31* compare the Base Case, High Growth Scenario, and Low Growth Scenario passenger enplanement forecasts.

TABLE 20
FORECAST-ENPLANEMENTS SCENARIOS (2020-2039)

FY	Base Case Forecast	High Growth Scenario	Low Growth Scenario
2010	306,951	306,951	306,951
2015	301,055	301,055	301,055
2019[1]	348,721	348,721	348,721
2020	352,666	366,642	340,076
2024	369,337	398,219	356,842
2029	388,466	417,827	376,101
2039	417,260	447,341	405,151
AAGR			
2020-2024	1.2%	2.7%	0.5%
2025-2029	1.0%	1.0%	1.1%
2030-2039	0.7%	0.7%	0.7%
2020-2039	0.90%	1.26%	0.76%

Notes: 1- FY 2019 is extrapolated using T-100 data for August and September 2019
Source: RS&H, 2019; FAA TAF, 2018

FIGURE 31
FORECAST-ENPLANEMENTS SCENARIOS (2020-2039)



Notes: 1- FY 2019 is extrapolated using T-100 data for August and September 2019
Source: RS&H, 2019; FAA TAF, 2018

3.6 AIR CARGO FORECAST

This section presents the forecasts of air cargo tonnage at the Airport. The air cargo forecast considered multiple regression analysis only.

3.6.1 Multiple Regression Analysis

The air cargo forecast utilized a multiple regression analysis in which enplaned tonnage is derived using predictor variables that have a correlation with its growth. Historical Airport data was used for annual[12] tonnage totals[13]. The output of these models (or dependent variable) is a projected tonnage of air cargo for each of the 20 years over the planning horizon. The independent variables that were tested and selected are shown on *Table 21*.

[12] Annual tonnage totals were used in CY format rather than FY format.
[13] There were two minor discrepancies within the historical data gathered and used within the regression model. The difference between the 2018 totals is 0.6% and the 2013 totals was 1.2%, which were both deemed as within the acceptable margin of error. The corrected totals are listed in the historical sections of the tables.

TABLE 21
FORECAST-REGRESSION MODEL VARIABLES AIR CARGO

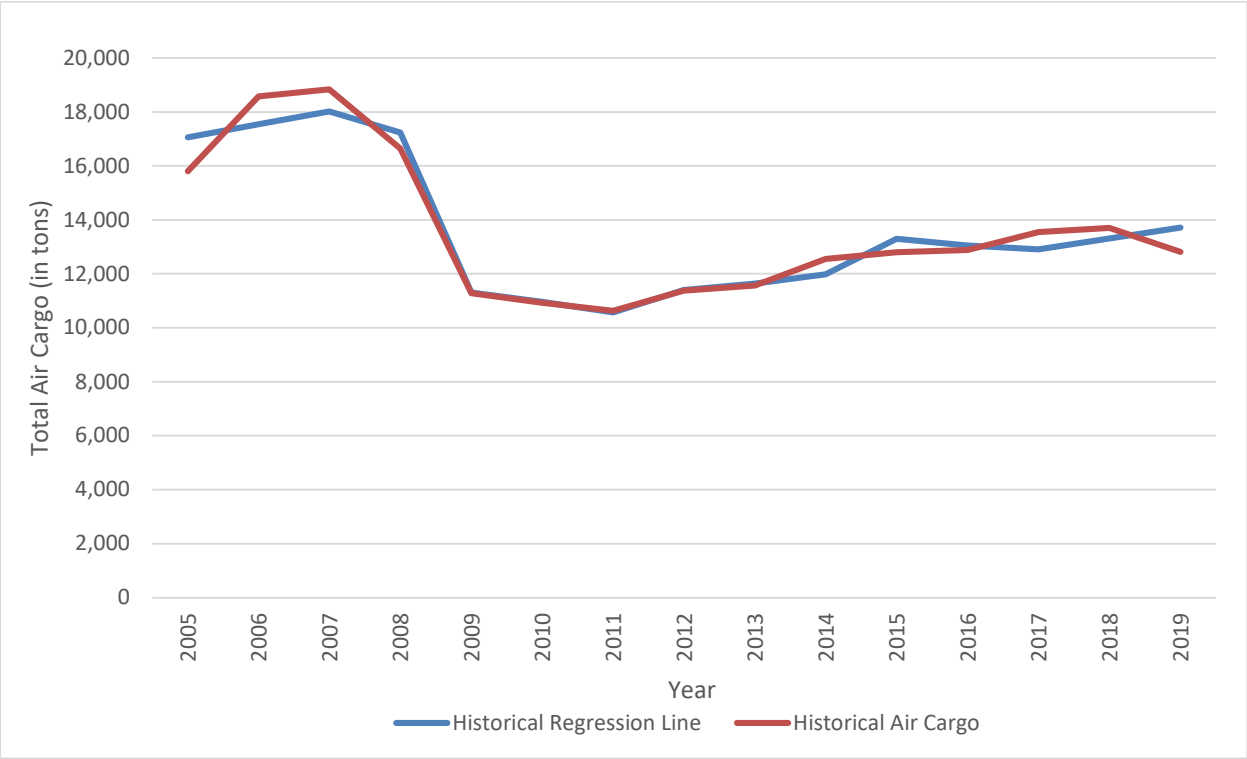
Variables Tested	Selected
ROA Service Area Population	
ROA Service Area Employment	
ROA Service Area PIPC	
ROA Service Area GRP	**X**
Commonwealth of Virginia GRP	
U.S. Gross Domestic Product (GDP)	
ROA Service Area Total Earnings	
ROA Service Area Manufacturing Employment	
ROA Service Area Manufacturing Earnings	
Annual Total Revenue Ton Miles (U.S.)	
Total Cargo Jet Aircraft (U.S.)	
Average Annual Jet Fuel Prices	
Recession of 2009 (Qualitative)	
Airborne Express (Qualitative)	**X**
Terrorist Attacks of 9/11 (Qualitative)	

Source: RS&H, 2019

The selected regression model for deriving projected air cargo tonnage yielded an R-squared value of 94.2 percent.

In order to check the accuracy and precision of the regression model, historical inputs were used and carried from 2005-2019. The results follow a similar trend as seen in the historical air cargo tonnage totals of the Airport's records. A comparison of the regression model using historical variable inputs and the historical air cargo tonnage is shown in *Figure 32*.

FIGURE 32
HISTORICAL-REGRESSION MODEL AND HISTORICAL TONNAGE COMPARISON (2005-2019)



Source: RS&H, 2019; Roanoke-Blacksburg Regional Airport, 2019

3.6.2 Base Case and Growth Scenario Forecasts

The regression model forecast presented above was selected as the preferred air cargo Base Case forecast which projects total air cargo tonnage to increase at an AAGR of 2.3 percent.

The High Growth Scenario air cargo forecast assumes an increase in the projected GRP of the ROA Service Area as part of the regression model and results in a projection of total air cargo tonnage at an AAGR increase of 2.78 percent. The Low Growth Scenario air cargo forecast assumes a decrease in the projected GRP of the ROA Service Area as part of the regression model and results in a projection with an AAGR increase 1.75 percent.

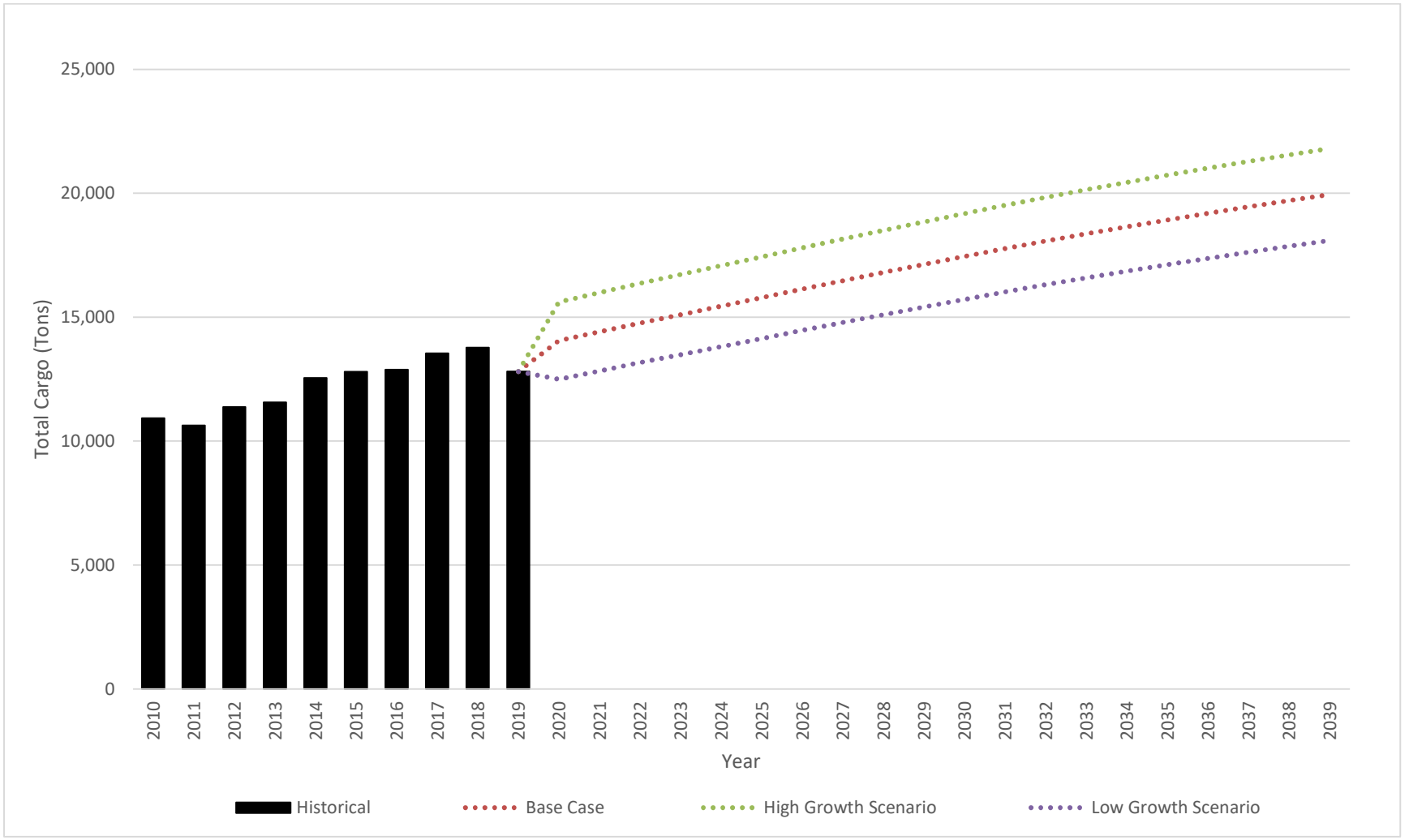
Table 22 and *Figure 33* compares the Base Case, High Growth, and Low Growth Scenario Total Air Cargo forecasts.

TABLE 22
FORECAST-AIR CARGO TONNAGE SCENARIOS (2020-2039)

Year	Base Case	High Growth	Low Growth
2010	10,926	10,926	10,926
2015	12,801	12,801	12,801
2019	12,810	12,810	12,810
2020	14,057	15,619	12,496
2021	14,409	15,989	12,830
2022	14,772	16,369	13,174
2023	15,106	16,720	13,491
2024	15,446	17,077	13,815
2025	15,790	17,438	14,141
2026	16,135	17,800	14,469
2027	16,473	18,156	14,791
2028	16,804	18,503	15,105
2029	17,134	18,850	15,419
2030	17,455	19,187	15,724
2031	17,770	19,517	16,023
2032	18,074	19,837	16,312
2033	18,367	20,145	16,590
2034	18,651	20,442	16,859
2035	18,927	20,732	17,122
2036	19,193	21,012	17,375
2037	19,452	21,284	17,621
2038	19,706	21,550	17,862
2039	19,954	21,810	18,097
AAGR			
2020-2024	3.85%	6.19%	1.54%
2025-2029	2.10%	1.99%	2.22%
2030-2039	1.54%	1.47%	1.61%
2020-2039	2.26%	2.78%	1.75%

Source: RS&H, 2019; Roanoke-Blacksburg Regional Airport, 2019

FIGURE 33
FORECAST-AIR CARGO TONNAGE SCENARIOS (2020-2039)



Source: RS&H, 2019; Roanoke-Blacksburg Regional Airport Records, 2019

3.7 AIRCRAFT OPERATIONS

The operations forecast is broken down by category which include passenger operations, air cargo operations, GA operations, and military operations. The passenger operations are generated from the enplanement forecasts; the air cargo operations are generated from the air cargo tonnage forecasts; the GA operations are generated from OPBA forecasts (which are presented in this section), and the military forecasts are equal to the last year of the FAA TAF 2018. The sum of each of these operation subcategories provides the Base Case Forecast of total operations as well as High and Low Growth scenarios.

3.7.1 Commercial Operations Forecast

The total commercial operations are a sum of both air carrier and air taxi & commuter operations, and at the same time the sum of passenger and air cargo operations. The commercial operations forecast was built through enplanements and air cargo tonnage projections; therefore, total passenger and air cargo operations were generated first. The distribution of air carrier (36.3% share) and air taxi & commuter (63.7% share) among the projected commercial operations is applied based on the FAA TAF's future percentages for ROA.

3.7.1.1 Passenger Operations Forecast

To accurately forecast the passenger operations only, the air cargo operations were removed from the total using the historical count and distribution from the FAA Traffic Flow Management System Count (TFMSC) data, which is also in FY format. The forecasts for passenger operations were generated by determining total seats available and total enplanements of each scenario. The resulting average enplanements per departure was based on the load factor for the Airport, which was assumed will be 82.6%[14] and between 40-45 seats available per departure over the forecast horizon depending on the scenario.

Table 23 and *Figure 34* shows the passenger operations projected in the Base Case, High Growth, and Low Growth Scenario Forecasts.

3.7.1.2 Air Cargo Operations Forecast

Air cargo operations were projected in a similar manner as passenger operations, but instead it used enplaned tonnage instead of passengers. The total air cargo tonnage forecast was adjusted as enplaned and deplaned using the average enplaned (47%) and deplaned (53%) air cargo averages from 2017 to 2019. After calculating enplaned tonnage per departure, and deplaned tonnage per arrival each rate was increased over the forecast horizon, signifying the impacts of upgauged aircraft and air cargo load factors.

Table 24 and *Figure 35* show the aircraft operations projected in the Base Case, High Growth, and Low Growth Scenario Forecasts.

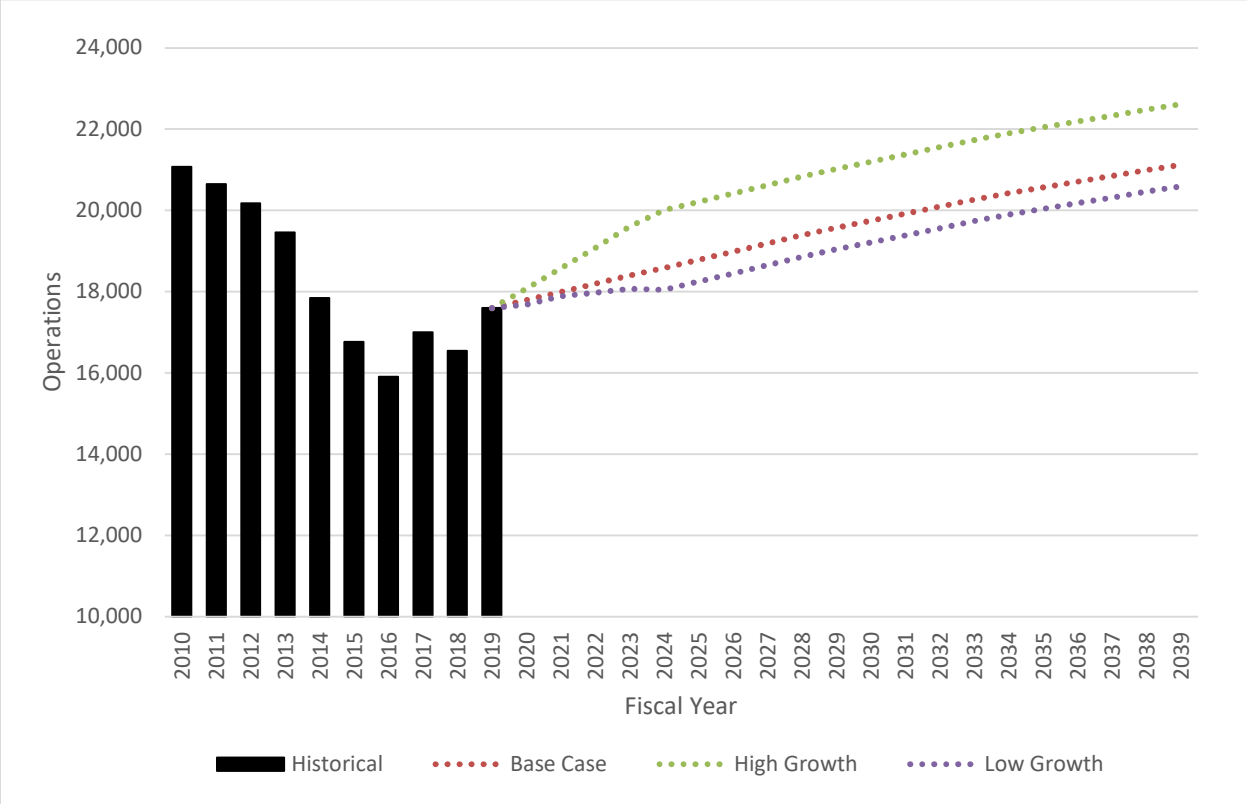
[14] 82.62% represents the average load factor for ROA from FY 2017-2019.

TABLE 23
FORECAST-PASSENGER OPERATIONS SCENARIOS (2020-2039)

Year	FAA TAF 2018	Base Case	High Growth Scenario	Low Growth Scenario
2010	21,074	21,074	21,074	21,074
2015	16,760	16,760	16,760	16,760
2019	17,595	17,595	17,595	17,595
2020	18,021	17,793	18,077	17,686
2024	16,648	18,585	20,004	18,049
2029	17,361	19,576	21,023	19,043
2039	19,000	21,121	22,616	20,593
AAGR				
2020-2024	-1.1%	1.1%	2.6%	0.5%
2025-2029	0.8%	1.0%	1.0%	1.1%
2030-2039	0.9%	0.8%	0.7%	0.8%
2020-2039	0.39%	0.92%	1.27%	0.79%

Source: RS&H, 2019; FAA TAF, 2018

FIGURE 34
FORECAST-PASSENGER OPERATIONS SCENARIOS (2020-2039)



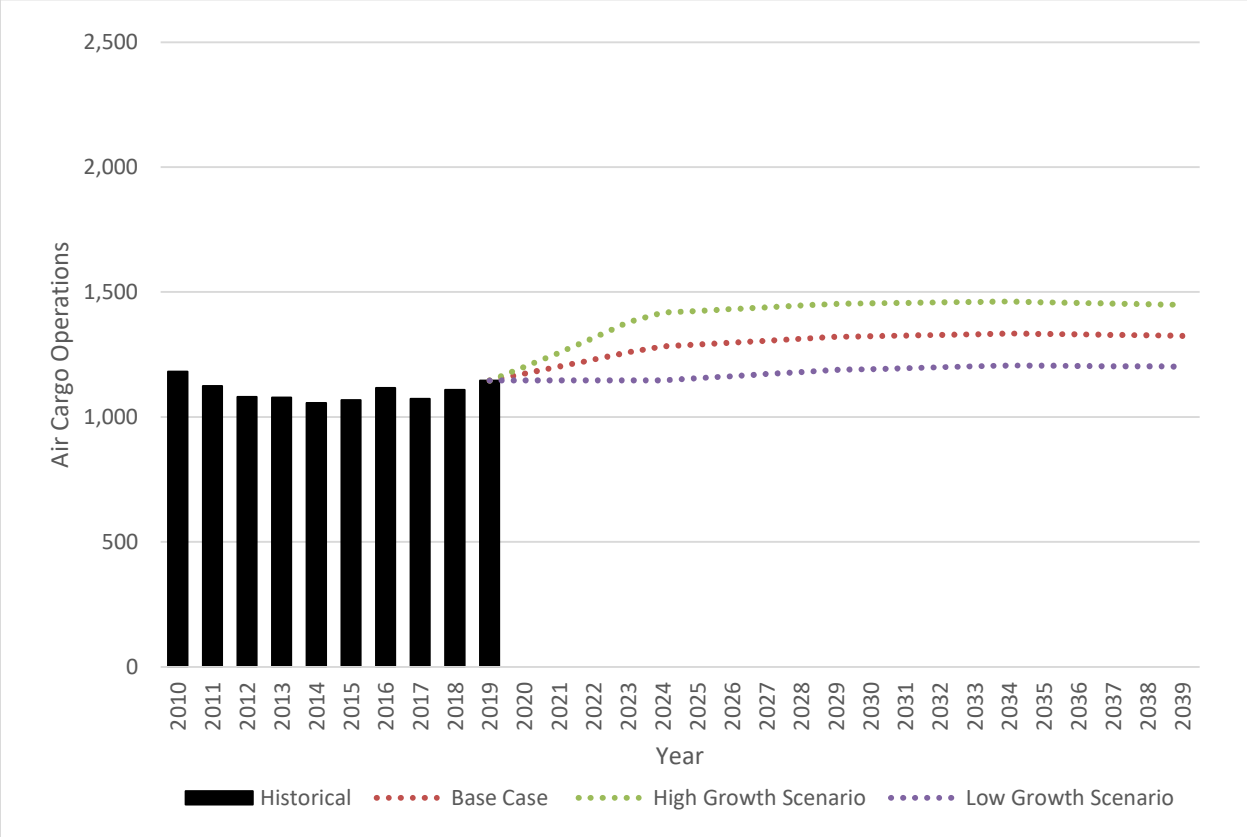
Source: RS&H, 2019; FAA TAF, 2018

TABLE 24
FORECAST-AIR CARGO OPERATIONS SCENARIOS (2020-2039)

Year	Base Case	High Growth Scenario	Low Growth Scenario
2010	1,181	1,181	1,181
2015	1,068	1,068	1,068
2019	1,146	1,146	1,146
2020	1,173	1,200	1,146
2024	1,283	1,418	1,147
2029	1,321	1,453	1,189
2039	1,325	1,449	1,202
AAGR			
2020-2024	2.3%	4.4%	0.0%
2025-2029	0.6%	0.5%	0.7%
2030-2039	0.0%	0.0%	0.1%
2020-2039	0.73%	1.20%	0.24%

Source: RS&H, 2019; FAA TFMSC, 2019

FIGURE 35
FORECAST-AIR CARGO OPERATIONS SCENARIOS (2020-2039)



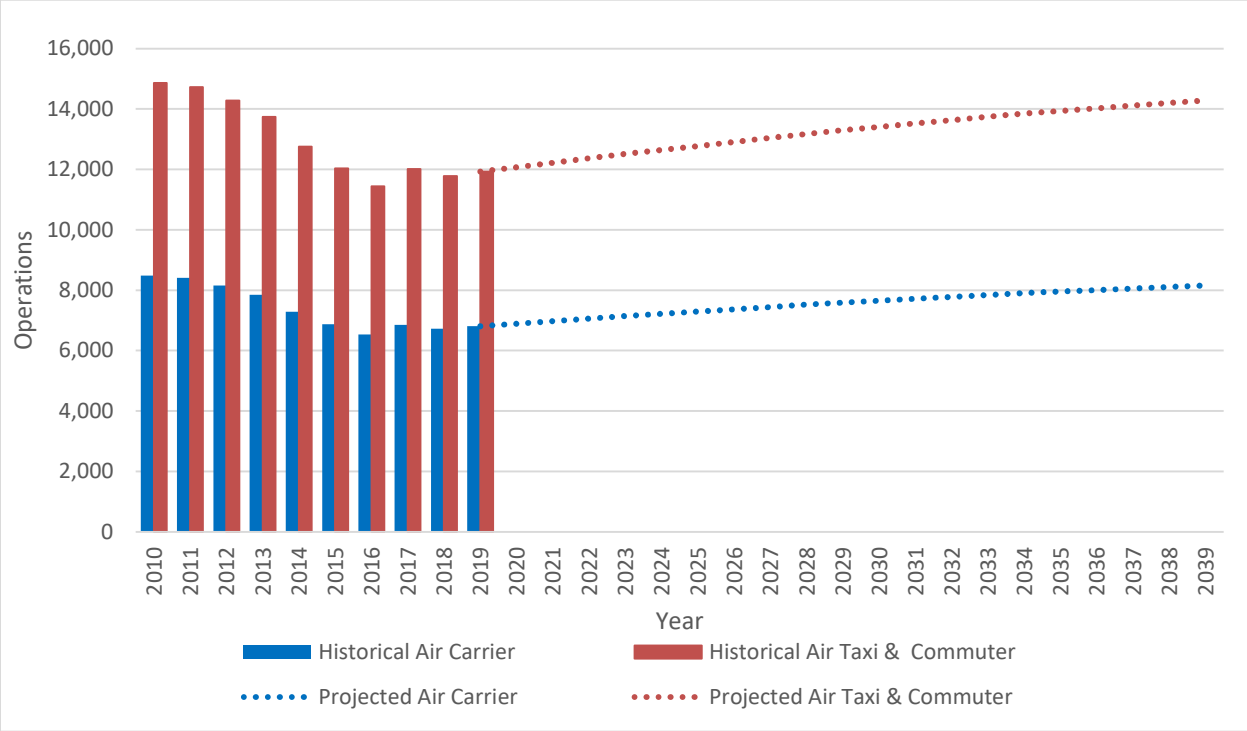
Source: RS&H, 2019; FAA TFMSC, 2019

3.7.1.3 Air Carrier and Air Taxi & Commuter Forecast

The projections of air carrier (36.3%) versus air taxi & commuter (63.7%) operations over the forecast horizon are consistent. This trend reinforces the Airport's primary passenger activity made up of regional jets and airlines.

Figure 36 shows the Base Case Forecast for air carrier and air taxi & commuter operations from 2020-2039.

FIGURE 36
FORECAST-BASE CASE AIR CARRIER/AIR TAXI & COMMUTER OPERATIONS (2020-2039)



Source: RS&H, 2019; FAA TAF, 2019

3.7.1.4 Total Commercial Operations Forecast

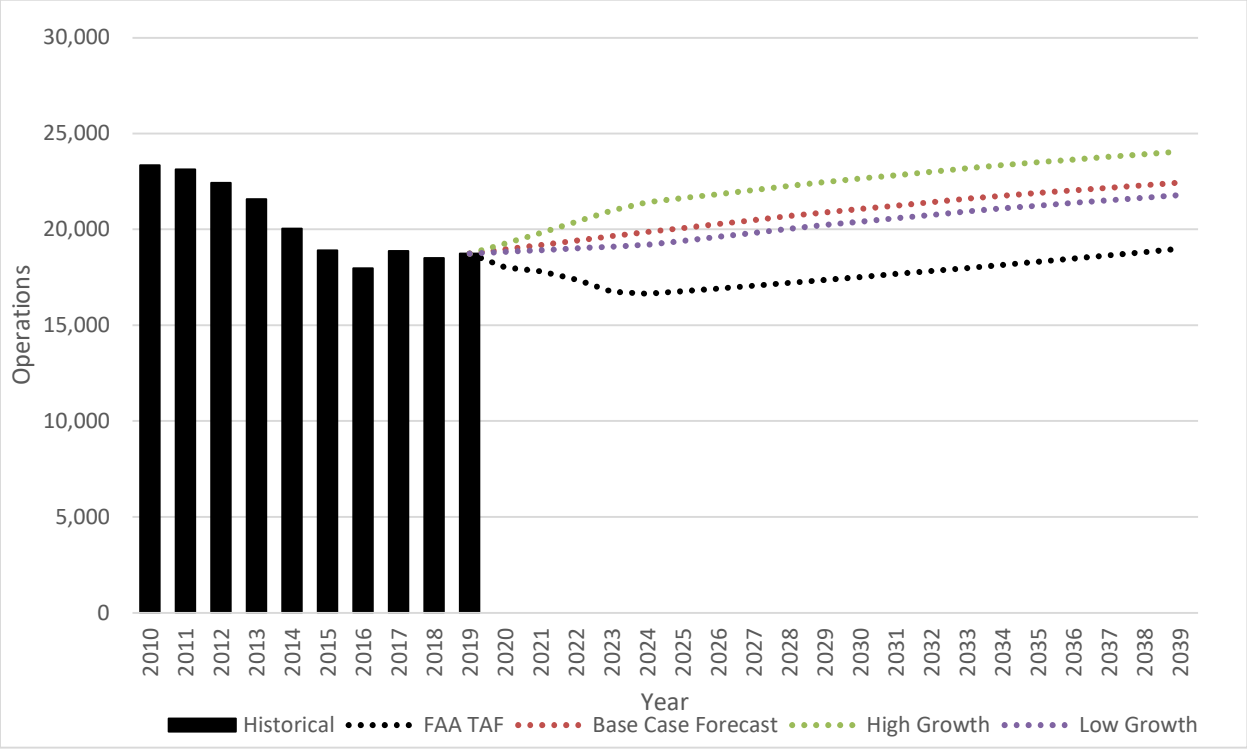
Table 25 and *Figure 37* show the total commercial operations forecast.

TABLE 25
FORECAST-COMMERCIAL OPERATIONS SCENARIOS (2020-2039)

Year	FAA TAF 2018	Base Case	High Growth Scenario	Low Growth Scenario
2010	23,343	23,343	23,343	23,343
2015	18,906	18,906	18,906	18,906
2019	18,741	18,741	18,741	18,741
2020	18,021	18,966	19,277	18,832
2024	16,648	19,868	21,422	19,196
2029	17,361	20,897	22,476	20,232
2039	19,000	22,446	24,064	21,795
AAGR				
2020-2024	-2.3%	1.2%	2.7%	0.5%
2025-2029	0.8%	1.0%	1.0%	1.1%
2030-2039	0.9%	0.7%	0.7%	0.7%
2020-2039	0.08%	0.91%	1.26%	0.76%

Source: RS&H, 2019; FAA TAF, 2018; FAA TFMSC, 2019

FIGURE 37
FORECAST-COMMERCIAL OPERATIONS SCENARIOS (2020-2039)



Source: RS&H, 2019; FAA TAF, 2018; FAA TFMSC, 2019

3.7.2 GA Operations Forecast

3.7.2.1 Based Aircraft

The FY 2019 based aircraft total was taken from the Airport's 2019 inventory[15]. The TAF projects a total of 147 based aircraft by 2039. Each of the forecast scenarios incorporated growth rates associated with the FAA TAF or FAA Aerospace Forecast[16]. The Base Case Forecast projected a 1.3% AAGR for Single Engine Piston (SEP) and Multi-Engine Piston (MEP) instead. It then adopted the FAA TAF's 2.3% AAGR for ROA, on all other aircraft from 2020-2039. The pistons increased by 1.0% less than the TAF's projection to account for the FAA Aerospace Forecast FY 2019-2039 which projected a -1.0% AAGR in pistons during that time. The High Growth Scenario Forecast has a 3.0% AAGR and the Low Growth Scenario Forecast has a 1.3% AAGR from 2020-2039.

Table 26 shows each of the forecast scenarios for based aircraft from 2020-2039.

TABLE 26
FORECAST-BASED AIRCRAFT SCENARIOS (2020-2039)

Base Case Forecast							
Year	**SEP[1]**	**MEP[2]**	**SETP[3]**	**METP[4]**	**Jet**	**Rotor[5]**	**Total**
2019	68	15	1	3	6	0	93
2024	73	16	1	3	7	0	100
2029	77	17	1	4	8	1	108
2034	83	18	1	4	8	1	115
2039	88	19	2	5	9	1	124
High Growth Case Forecast							
Year	**SEP[1]**	**MEP[2]**	**SETP[3]**	**METP[4]**	**Jet**	**Rotor[5]**	**Total**
2019	68	15	1	3	6	0	93
2024	77	17	1	3	7	1	106
2029	87	19	1	4	8	1	120
2034	98	22	2	5	9	1	137
2039	111	25	2	5	11	1	155
Low Growth Case Forecast							
Year	**SEP[1]**	**MEP[2]**	**SETP[3]**	**METP[4]**	**Jet**	**Rotor[5]**	**Total**
2019	68	15	1	3	6	0	93
2024	71	16	1	3	6	1	98
2029	75	17	1	3	7	1	104
2034	79	17	1	4	7	1	109
2039	83	18	1	4	8	1	115

Note: 1-SEP=Single Engine Piston Aircraft; 2-MEP=Multi-engine Piston Aircraft; 3-SETP=Single Engine Turboprop Aircraft; 4-METP=Multi-Engine Turboprop Aircraft; Jet=Turbojet Aircraft; 5-Rotor=Helicopter/Rotorcraft
Source: RS&H, 2019; Roanoke-Blacksburg Regional Airport Based Aircraft Inventory, 2019

[15] An ROA flight school reported that they had just purchased two additional piston aircraft. One of the other aircraft in the inventory was not included based on its n-number details.

[16] Projections made using the FAA Aerospace Forecast Fiscal Years 2019-2039, Table 28 Active General Aviation and Air Taxi Aircraft

3.7.2.2 Total GA Operations

The historical GA section discussed the use of the OPBA method for generating a forecast of GA operations. In this forecast, the OPBA for FY 2019 (357) was increased in each of the three scenarios at a 4.0%[17] AAGR to reach the 25-year historical average by 2039. Once each of the based aircraft forecast scenarios were applied, the total GA operation projections were developed.

The FAA TAF 2018 shows a 0.18% AAGR for total GA operations from 2020-2039, while the Base Case (1.84% AAGR), High Growth Scenario (2.99% AAGR), and Low Growth Scenario (1.46% AAGR) Forecasts each show higher growth rates.

Between 2005 and 2019, general aviation operations at ROA have had a highly variable split between itinerant and local operations. Historically, the itinerant/local operations split was averaging 48%/52% before 2007. Starting in 2008 and lasting until 2016, the split changed dramatically due to the large reduction in local GA operations at the Airport, altering the split to an average of 67%/33%. Local GA operations began increasing significantly again in 2017, causing the itinerant to local operations split to return to pre-2007 levels.

As a result, the FAA TAF projects the itinerant/local GA operations split to stabilize and remain constant at 46%/54% through 2039, as the Airport is projected to be more heavily used by GA aircraft over the next 20 years. The projected GA operations distribution split is applied to each of the forecasts to generate projected itinerant and local GA operations.

Figure 39 shows the projected itinerant and local GA operations from the Base Case Forecast.

3.7.3 Military Operations

The itinerant and local military aircraft that operate out of ROA represented only 2.2% of all 325,093 operations as identified within FAA TAF 2018. This forecast does not make any changes to the number of local or itinerant military operations. Instead, as is a customary practice, it holds the existing count of 7,348 operations for local and itinerant military operations constant from 2020-2039. *Table 28* shows the military forecast for 2020-2039 for the Base Case, High Growth, and Low Growth Scenarios.

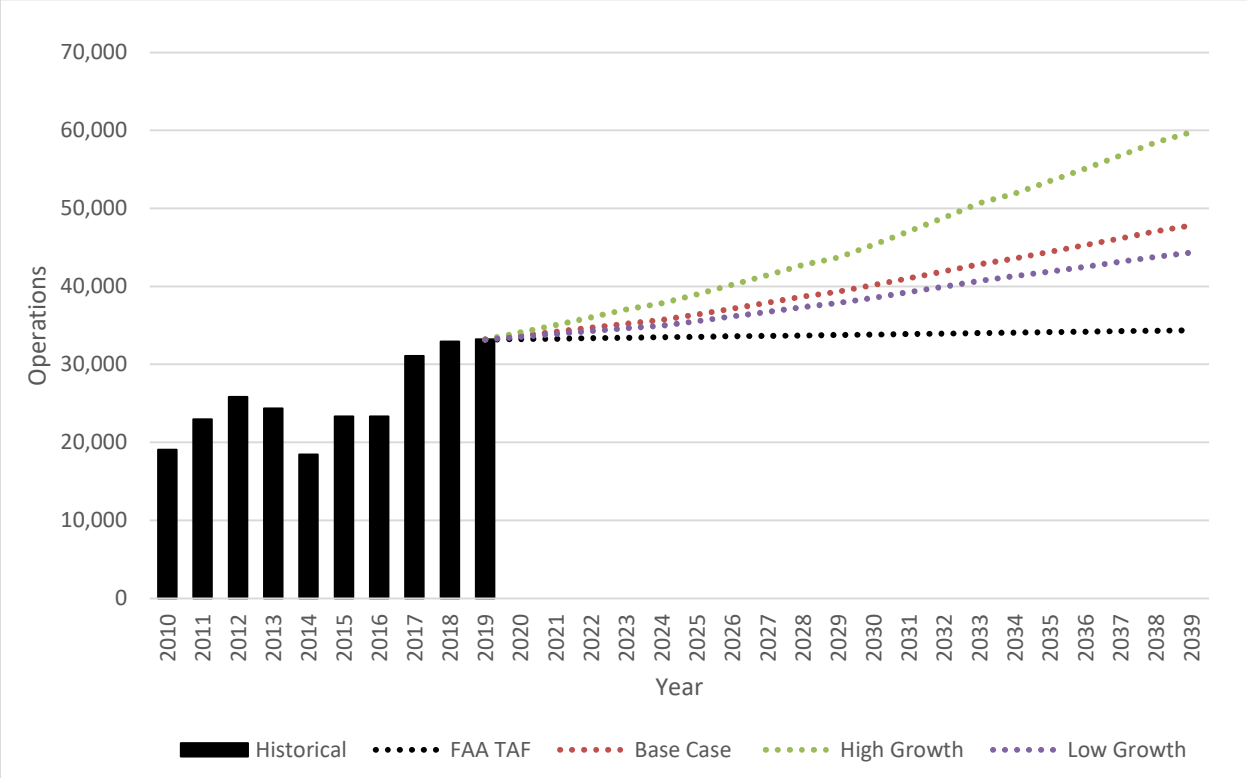
[17] From FY 1995-2019, the ROA OPBA had an average of 386.

TABLE 27
FORECAST-GA OPERATIONS SCENARIOS (2020-2039)

Year	FAA TAF 2018	Base Case	High Growth Scenario	Low Growth Scenario
2010	19,058	19,058	19,058	19,058
2015	23,339	23,339	23,339	23,339
2019	33,199	33,199	33,199	33,199
2020	33,258	33,699	34,128	33,556
2024	33,494	35,700	37,842	34,986
2029	33,789	39,337	43,708	37,880
2039	34,389	47,827	59,784	44,356
AAGR				
2020-2024	0.2%	1.5%	2.7%	1.1%
2025-2029	0.2%	2.0%	2.9%	1.6%
2030-2039	0.2%	2.0%	3.2%	1.6%
2020-2039	0.18%	1.84%	2.99%	1.46%

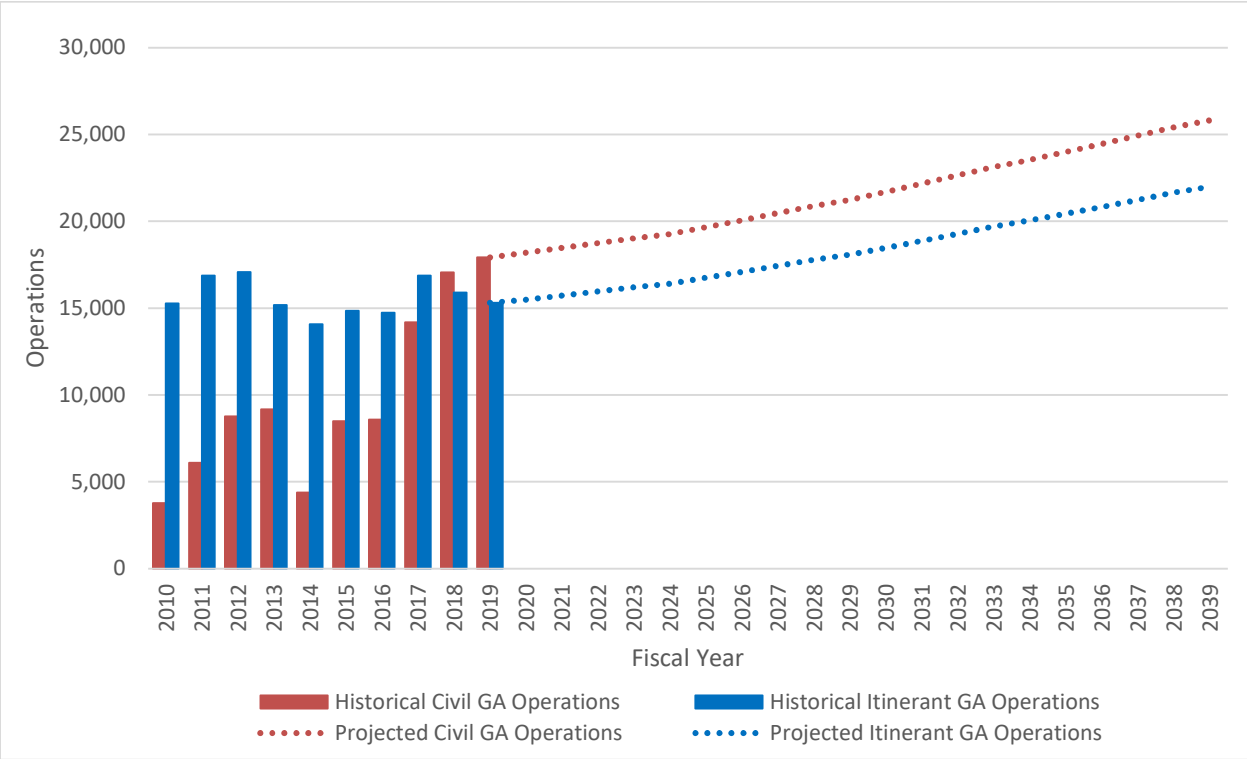
Source: RS&H, 2019; FAA, 2018

FIGURE 38
FORECAST-GA OPERATIONS SCENARIOS (2020-2039)



Source: RS&H, 2019; FAA, 2018

FIGURE 39
FORECAST-BASE CASE ITINERANT AND GA OPERATIONS (2020-2039)



Source: RS&H, 2019; FAA, 2018

TABLE 28
FORECAST-MILITARY OPERATIONS (2020-2039)

Year	FAA TAF 2018	Base Case	High Growth Scenario	Low Growth Scenario
2010	1,358	1,358	1,358	1,358
2015	1,378	1,378	1,378	1,378
2019	1,366	1,366	1,366	1,366
2020	1,366	1,366	1,366	1,366
2024	1,366	1,366	1,366	1,366
2029	1,366	1,366	1,366	1,366
2039	1,366	1,366	1,366	1,366
AAGR				
2020-2024	0.0%	0.0%	0.0%	0.0%
2025-2029	0.0%	0.0%	0.0%	0.0%
2030-2039	0.0%	0.0%	0.0%	0.0%
2020-2039	0.0%	0.0%	0.0%	0.0%

Source: RS&H, 2019; FAA TAF, 2018

3.7.4 TRACON Operations

3.7.4.1 IFR and VFR Operations

Data from FAA Operations Network (OPSNET) was gathered for the ROA Terminal Radar Approach Control (TRACON) in FY 2019. The results provided a distribution of the existing IFR and VFR itinerant operations for ROA. For baseline year 2019, the Airport had 45.2% visual flight rules (VFR) operations and 54.8% instrument flight rules (IFR) operations. Holding the 2019 distribution constant, the IFR and VFR operations projected for each of the forecast years are compared in *Table 29*.

TABLE 29
FORECAST-IFR AND VFR OPERATIONS SCENARIOS (2020-2039)

FY	Base Case Forecast		High Growth Scenario		Low Growth Scenario	
	IFR	VFR	IFR	VFR	IFR	VFR
2019	30,178	23,128	30,178	23,128	30,178	23,128
2024	32,168	24,766	34,381	26,249	31,298	24,250
2029	34,536	27,064	37,677	29,874	33,369	26,109
2039	39,325	32,314	45,583	39,631	37,351	30,165

Source: RS&H, 2019; FAA OPSNET, 2019 (ROA TRACON)

3.7.4.2 Annual Instrument Approaches

Annual instrument approaches represent the number of approaches that use IFR procedures annually. The number of annual instrument approaches can be identified as 50% of the IFR operations projected for the Airport in each forecast. *Table 30* shows the forecasts for annual instrument approaches for baseline year 2019 and the three forecast years.

TABLE 30
FORECAST-ANNUAL INSTRUMENT APPROACHES SCENARIOS (2020-2039)

FY	Base Case Forecast	High Growth Scenario	Low Growth Scenario
2019	15,089	15,089	15,089
2024	16,084	17,191	15,649
2029	17,268	18,838	16,685
2039	19,662	22,791	18,676

Source: RS&H, 2019; FAA OPSNET, 2019; (ROA TRACON)

3.7.5 Total Operations

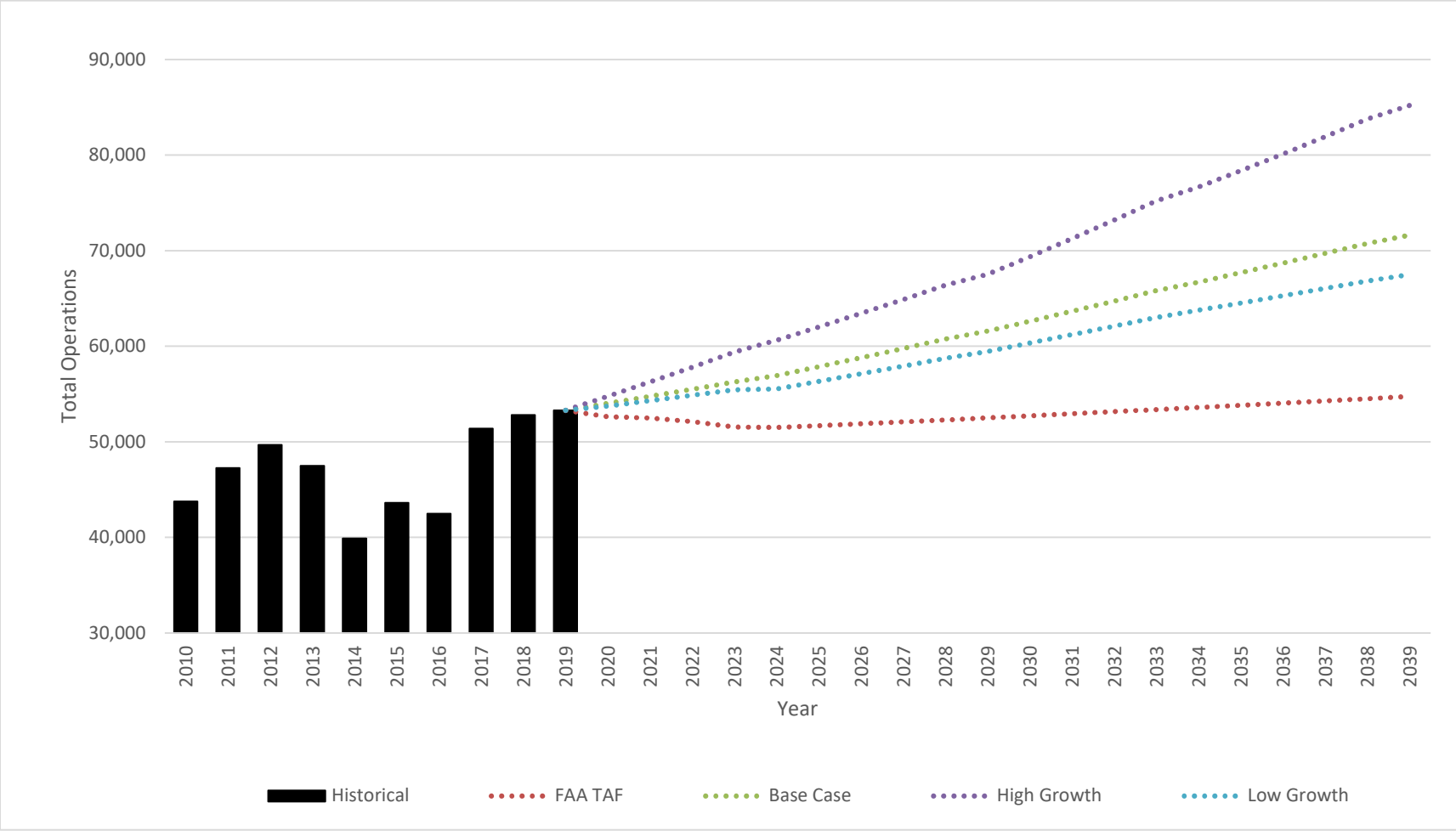
The forecast of total operations for the Airport are a summation of the passenger, air cargo, GA, and military operation forecasts presented in previous sections. *Table 31* and *Figure 40* show the projected totals from 2020-2039 for each scenario.

TABLE 31
FORECAST-TOTAL OPERATIONS SCENARIOS (2020-2039)

Year	FAA TAF 2018	Base Case	High Growth Scenario	Low Growth Scenario
2010	43,759	43,759	43,759	43,759
2011	47,257	47,257	47,257	47,257
2012	49,665	49,665	49,665	49,665
2013	47,483	47,483	47,483	47,483
2014	39,896	39,896	39,896	39,896
2015	43,623	43,623	43,623	43,623
2016	42,493	42,493	42,493	42,493
2017	51,395	51,395	51,395	51,395
2018	52,812	52,812	52,812	52,812
2019	53,306	53,306	53,306	53,306
2020	52,645	54,032	54,771	53,754
2021	52,503	54,768	56,277	54,315
2022	52,125	55,514	57,827	54,773
2023	51,543	56,272	59,420	55,235
2024	51,508	56,934	60,630	55,548
2025	51,698	57,867	62,014	56,334
2026	51,894	58,817	63,436	57,132
2027	52,102	59,785	64,899	57,942
2028	52,309	60,770	66,402	58,764
2029	52,516	61,600	67,550	59,478
2030	52,734	62,626	69,375	60,342
2031	52,952	63,672	71,263	61,220
2032	53,170	64,739	73,216	62,112
2033	53,387	65,826	75,239	63,019
2034	53,605	66,730	76,672	63,797
2035	53,826	67,712	78,381	64,541
2036	54,055	68,711	80,137	65,295
2037	54,287	69,728	81,943	66,058
2038	54,519	70,762	83,801	66,832
2039	54,755	71,639	85,214	67,516
AAGR				
2020-2024	-0.7%	1.3%	2.6%	0.8%
2025-2029	0.4%	1.6%	2.2%	1.4%
2030-2039	0.4%	1.5%	2.4%	1.3%

Source: RS&H, 2019; FAA TAF, 2018

FIGURE 40
TOTAL OPERATIONS FORECAST COMPARISON (2020-2039)



Source: RS&H, 2019; FAA TAF, 2018

3.8 DESIGN HOUR ACTIVITY

3.8.1 Passenger Activity

The Airport's peak month for passenger activity has most commonly been October over the past 15 fiscal years. During that time the month of October has averaged 9.3% of the annual enplanement total.

Table 32 shows the peak month forecast of total passengers using the Base Case, High Growth, and Low Growth Scenarios.

TABLE 32
FORECAST-PEAK MONTH TOTAL PASSENGERS (2019-2039)

Peak Month			
FY	**Base Case**	**High Growth**	**Low Growth**
2019	63,512	63,512	63,512
2024	68,714	74,087	66,389
2029	72,273	77,735	69,972
2039	77,630	83,226	75,377

Source: RS&H, 2019

3.8.1.1 Departing Passengers

3.8.1.1.1 Average Day Peak Month

Using October's historical average share of the Airport's annual enplanements, an average day of the peak month (ADPM) for October 2019, would be 1,046 departing (or enplaning) passengers. When comparing this to the October 2019 ROA airline schedule, the day that most closely aligns would be an average Thursday which had 1,008 daily enplaning passengers.

Table 33 shows the ADPM forecast for departing passengers using the Base Case, High Growth, and Low Growth Scenarios.

TABLE 33
FORECAST-ADPM DEPARTING PASSENGERS (2019-2039)

ADPM			
FY	**Base Case**	**High Growth**	**Low Growth**
2019	1,008	1,008	1,008
2024	1,068	1,151	1,031
2029	1,123	1,208	1,087
2039	1,206	1,293	1,171

Source: RS&H, 2019

3.8.1.1.2 Design Hour

The design hour (or peak hour of the ADPM) is the time with the greatest number of departing passengers at ROA on an average Thursday in October 2019. In order to accurately define this time, an analysis generated a rolling total of departing passengers at the Airport over 15-minute intervals.[18] For Baseline Year 2019, the design hour was 17:15 (5:15 pm) with 158 departing passengers. The design hour was projected for each of the forecast scenarios by keeping the distribution of passengers over the baseline year constant as well as specific inputs from the Airport's current commercial passenger activity. These inputs include:

- 2019 Enplaning Load Factors for ROA Airlines
- Equipment Operated by ROA Airlines in October 2019
- Seat Configurations of Equipment

Table 34 shows the design hour forecast for departing passengers using the Base Case, High Growth, and Low Growth Scenarios. *Figure 41* shows an ADPM distribution of departing passengers in 2019.

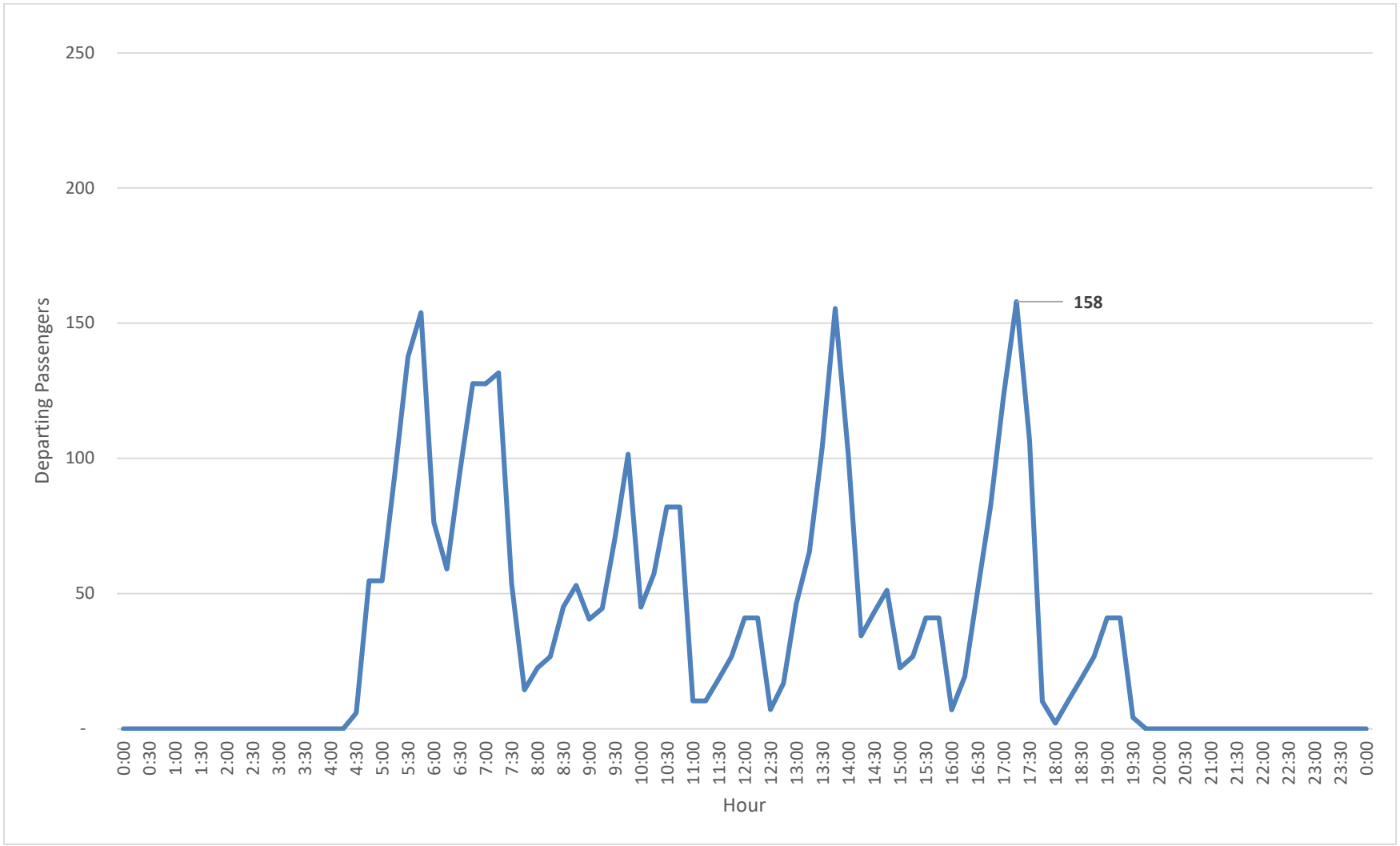
TABLE 34
FORECAST-DESIGN HOUR DEPARTING PASSENGERS (2019-2039)

Design Hour			
FY	**Base Case**	**High Growth**	**Low Growth**
2019	158	158	158
2024	174	187	168
2029	183	197	177
2039	196	210	191

Source: RS&H, 2019

[18] General industry-wide assumptions were used for passengers arriving at the Airport prior to their departing flights.

FIGURE 41
AVERAGE DAY PEAK MONTH DEPARTING PASSENGERS (2019)



Source: RS&H, 2019

3.8.1.2 Arriving Passengers

3.8.1.2.1 Average Day Peak Month

Assuming that the Airport maintains the same number of arriving (or deplaning) passengers as enplaning passengers, the ADPM for arriving passengers would also anticipate a total of approximately 1,046. When comparing this to the October 2019 ROA airline schedule, the day that most closely aligns would be an average Thursday which had 1,049 daily deplaning passengers.

Table 35 shows the ADPM forecast for arriving passengers using the Base Case, High Growth, and Low Growth Scenarios.

TABLE 35
FORECAST-ADPM ARRIVING PASSENGERS (2019-2039)

ADPM			
FY	**Base Case**	**High Growth**	**Low Growth**
2019	1,049	1,049	1,049
2024	1,111	1,198	1,074
2029	1,169	1,257	1,132
2039	1,256	1,346	1,219

Source: RS&H, 2019

3.8.1.2.2 Design Hour

The design hour of arriving passengers at ROA was defined on an average Thursday in October 2019. Like the departure design hour analysis, it was generated using a rolling total of arriving passengers at the Airport over 15-minute intervals.[19] For Baseline Year 2019, the design hour was 20:15 (8:15 pm) with 157 arriving passengers. The design hour was projected for each forecast scenario by keeping the distribution of passengers over the baseline year constant as well as inputs used in the departing passenger analysis.

Table 36 shows the design hour forecast for departing passengers using the Base Case, High Growth, and Low Growth Scenarios. *Figure 42* shows an ADPM distribution of arriving passengers in 2019.

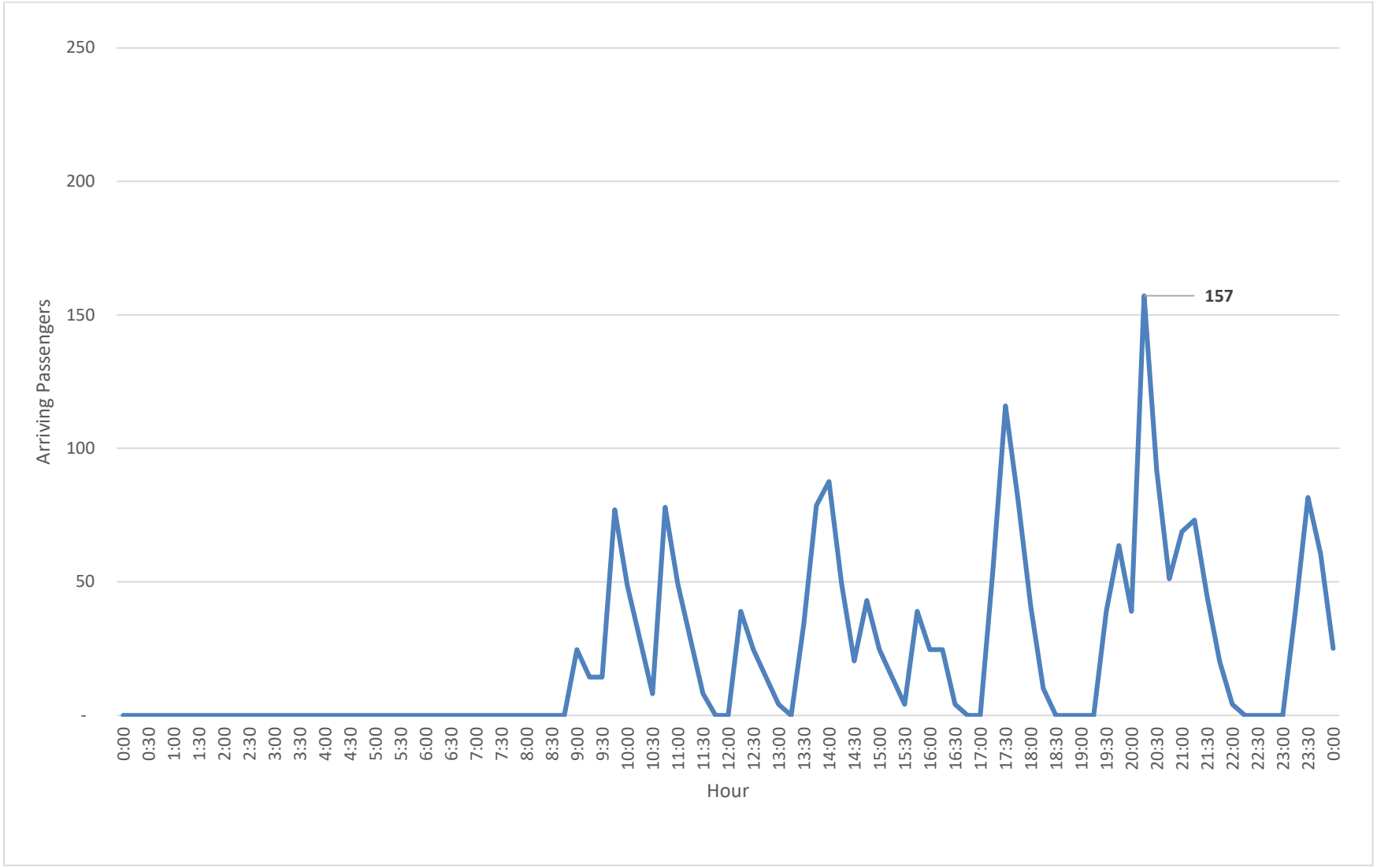
TABLE 36
FORECAST-DESIGN HOUR ARRIVING PASSENGERS (2019-2039)

Design Hour			
FY	**Base Case**	**High Growth**	**Low Growth**
2019	158	158	158
2024	166	179	160
2029	175	188	169
2039	188	201	182

Source: RS&H, 2019

[19] General industry-wide assumptions were used for passengers arriving at the Airport after their flights landed.

FIGURE 42
AVERAGE DAY PEAK MONTH ARRIVING PASSENGERS (2019)



Source: RS&H, 2019

3.8.1.3 Total Passengers

3.8.1.3.1 Average Day Peak Month

The sum of ADPM totals for departing and arriving passengers is shown in *Table 37*. The forecasts for each scenario reflect an average Thursday in October.

TABLE 37
FORECAST-ADPM TOTAL PASSENGERS (2019-2039)

ADPM			
FY	Base Case	High Growth	Low Growth
2019	2,057	2,057	2,057
2024	2,179	2,349	2,105
2029	2,292	2,465	2,219
2039	2,462	2,639	2,390

Source: RS&H, 2019

3.8.1.3.2 Peak Hour

The design hour for total passengers reflects the rolling totals of departing and arriving passengers for the ADPM in October 2019. The results identify a design hour of 234 total passengers at 13:45 (1:45 pm). As a result, neither the departing nor arriving passengers influence the design hour for all passengers.

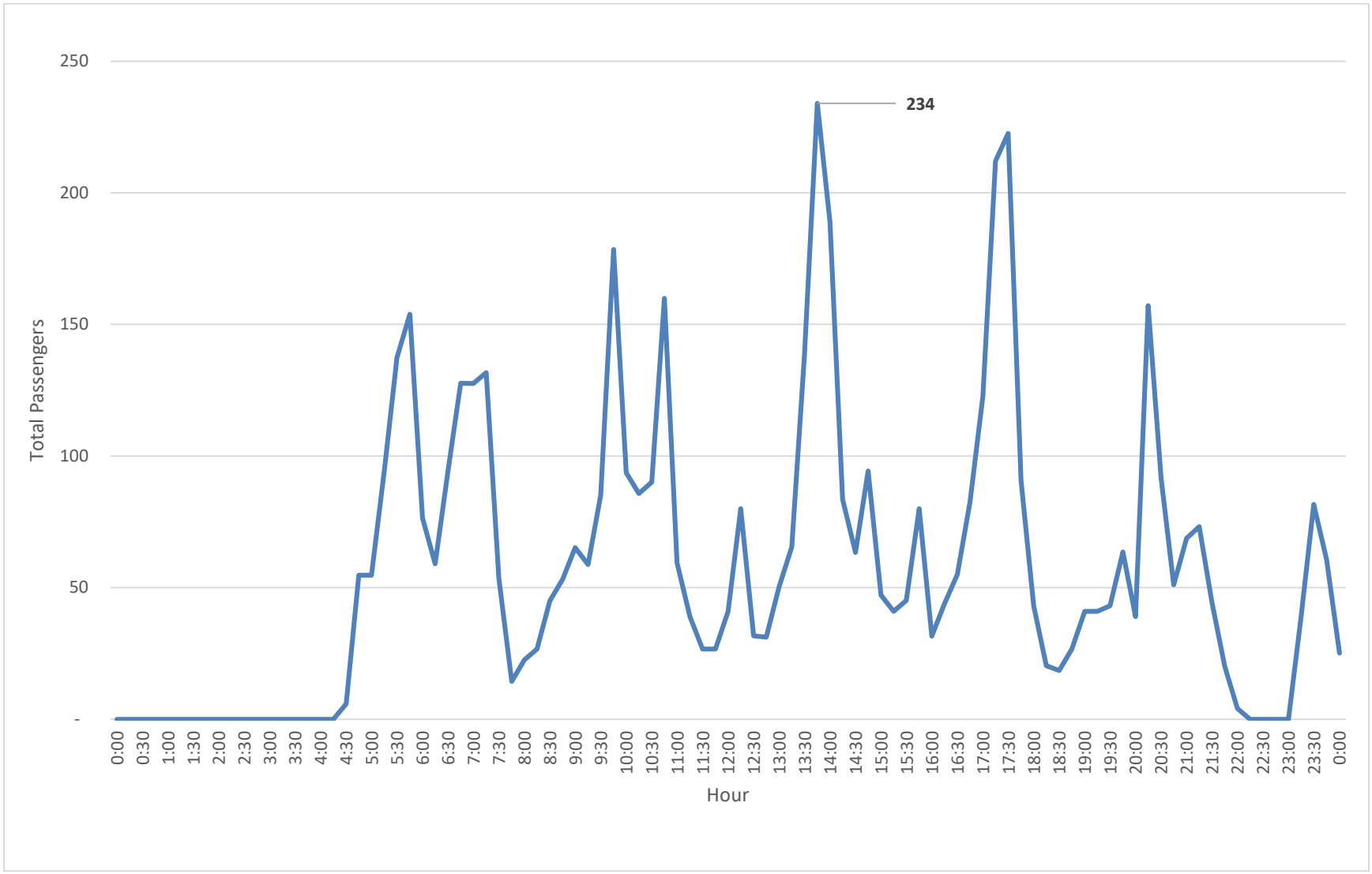
Table 38 shows the design hour forecast for departing passengers using the Base Case, High Growth, and Low Growth Scenarios. *Figure 43* shows an ADPM distribution of total passengers in 2019.

TABLE 38
FORECAST-DESIGN HOUR TOTAL PASSENGERS (2019-2039)

Design Hour			
FY	Base Case	High Growth	Low Growth
2019	316	316	316
2024	347	375	336
2029	365	393	354
2039	393	421	381

Source: RS&H, 2019

FIGURE 43
AVERAGE DAY PEAK MONTH TOTAL PASSENGERS (2019)



Source: RS&H, 2019

3.8.2 Aircraft Operations

3.8.2.1 Average Day Peak Month

Total annual operations by aircraft were analyzed by day and month for CY 2018[20]. The result of the analysis showed that the peak month, which was May, represented 10.1% of the Airport's annual total. A comparison of the daily May 2018 operations found that May 21, which had 171 operations should be considered an ADPM. *Table 39* shows the forecast of total operations for the ADPM by scenario from 2019-2039.

TABLE 39
FORECAST-ADPM OPERATIONS (2019-2039)

ADPM			
FY	Base Case	High Growth	Low Growth
2019	171	171	171
2024	185	197	181
2029	201	220	194
2039	233	278	220

Notes: 1-Operations are rounded
Source: RS&H, 2019; FAA CountOps, 2019

The operations distribution of the course of an ADPM in May were analyzed by hour and the design hour was from 14:00-14:59 (2:00-2:59 pm) with 24 operations. *Figure 44* shows the 2019 design hour of operations on the ADPM.

3.8.2.2 Design Hour

Assuming the distribution trends of monthly and daily operational activity would hold constant over the forecast horizon, the design hour would increase relative to its share of the ADPM total operations for May 21. *Table 40* shows the design hour operations for each scenario from 2019-2039.

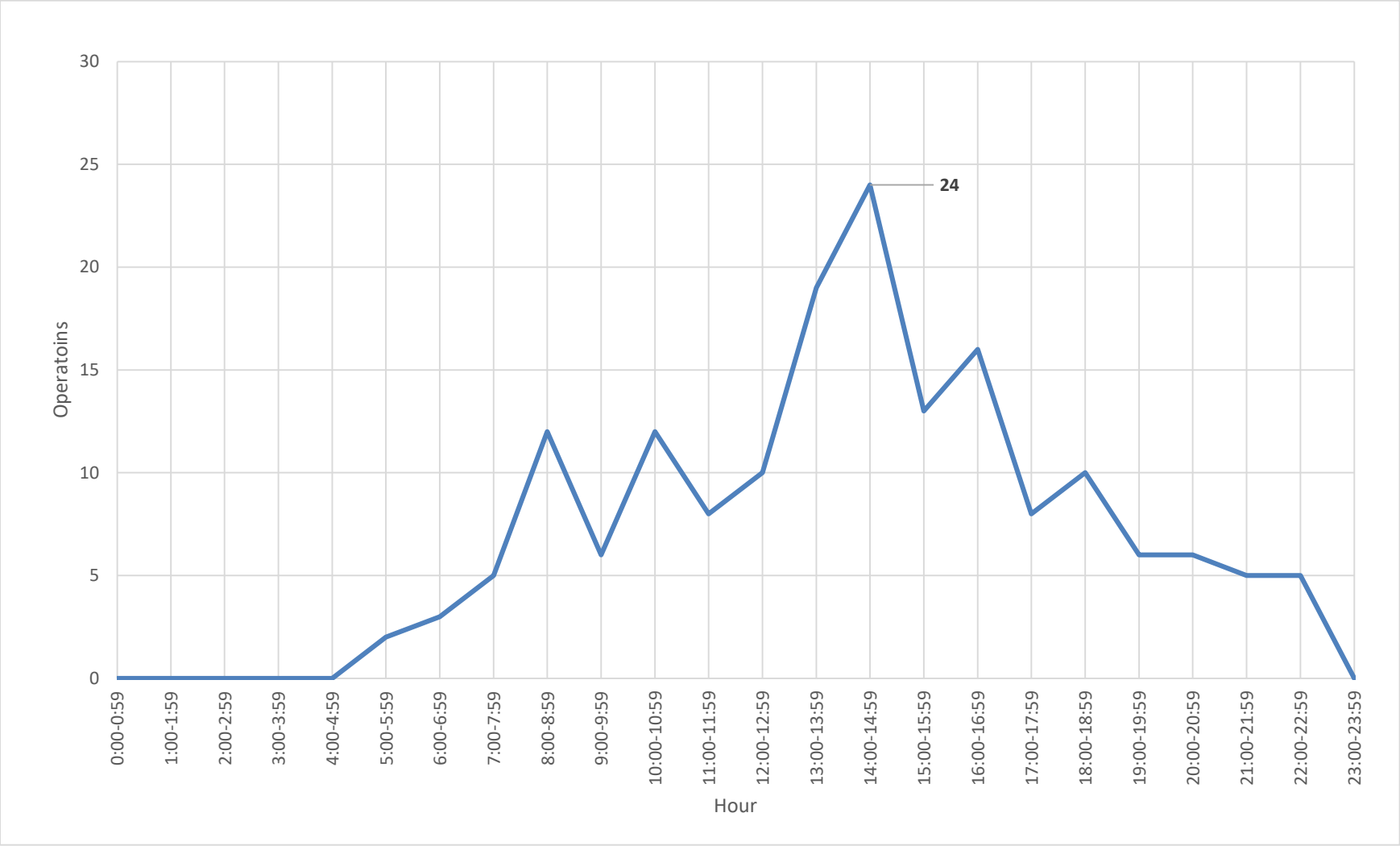
TABLE 40
FORECAST-DESIGN HOUR TOTAL OPERATIONS (2019-2039)

Design Hour			
FY	Base Case	High Growth	Low Growth
2019	24	24	24
2024	26	28	25
2029	28	31	27
2039	33	39	31

Notes: 1-Operations are rounded
Source: RS&H, 2019; FAA CountOps, 2019

[20] The CY 2018 total was extrapolated to meet the FAA TAF 2018 operations total.

FIGURE 44
AVERAGE DAY PEAK MONTH TOTAL OPERATIONS (2019)



Source: RS&H, 2019

3.9 CRITICAL AIRCRAFT

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. Ultimately, the critical aircraft provides details for airport design which include: Aircraft Approach Category (AAC)[21] and Airplane Design Group (ADG)[22], and Taxiway Design Group (TDG). For airports with multiple runways, critical aircraft are identified for each runway. In regard to ROA, both runways share the same design aircraft.

The 2008 Master Plan and current Airport Layout Plan defines the current critical aircraft as a Boeing 757-200 which is used for cargo operations by UPS and has a Runway Design Code of C-IV-4. The largest and most demanding aircraft for commercial service operations at the Airport is the Airbus 319 (C-III-3) operated by Delta Air Lines and Allegiant Airlines.

For future conditions, each service component of the Airport in regard to aircraft (commercial service, cargo, and general aviation) were reviewed separately to determine the future critical aircraft.

Commercial Service Aircraft

In the future conditions for commercial service at ROA, two considerations were analyzed in relation to determining critical aircraft: upgauging of the existing fleet and new service markets.

Of the current aircraft and airlines serving ROA, several aircraft types are anticipated to be upgauged over the planning period. The regional affiliates of Delta, United, and American are currently using a range of regional jet aircraft such as the Bombardier CRJ series 200/700/900, and the Embraer 135/145. It is anticipated the regional affiliates will continue to use aircraft of this size throughout the planning horizon and therefore not by themselves cause a change to the critical aircraft serving the commercial service sector at the Airport.

The mainline airlines (Delta, and Allegiant) currently operating at ROA consistently use the Airbus 319/320 aircraft for their operations. Over the planning period, operations by these aircraft are anticipated to increase in frequency, but an increase to larger aircraft is not anticipated. While it is possible that ROA may see the Airbus 321 by either Delta or Allegiant, it is expected that this would be an infrequent use not anticipated to reach the 500-operation annual threshold for determining critical aircraft.

An analysis was completed to see what types of aircraft were used for various markets by other airports in the vicinity or ROA. Several destinations were discussed and identified in the 2018 Airport Leakage Study and confirmed in the Expert Panel Session Meeting in October. The potential destinations or new non-stop markets were analyzed to see what other airports in the same vicinity as ROA would use given the similar distances that would need to be traveled. The results of the analysis are shown in *Table 41*.

[21] AAC is based on the approach speed of an aircraft.

[22] ADG is a classification of aircraft based on wingspan and tail height. When the aircraft wingspan and tail height fall in different groups, the higher group is used.

Based on the upgauging review and the new market analysis, for the commercial service sector at ROA, the largest regular-use aircraft under future conditions is anticipated to be the Airbus 320 (C-III-3).

TABLE 41
POTENTIAL FUTURE NON-STOP MARKETS FOR ROA

Market	Item:	ROA	CHO	GSO	RIC	RDU	CLT
Boston (BOS)	***Distance[1]:***	512 NM	425 NM	559 NM	411 NM	531 NM	632 NM
	Equipment (Airline):	-	-	-	E190 (B6); E170 (DL)	A319(NK); A320 (F9); A320 (DL); E190 (B6)	E190(B6); A319,A320, A321 (AA)
Dallas/Ft. Worth (DFW)	***Distance:***	877 NM	959 NM	866 NM	1,003 NM	920 NM	811 NM
	Equipment (Airline):	-	-	A319, CRJ9 (AA)	B737 (AA)	B737(WN) (to DAL)	A321 (AA)
Denver (DEN)	***Distance:***	1,164 NM	1,227 NM	1,187 NM	1,284 NM	1,245 NM	1,159 NM
	Equipment (Airline):	-	-	-	A319, E175 (UA)	A320(F9); A320, B737 (UA); B737 (WN)	E175 (UA); A321 (AA)
Detroit (DTW)	***Distance:***	332 NM	332 NM	400 NM	396 NM	435 NM	435 NM
	Equipment (Airline):	-	-	CRJ9 (DL)	CRJ9 (DL)	A320, B717 (DL)	B717 (DL); A319, A320, B737, CRJ9(AA)
Houston (IAH)	***Distance:***	883 NM	969 NM	856 NM	1,004 NM	904 NM	791 NM
	Equipment (Airline):	-	-	-	E175 (UA)	A319, E170, E175 (UA)	A319, A320, B737(AA); E175 (UA)

Notes: 1-Distance is presented in nautical miles; 2-Airline Codes include: AA-American Airlines, B6-Jet Blue, DL-Delta Air Lines, NK-Spirit Airline, UA-United Airlines, WN-Southwest Airlines
Source: RS&H, 2019

Cargo Aircraft

Currently, FedEx and UPS fly the Boeing 757-200 (C-IV-4) and Airbus 300-600F (C-IV-5), respectively. Based on discussions with both company's local representatives and published fleet transition information, it is anticipated that both cargo carriers will transition to the Boeing 767-300F (C-IV-5) by the end of the planning period.

General Aviation Aircraft

Based on discussions with the FBO, the Forecast Expert Panel, and the Master Plan Advisory Committee, operations within the general aviation areas of the Airport should anticipate the increasing use of larger corporate aircraft such as the Gulfstream 500 (C-III). This aircraft had 99 operations in FY 2019, and it is anticipated to increase to at least 500 by 2029.

Future Critical Aircraft

While each future aircraft identified for each sector above will be used to appropriately evaluate and analyze the airfield needs of the terminal, cargo, and general aviation ramp areas, the future critical aircraft for ROA is identified as the Boeing 767-300F and will require airfield design standards to accommodate the following:

- Aircraft Approach Category C
- Airplane Design Group IV
- Taxiway Design Group 5

3.10 SUMMARY

This section compares the FAA TAF 2018 published January 2018 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 of enplanements was generated through an extensive analysis of regional socioeconomic statistics, trends, and sources as well as in-depth interviews with key stakeholders within the Roanoke-Blacksburg regional area. Based on these inputs, a best-fit model was produced using a multiple variable regression analysis. In addition to the Base Case Forecast, alternative High and Low Growth Scenario Forecasts were developed to provide varying enplanement levels due to unanticipated local or national events.

Operation forecasts and derivatives were created using planning design day models for an ADPM passenger schedule from July 2018. The projected passenger and air cargo operation projections align with the enplanement projections of the forecast scenarios. Existing and anticipated load factors, equipment, and markets were all considered, as well as industry-wide trends. Like the enplanement forecasts, alternative based aircraft and operations forecasts were identified and detailed in these forecasts. The existing military operations from TAF 2018 are projected to remain constant over the 20-year planning horizon.

Table 42 and *Table 43* present the comparison between the Master Plan Base Case forecast and the FAA TAF in the internal FAA review template formats.

After the submission of the forecasts to the FAA, the COVID-19 pandemic virtually shut down aviation in the United States and most of the world. The forecasts developed in this report do not assess the

ultimate impact of this event, which is still unfolding. A reevaluation of the forecast data may be conducted in the future depending on the timeline of implementation of upcoming airport improvements.

TABLE 42
BASE CASE FORECAST COMPARISON WITH FAA TAF 2018

	Year	Airport Forecast	TAF	AF/TAF (% Difference)
Passenger Enplanements				
Base yr.	2019	348,721	327,492	6.5%
Base yr. + 5yrs.	2024	369,337	344,189	7.3%
Base yr. + 10yrs.	2029	388,466	357,451	8.7%
Base yr. + 15yrs.	2034	404,561	372,411	8.6%
Commercial Operations				
Base yr.	2019	18,741	18,741	0.0%
Base yr. + 5yrs.	2024	19,868	16,648	19.3%
Base yr. + 10yrs.	2029	20,897	17,361	20.4%
Base yr. + 15yrs.	2034	21,763	18,150	19.9%
Total Operations				
Base yr.	2019	53,306	53,306	0.0%
Base yr. + 5yrs.	2024	56,934	51,508	10.5%
Base yr. + 10yrs.	2029	61,600	52,516	17.3%
Base yr. + 15yrs.	2034	66,730	53,605	24.5%

Note: TAF data and Airport Forecast data is on a U.S. government fiscal year basis (October through September).
Source: RS&H, 2019; FAA TAF, 2018

TABLE 43
FORECAST LEVELS AND GROWTH RATES

A. Forecast Levels and Growth Rates									
	Specify base year:	2019							
						Average Annual Compound Growth Rates			
	Base Yr. Level	**Base Yr.+1yr.**	**Base Yr.+5yrs.**	**Base Yr.+10yrs.**	**Base Yr.+15yrs.**	**Base Yr. to +1**	**Base Yr. to +5**	**Base Yr. to +10**	**Base Yr. to +15**
Passenger Enplanements									
Air Carrier/Commuter	348,721	352,666	369,337	388,466	404,561	1.1%	1.2%	1.1%	1.0%
Operations									
Itinerant									
Air carrier/Commuter/Air Taxi	18,741	18,966	19,868	20,897	21,763	1.2%	1.2%	1.1%	1.0%
General aviation	15,272	15,502	16,422	18,095	20,057	1.5%	1.5%	1.7%	1.8%
Military	943	943	943	943	943	0.0%	0.0%	0.0%	0.0%
Local									
General aviation	17,927	18,198	19,278	21,242	23,545	1.5%	1.5%	1.7%	1.8%
Military	423	423	423	423	423	0.0%	0.0%	0.0%	0.0%
TOTAL OPERATIONS	53,306	54,032	56,934	61,600	66,731	1.4%	1.3%	1.5%	1.5%
Instrument Operations	30,178	30,576	32,168	34,536	36,931	1.3%	1.3%	1.4%	1.4%
Peak Hour Operations	24	24	26	28	31	0.0%	1.6%	1.6%	1.7%
Cargo/mail (enplaned + deplaned tons)	12,810	14,057	15,446	17,134	18,651	9.7%	3.8%	3.0%	2.5%
Based Aircraft									
Single Engine (Nonjet)	68	69	73	77	83	1.5%	1.4%	1.3%	1.3%
Multi Engine (Nonjet)	15	15	16	17	18	0.0%	1.3%	1.3%	1.2%
Jet Engine	10	10	11	13	13	0.0%	1.9%	2.7%	1.8%
Helicopter	0	0	0	1	1	NA	NA	NA	NA
Other	0	0	0	0	0	NA	NA	NA	NA
TOTAL	93	94	100	108	115	1.1%	1.5%	1.5%	1.4%

B. Operational Factors					
	Base Yr. Level	**Base Yr.+1yr.**	**Base Yr.+5yrs.**	**Base Yr.+10yrs.**	**Base Yr.+15yrs.**
Average aircraft size (seats)	45	45	45	45	45
Average enplaning load factor	82.00%	82.62%	82.62%	82.62%	82.62%
GA operations per based aircraft	357.0	358.5	357.0	364.2	379.1

Notes: Values may not add due to rounding.