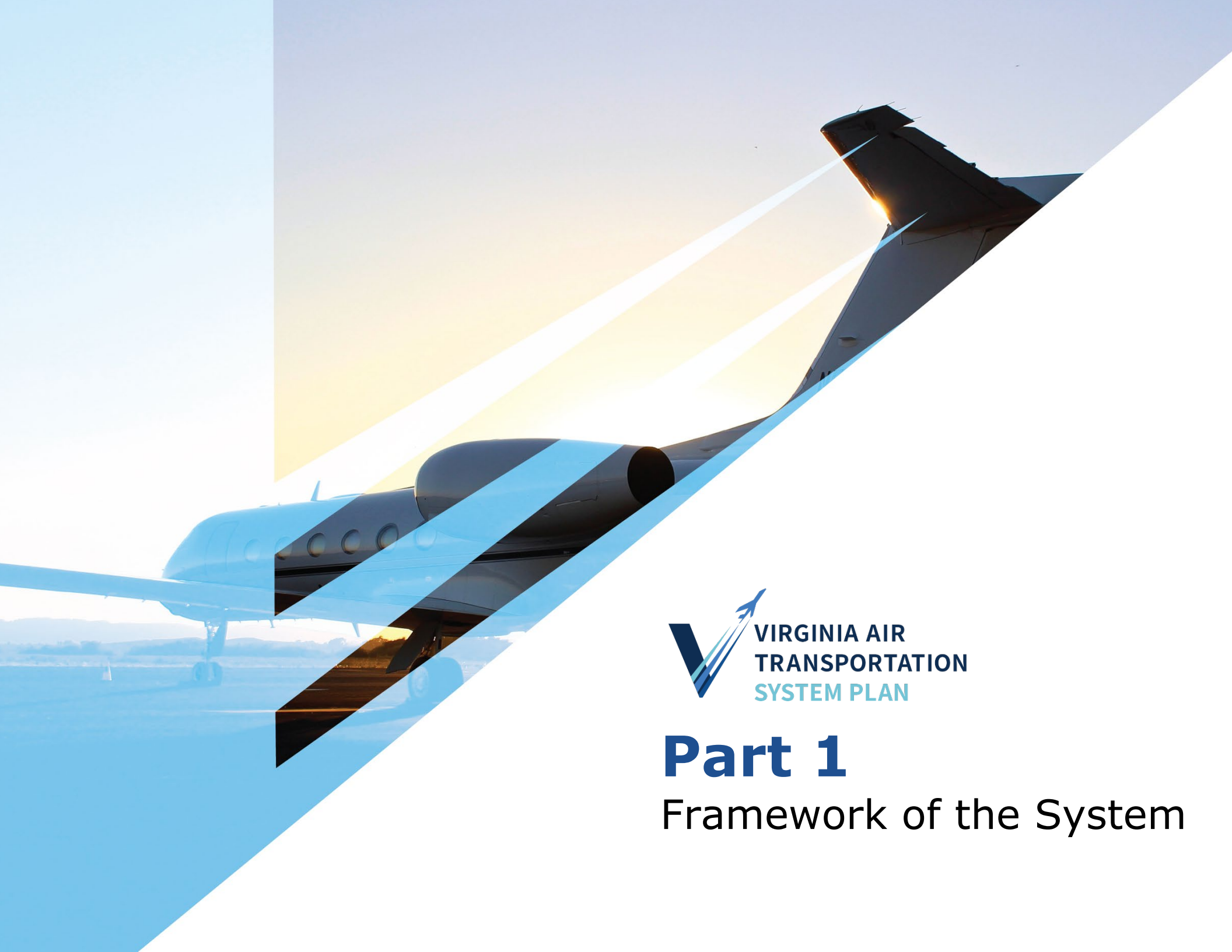

VIRGINIA AIR TRANSPORTATION SYSTEM PLAN

Part 1

Framework of the System

The preparation of this document was financed in part through a planning grant from the Federal Aviation Administration (FAA) as provided under Section 505 of the Airport and Airway Improvement Act as amended. The contents of this document do not necessarily reflect the official views of the FAA. Acceptance of this report by the FAA does not in any way constitute a commitment on the part of the United States to participate in any development depicted therein, nor does it indicate that the proposed development is environmentally acceptable in accordance with applicable public laws.

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Technical Report Summary

Virginia is served by a robust system of sixty-six (66) public-use airports, relied on by businesses, residents, and visitors every day. This Virginia Air Transportation System Plan (VATSP) is an update of the previous system plan, published in 2016. The purpose of the VATSP is to develop a modern system plan that will serve as a blueprint for airport development in the Commonwealth for the next 20 years. This update considers existing system data and evaluates changes since the publication of the 2016 VATSP.

This system plan explores the role and value of Virginia's airports in providing access for all users to the larger air transportation network. Additionally, this plan serves as a resource for federal, state, and local stakeholders to maintain and develop the system for continued use.

In order to effectively present the findings of this update, the technical report is divided into three parts (shown below), with the first part outlining the framework of the system, the second providing the analysis, and the third summarizing the recommendations and findings.

Part 1 – Framework of the System

- Chapter 1: Introduction – Virginia Aviation System
- Chapter 2: Purpose of the VATSP
- Chapter 3: Airport Roles
- Chapter 4: Issues Affecting Virginia Airports

Part 2 – System Analysis

- Chapter 5: Activity Forecasts
- Chapter 6: Inventory
- Chapter 7: Alternatives Analysis

Part 3 – Recommendations and Findings

- Chapter 8: Recommended Aviation System
- Chapter 9: Costs and Funding
- Chapter 10: Implementation Plan

Source: DOAV.

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Chapter 1: Introduction – Virginia Aviation System

A state aviation system plan has many objectives that can vary depending upon the interests and desires of the state entity who is conducting the study. The ultimate intent is to examine the system of public-use airports. For the Commonwealth of Virginia, the objective of this document is to provide an update of the previous Virginia Air Transportation System Plan (VATSP), which was completed in 2016. This Plan applies current system data and reviews and evaluates the system for changes since the previous VATSP's publication. A thorough evaluation of system developments and the implementation of the recommendations from the previous plan are included in this effort.

This chapter provides background information on system planning as well as components that guided and led to the development of this VATSP. These are summarized in the following sections:

- Overview of System Planning
- Virginia Aviation System History
- VATSP Public Engagement
- Comparative Analysis

Overview of System Planning

A state aviation system plan is a high-level assessment of the airports that comprise a state aviation system. This assessment is typically tailored to the needs of the study sponsor, but usually includes an evaluation of the performance of the aviation system, future system needs, and the needs of the system airports to properly serve their aviation users. Performance evaluations often consist of measuring the levels of service that the aviation system provides residents and businesses of the state. Individual airports are usually assessed for the adequacy of their facilities, such as runway width and length, passenger terminal, or supporting infrastructure.

Source: DOAV.

The purpose of system planning is to facilitate coordination between local, state, and federal agencies in maintaining and promoting a safe and efficient national aviation system. The development and maintenance of Virginia's aviation system is a collaborative effort between multiple entities and is led by the Virginia Department of Aviation (DOAV). DOAV uses the VATSP to cultivate an advanced aviation system that is safe, secure, and provides for economic development while also promoting aviation awareness and education.

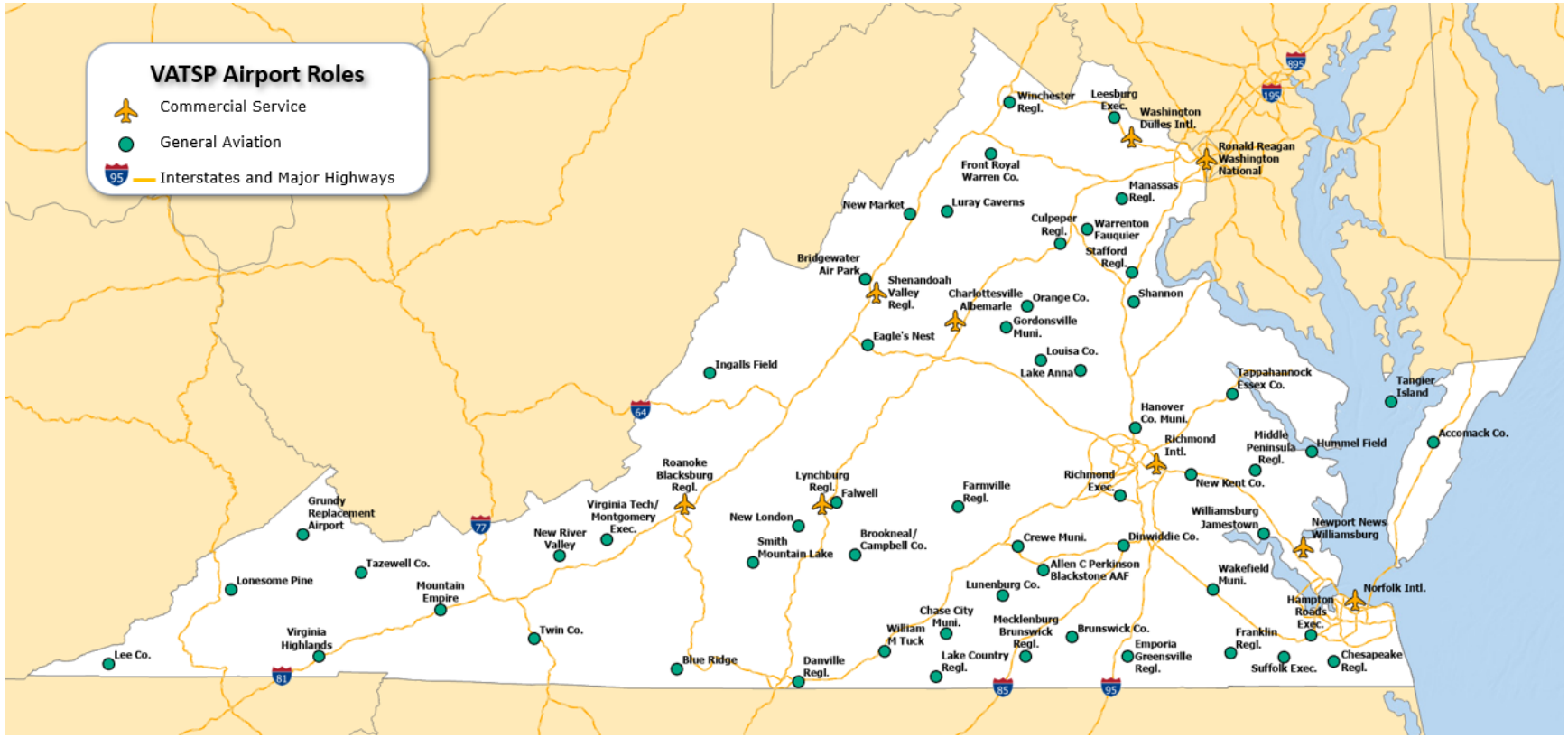
At the federal level, system plans are required by the Federal Aviation Administration (FAA) and must be evaluated periodically to receive funding through the Airport Improvement Program (AIP) for airports that are a part of the National Plan of Integrated Airport Systems (NPIAS). The FAA provides guidance to the states through the FAA Advisory Circular (AC) 150/5070-7 *The Airport System Planning Process* on how to conduct system plan evaluations or studies. This AC addresses core components of a system plan but also allows for customization by states based on individual needs.

At the state level, the VATSP provides guidance to DOAV for distribution of state funding to support individual airport development and growth.

At the local level, the VATSP targets stakeholders such as airport boards and authorities, municipalities, fixed-base operators, and members of the public who reference the Plan for guidance to achieve system goals and objectives. The VATSP also provides airport-specific operational forecasts and recommendations that help airport sponsors plan for improvements to meet user needs.

Virginia Aviation System History

Virginians strive to be the best and take pride in everything the state has to offer, so it comes as no surprise that the Commonwealth maintains one of the nation's most comprehensive and advanced statewide aviation systems. DOAV has a long history of aviation system planning, reaching back to the 1940s. DOAV is one of the most dedicated and consistent states in the U.S. when it comes to updating their aviation system plan, with the last update taking place in 2016. The VATSP examines the 66 public-use airports in the Virginia aviation system, which are displayed in **Figure 1-1**.



Source: Cignus, LLC.

Figure 1-1: Virginia Aviation System

VATSP Public Engagement

As a part of the project development, progress was shared with various stakeholders at key points and their resulting feedback was incorporated into the final technical report and executive summary. Each component of this engagement was critical to guiding and shaping the VATSP. These stakeholders and the varying roles they played are summarized in the following sections.

Virginia Aviation Board (VAB)

The VAB plays a critical role in the Virginia aviation system, with many responsibilities that impact its overall success. Because of this, DOAV knew that their involvement throughout the process was imperative.

Project updates were presented at VAB meetings throughout the VATSP's development. The VAB membership was solicited for comments and suggestions during each of these presentations. Feedback that would strengthen the final results was encouraged.

Responsibilities of the VAB

- Establishes financial assistance programs
- Allocates funds for capital improvement projects
- Sets policies to guide the funding programs and to promote and develop safe aviation practices and operations
- Hears airport sponsor and citizen concerns on matters pertaining to aviation and acts as a liaison to DOAV

Complete duties and responsibilities of the VAB can be found in *Code of Virginia* §5.1-2.1 et seq.

Virginia Airport Operator's Council (VAOC) Conferences

Presentations were made at two VAOC Conferences as well as one of the VAOC Spring Workshops. The goal of these presentations was to inform members of the Plan's progress, to initiate conversations with attendees about the Commonwealth's system as a whole, and to discuss what they hoped to gain from the Plan's results.

Study Advisory Group (SAG)

DOAV worked with the president of the VAOC to select members of a SAG, whose goal was to serve in an advisory capacity at key milestones throughout the project. These members included DOAV representatives, VAB members, and airport managers from air carrier and general aviation airports in Virginia. Six meetings were held throughout the process, at which the SAG members offered comments and improvements on the VATSP's development.

Study Advisory Group Members

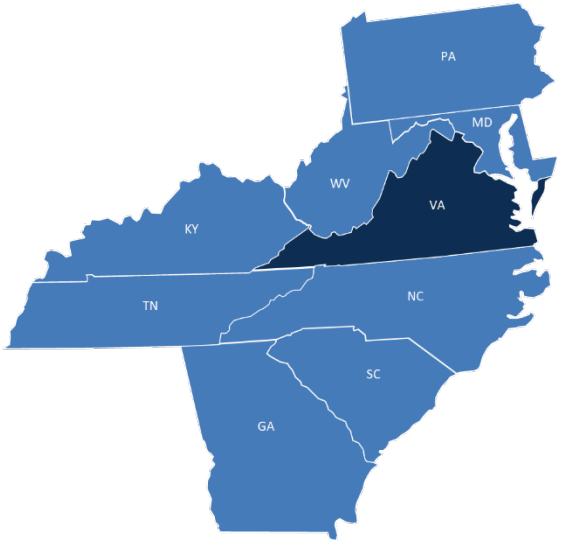
- **DOAV**
  - Greg Campbell
  - Rusty Harrington
- **VAB Members**
  - Dak Hardwick
  - Vicki Cox
- **Air Carrier Airports**
  - Charles Braden (ORF)
  - Perry Miller (RIC)
  - Andrew Ndolo (MWAA)
- **GA Airports**
  - Jason Davis (MTV)
  - Scott Coffman (JYO)
  - Keith Holt (BCB)
  - Debbie Kendall (GVE)
  - Chris Schrantz (CPK)
  - Donnie Rose (LNP)

VATSP Photo Contest

In order to showcase Virginia's aviation system, a photo contest was held encouraging members of the public to submit photos of Virginia's airports, aviation facilities, aircraft, and users. The number of photos submitted was vast, and many have been included in this report.

Comparative Analysis

As a part of a key task to kick off the VATSP, a comparison was conducted that evaluated peer State agencies and their most recent airport system plans. The peer group was comprised of Virginia's border states: Maryland, Pennsylvania, West Virginia,[1] Kentucky, Tennessee, and North Carolina, as well as, South Carolina, and Georgia.



The overall goal in the comparative analysis was to understand how each state agency utilizes their airport system plan and to identify new practices, approaches, perspectives, and innovative efforts being applied in the ongoing, daily stewardship of planning for and supporting an aviation system. Additional goals for the comparative analysis included evaluating Virginia's position compared to its peers and enhancing DOAV's effectiveness to support its aviation system. In addition to assessing the airport system planning effort, other aviation-related elements were evaluated and discussed with each state agency. Over approximately two weeks, interviews were conducted with the head of each peer state's aviation/aeronautics agency along with key planning staff, to discuss the following elements:

- The most recent system plan
  - Goals and objectives
  - Performance measures
  - Airport classifications
  - System gaps including deficiencies and funding
- Funding levels and trends
- Economic development
- Aviation policy
- Recovery from COVID-19

The text in **Appendix A** describes in detail the overall findings from the effort. Each state agency discussion provided information that served as key input to DOAV's system planning effort and its overall approach to implementing airport project funding.

While the review and interview process provided many considerations, there are six key takeaways that provide an overview on best practices in peer states and provided guidance to DOAV on next steps. These key takeaways are summarized to the right.

One overriding observation is that state agencies have little direct control over the aviation system, except for states that own and operate an airport. DOAV does not own any of the airports in the state, which is a constraint on policy, funding, and decision making. However, state agencies serve a vital role in guiding, influencing, and funding their airport facilities' infrastructure growth and development. The eight peer state agencies are strong partners to both the airports within their system and the FAA.

Key Takeaways

- All states have goals. Those states who link them to performance metrics and airport classifications should be examined more closely for effectiveness in achieving an integrated system.
- All of the peer states had performance measures (PMs) that measured accessibility, but only four had a full set of PMs that actually provided a foundation that could guide the state's management of its airport system.
- All states recognized the importance of meaningful airport classifications, but only a few states used classifications to guide an airport's development.
- While Virginia could seek more funding sources, the stability of Virginia's funding sources allows for a predictable partner for airports and the FAA.
- There was no discernible advantage or disadvantage to being a block grant state.
- Some states understand and encourage the link between aviation and economic development. These states should be studied for return on investment.

[1] West Virginia has not completed a State Aviation System Plan.

Chapter 2: Purpose of the VATSP

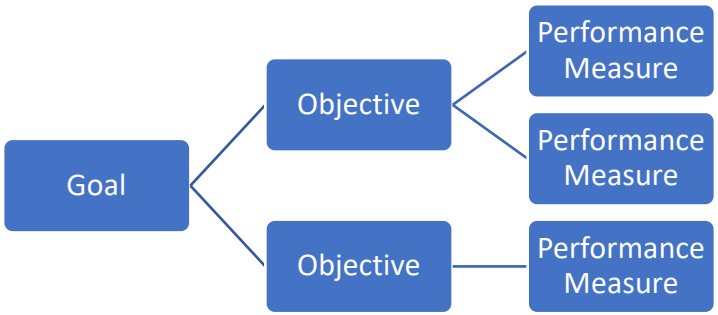
It is important at the onset of the planning process to define the overarching purpose of the Plan and design it to accomplish this purpose. This chapter defines the Virginia Air Transportation System Plan's (VATSP) purpose and explains how the Virginia Department of Aviation (DOAV) developed goals, objectives, and performance measures to ensure that it was achieved. Specifics on the importance and development of goals, objectives, and performance measures, as well as the resulting targets, are included in the following sections:

- Development of Goals, Objectives, and Performance Measures
- Goal 1: Assist DOAV in developing and maintaining a safe aviation system
- Goal 2: Provide DOAV with a blueprint for airport development based on the airport's role
- Goal 3: Assist DOAV in developing an accessible aviation system
- Goal 4: Assist DOAV in leveraging the economic development from system airports
- Goal 5: Assist DOAV in its continued use of technology to support the aviation system
- Goal 6: Promote environmental stewardship and sustainability in the aviation system

Development of Goals, Objectives, and Performance Measures

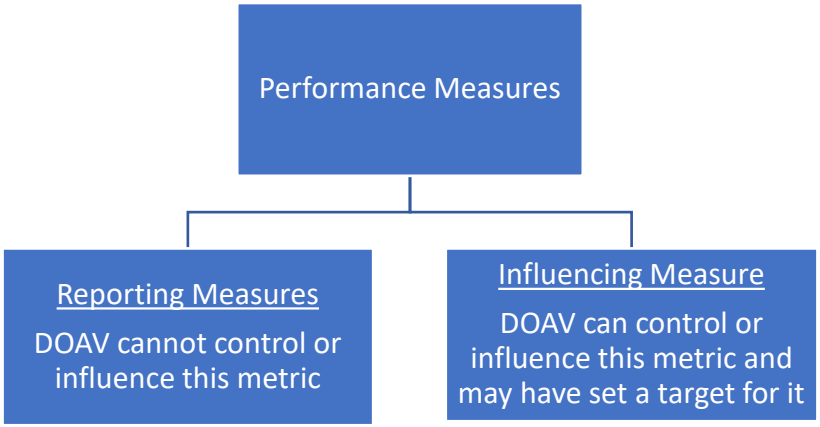
As previously stated, the purpose of the VATSP is to develop a modern system plan that will serve as a blueprint for airport development in the Commonwealth for the next 20 years. To accomplish this, DOAV aimed to develop a set of goals, objectives, and performance measures that guided certain elements of the system plan. This process began by clearly defining the meaning and intent of the terms goals, objectives, and performance measures.

- Goals – These are broad targets or aims that DOAV wanted the system plan to achieve. An example could be that a goal of the VATSP is to evaluate the safety of the Virginia aviation system.
- Objectives – Objectives are more detailed and quantifiable than goals. They define specific areas where progress is desired to achieve the goal and may include timeframes for accomplishment of objectives. Because goals tend to be broad in nature, multiple objectives are sometimes needed to support the achievement of each goal. An example of an objective that could partially address the goal of evaluating the safety of the Virginia aviation system could be achieving Runway Safety Area (RSA) compliance at Virginia's system airports within the next five years.
- Performance Measures – Performance measures (PM) quantitatively assess a particular objective. Each objective needs one or more PMs that are used to determine if the objective has been achieved or not. These PMs can evaluate specific aspects of each airport, or the collective performance of the aviation system, depending upon the objective. Continuing our example, the PM for the objective of evaluating the RSAs of Virginia's airports could assess the adequacy of each airport's RSA dimensions and tabulate which airports do or do not meet the Federal Aviation Administration (FAA) RSA design standard. For the system, a PM reporting the percentage of system airports meeting their FAA design standard could be tracked by DOAV.



Source: Mead & Hunt, Inc.

An important aspect of PMs is detailed in Airport Cooperative Research Program (ACRP) Research Report 223, *Performance Measures for State Aviation Agencies*. In brief, PMs are categorized as one of two types – reporting and influencing. A reporting measure is one that DOAV cannot control or influence, while an influencing measure is one that DOAV does exercise control over its outcome.



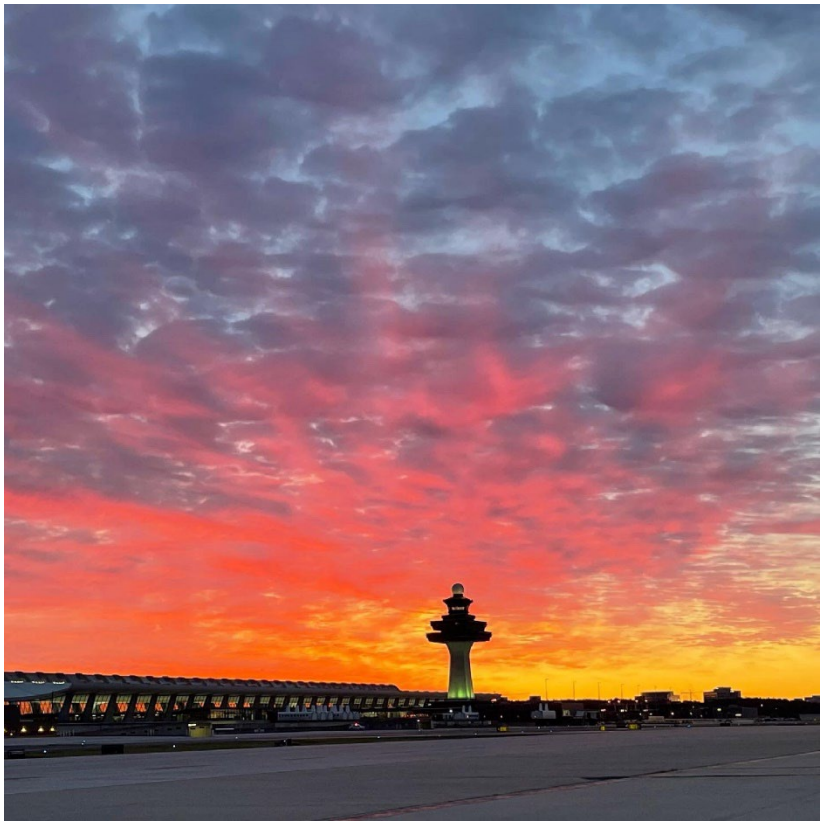
Source: Mead & Hunt, ACRP Report 223.

Returning to the RSA example previously used, the percentage of system airports that meet their FAA design standard would be an influencing measure, since DOAV has the ability to fund RSA improvement projects at airports. An example of a reporting measure would be the number of aircraft accidents in Virginia, since DOAV has no direct control over aircraft accidents.

Simply measuring performance without knowing what is or is not acceptable performance is not useful. To properly evaluate certain objectives and PMs, there needs to be a target against which the actual measurement can be compared. If the PM surpasses this target, then the associated objective is met.

Establishing a target for a PM should be based on the goals of DOAV. It can be as simple as translating desired compliance into a corresponding target. For example, a PM may be established that says 100 percent of system airports will have a current airport layout plan (ALP) on file. If 50 out of Virginia's 66 system airports have a current ALP on file, DOAV could report having 75.8 percent compliance with this goal. This would be the report for the PM across the whole system.

The target can be further refined to account for different types of airports within the system. If the 16 airports in the example above do not have a current ALP because they are privately owned, general aviation airports that have no obligation to maintain an ALP, then the target can be refined to state that of those system airports obligated to maintain an ALP, 100 percent are required to have a current ALP on file. This would then allow the PM to be shown as 100 percent since the 50 required airports comply.



Source: Kristen Long.

For other PMs, the choice of a target can be more complex. For example, DOAV has various options for establishing one or more targets for tracking instrument approach procedures (IAP). The simplest option is to set a target for the total number of IAPs in the state. Setting a target for total number of IAPs can be appropriate if DOAV has a goal of rightsizing the facilities under its jurisdiction, as the target may be below or above the existing number of IAPs.

If DOAV establishes a goal of improving access to its airports, a possible means of accomplishing this is setting a target for the average number of IAPs per airport that is higher than the current measure, knowing that raising this average will improve the ability to use airports during periods of poor weather.

These considerations were important when contemplating the appropriate goals, objectives, and PMs for the VATSP. In general, DOAV was looking for PMs that it can influence, since the feedback from such PMs can help DOAV improve the job it is doing. There are three questions that were kept in mind when developing the goals, objectives, and PMs for the VATSP:

- How does this help DOAV do its job?
- Is this something DOAV can influence?
- If DOAV cannot influence it, is it information that DOAV needs?

The following goals, objectives, and PMs for the VATSP were developed using the preceding definitions and concepts.

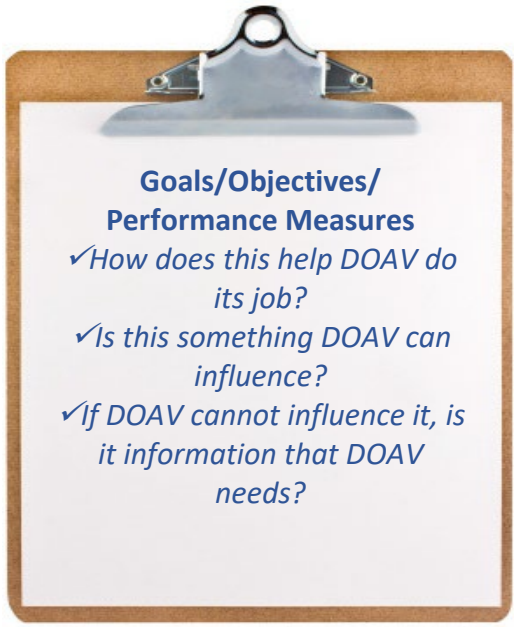
The process of developing the four goals for the VATSP started with the mission of the DOAV:

- Develop, promote, and advance aviation in Virginia for the benefit of all; and
- Partner with airports to improve airport facilities, provide safe air transportation, cultivate new technologies, inspire the next generation, and foster economic development in the Commonwealth.

After evaluating DOAV's mission and how it relates to the VATSP's purpose, the following higher-level targets were established as a starting point:

- Develop an airport classification system that guides airport development over the next 20 years;
- Estimate the costs of recommended system level capital improvement projects for Virginia's airports;
- Assist DOAV in developing guidance for airport funding priorities;
- Evaluate the Navigational Aids (NAVAIDs) in Virginia, and their anticipated maintenance and replacement cost;
- Review technology trends, such as Uncrewed Aerial Vehicles (UAV)/Urban Air Mobility (UAM) and remote air traffic control towers and evaluate how they might impact Virginia's airports; and
- Produce materials for communicating the value, importance, and needs of Virginia's system airports.

The development of goals, objectives, and PMs was a continuous process with input from numerous sources. A review of the 2016 VATSP provided an initial framework for discussion of goals for the VATSP.



Source: Mead & Hunt, Inc.

DOAV conducted a review of the aviation system plans of peer states to get ideas of the goals, objectives, and PMs used by other states. The findings from that review, summarized in **Chapter 1**, were considerations in the formulation of the goals, objectives, and PMs for the VATSP.

Through discussions with DOAV staff, the goals and objectives were further refined before sharing them with the Study Advisory Group, who provided valuable input that further revised the goals for the project. Throughout the Plan's development the goals, objectives, and PMs underwent review and revision, to reflect the emerging findings of the Plan.

This continuous process produced the following goals, objectives, and PMs.

Goal 1: Assist DOAV in developing and maintaining a safe aviation system

One element of DOAV's mission is to provide safe air transportation, so DOAV wanted to ensure that safety be incorporated into the goals of the VATSP. After evaluating the components that ensure a safe aviation system, including adherence to FAA standards, state licensing standards, and the DOAV Airport Program Manual, the following objectives and PMs were developed.

Objective 1.1 Assess system airports for adherence to FAA standards on critical safety areas.

Measure the percentage of system airports:

- *that adhere to FAA runway safety area (RSA) standards on primary runways.*
- *that control their runway protection zones (RPZ) on the primary runway.*
- *that control their object free areas (OFA) on their primary runway.*
- *with second runways that have justification (capacity or crosswind need) for that runway.*

Objective 1.2 Assess system airports for minimum facilities as defined by Virginia State Airport Licensing Standards.

Measure the percentage of system airports that meet the following minimum requirements for a standard airport license:

- an effective runway length of at least 2,000 feet for each direction of operation.
- minimum runway width of 50 feet.
- minimum runway safety area length equal to the length of the runway plus 100 feet at each end of the runway.
- minimum runway safety area width of 120 feet centered on the runway centerline.
- minimum unobstructed approach surface of 15:1 horizontal to vertical slope at each end of the runway.
- approach surface that is centered along the runway centerline and that begins at the threshold at a width of 250 feet; expands uniformly for a distance of 2,250 feet to a width of 700 feet; and continues at the width of 700 feet for a distance of 2,750 feet.
- minimum unobstructed runway object free area length equal to the length of the runway.
- minimum unobstructed runway object free area width of 250 feet centered on the runway centerline.
- displaced threshold, if an approach surface to either physical end of the runway is obstructed, and the obstacle cannot be removed, that shall be located down the runway at the point where the obstruction clearance plane intersects the runway centerline.

Source: Heather Ream.

Measure the percentage of system airports that meet the following minimum requirements for a standard Day/Visual Flight Rules (VFR) airport license:

- an effective runway length of at least 2,000 feet for each direction of operation.
- minimum runway width of 50 feet.
- minimum runway safety area length equal to the length of the runway plus 100 feet at each end of the runway.
- minimum runway safety area width of 120 feet centered on the runway centerline.
- minimum unobstructed approach surface of 15:1 horizontal to vertical slope at each end of the runway.
- approach surface that is centered along the runway centerline and that begins at the threshold at a width of 120 feet; expands uniformly for a distance of 500 feet to a width of 300 feet; and continues at the width of 300 feet for a distance of 2,500 feet.

Objective 1.3 Assess system airports for minimum facilities as defined by Basic Airport Unit measures in the DOAV Airport Program Manual.

Measure the percentage of system airports that have the following Basic Airport Unit elements:

- runway
- airport lighting system
- visual navigational aids
- stub taxiway
- aircraft parking apron
- terminal facility
- automobile parking
- airport access road
- fuel facility
- a terminal that provides adequate shelter from inclement weather, electric lighting, accessible public phone, and restroom facilities

Source: DOAV.

Goal 2: Provide DOAV with a blueprint for airport development based on the airport's role

A major component of a system plan, which will be covered in greater detail in **Chapter 3,** is the development and assignment of airport roles. These roles are used to classify airports based on how they contribute to the aviation system, and DOAV wanted a way to guide future development based on these assigned roles.

Objective 2.1 Assess the facilities, equipment, and services at each system airport based on assigned airport role.

Measure the percentage of system airports that have the following adequate facilities, equipment, and services as determined by that airport's role:

- runway length
- runway strength
- taxiway system, classified as "Stub," "Partial parallel," and "Full parallel" where Full parallel is any taxiway that provides access to both runway ends without the need for back taxi
- primary runway instrumentation (instrument approach type, approach lighting system, visual glide slope instruments, and runway lighting)
- automated weather reporting
- visual guidance (rotating beacon, windcone, segmented circle)
- terminal facilities
- fueling systems
- snow removal equipment
- pavement maintenance
- airport parking (non-revenue producing or affiliated)
- utilities (electric, water, sewer, internet)
- hangar space
- airport parking (revenue producing or exclusive)
- snow removal service
- fuel delivery (hours of availability, self-service, single-point fueling, over-wing fueling, credit card reader, call-out service)
- ground transportation available

Objective 2.2 Evaluate each system airport's runway parameters.

Assess the primary runway length at each system airport based on airport role.

Assess the primary runway width at each system airport based on airport role.

Source: DOAV.

Goal 3: Assist DOAV in developing an accessible aviation system

For an aviation system to be sustainable, it is critical that access is obtainable and feasible for as much of the population as possible. For this reason, developing an accessible aviation system was high on DOAV's list of priorities. This goal incorporates measures that look at not only airport coverage across the Commonwealth, but access to various services provided by the system as well.

Objective 3.1 Assess the coverage of Virginia system airports based on GIS drive-time analysis.

Measure the percentage of Virginia's population within a

- *45-minute drive time of any commercial service system airport, or neighboring state commercial service airports.*
- *30-minute drive time of any system airport.*
- *30-minute drive time of each category of airport role.*

Objective 3.2 Assess the coverage of services provided by Virginia system airports based on GIS drive-time analysis.

Measure the percentage of Virginia's population within a 30-minute drive time of any system airport that:

- *provides any fuel.*
- *provides jet fuel.*
- *has based flight training.*
- *has a 4,000-foot or longer runway.*
- *has a 5,000-foot or longer runway.*
- *has a 5,500-foot or longer runway.*
- *has a 6,000-foot or longer runway.*
- *has an instrument approach.*
- *has an instrument approach with vertical guidance.*
- *has on-site weather reporting.*
- *has an air traffic control tower.*
- *has a based air ambulance operator.*
- *can serve an air ambulance operator (4,500-foot runway, approach with vertical guidance, 24-hour jet fuel, and on-site weather reporting).*
- *serves business aircraft needs (5,500-foot runway, approach with vertical guidance, and on-site weather reporting).*

Source: DOAV.

Goal 4: Assist DOAV in leveraging the economic development from system airports

DOAV is focused on how airports can support economic development across the Commonwealth and felt that there were two key objectives when measuring this: through the facilitation of economic development efforts through system airports, and by tracking how well engaged each airport is in their local community.

Objective 4.1 Facilitate economic development efforts through system airports.

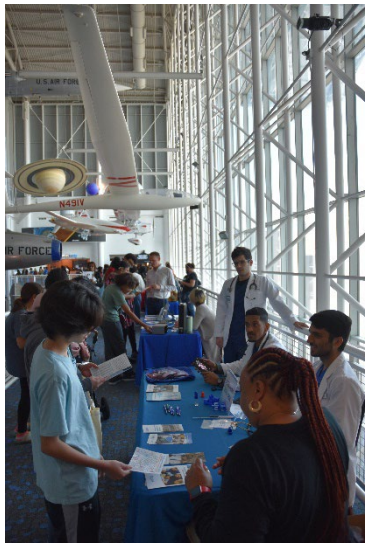
Measure the percentage of airports that:

- *show economic development areas on their ALP.*
- *are aware of development areas in their region.*
- *have site ready locations on their property.*

Objective 4.2 Evaluate the community engagement of system airports.

Measure the percentage of airports that:

- *have staff volunteering/serving with tourism boards or the Chamber of Commerce.*
- *have an internship or job shadowing program.*
- *communicate periodically with local officials or economic development representatives.*
- *host Chamber of Commerce, economic development, or other officials for Airport Days or similar events.*
- *host air shows, flights for veterans, career days, or similar events.*



Source: DOAV.

Goal 5: Assist DOAV in its continued use of technology to support the aviation system

The advancement of technology is not slowing down, and DOAV wanted measures that would assist in developing their system to include these advancing technologies, with specific focus on uncrewed air mobility and advanced air mobility.

Objective 5.1 Guide the development of the aviation system to facilitate the development of UAM/advanced air mobility (AAM).

Measure the population coverage provided by proposed AAM operations.

Measure the percentage of airports that:

- *anticipate electric vertical takeoff and landing (eVTOL) operations taking place on their airport during the planning period.*
- *are making plans for electric aircraft operations at their airport during the planning period.*
- *track aircraft operations and the method used.*

Goal 6: Promote environmental stewardship and sustainability in the aviation system

A growing concern across the aviation industry is the environmental impact that airports have, and how these facilities and users can encourage sustainability. DOAV felt that this was a critical topic and developed measures that track and encourage more sustainable and environmentally friendly practices at airports across the state.

Objective 6.1 Encourage the use of best environmental practices at system airports.

Measure the percentage of airports that use LED lighting for:

- *runway lighting.*
- *taxiway lighting.*
- *apron lighting.*
- *auto parking lighting.*
- *terminal lighting.*

Measure the percentage of airports that:

- *make use of native plants for landscaping.*
- *make use of water recycling.*
- *are recycling construction materials.*

Objective 6.2 Encourage the use of best sustainable practices at system airports.

Measure the percentage of airports that:

- *have solar farms.*
- *use geothermal energy.*
- *already have or are making provisions for electric charging stations for automobiles at their airport.*
- *already have or are making provisions for electric charging stations for aircraft at their airport.*

Source: DOAV.

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Chapter 3: Airport Roles

Airports serve many roles, and there are many means of classifying the roles played by airports. This chapter examines the different systems used to classify Virginia's airports and explains the reasons behind the Virginia Department of Aviation's (DOAV) decision to revise its airport role classification method for use in the Virginia Air Transportation System Plan (VATSP). It also describes the classification method DOAV selected for the VATSP and the resulting roles for each system airport.

Before laying out the process of assigning Virginia's system airports to their respective roles and process results, it is useful to examine how these airports are classified in various other system plans. There are two national system classifications that this chapter will examine to provide context. Both are found in the Federal Aviation Administration's (FAA) National Plan of Integrated Airport Systems (NPIAS). Each one is detailed below in terms of how it stratifies airports into groups, the purpose behind that stratification, and how Virginia's airports fit into those two systems of classification. This chapter covers the following sections, which showcase the reasoning, development, and resulting roles for Virginia's airports:

- NPIAS
- Virginia Airport Roles
- Facility, Equipment, and Service Targets
- Minimum Facilities of the VATSP

Virginia's NPIAS Airports

Virginia's system airports include 47 airports that are part of the NPIAS, with the Grundy Replacement Airport under consideration as a new addition to the NPIAS.

National Plan of Integrated Airport Systems

The NPIAS is the FAA's nationwide airport system plan. It is updated and sent to Congress every two years with the intent of identifying airports that are significant to the national air transportation system. The most recent NPIAS at the time of this system analysis, the *National Plan of Integrated Airport Systems (NPIAS) 2023–2027*, was published on September 30, 2022, and includes 3,287 existing and eight proposed airports that are eligible for federal funding through the FAA's Airport Improvement Program (AIP).

In order to be included in the NPIAS, existing general aviation airports must meet a number of criteria. In general, an airport must:

- Be operated by a sponsor eligible to receive federal funds and meet obligations.
- Be used by 10 or more operational and airworthy aircraft based on the airport. The aircraft tail numbers must be provided and validated against the FAA Aircraft Registry.
- Be located at least 30 miles from the nearest NPIAS airport. The 30-mile calculation must consider all existing NPIAS airports within a 30-mile radius, even if it is in an adjacent state.
- Be demonstrating an identifiable role in the national system (such as a basic, local, regional, or national).
- Be included in a state or territory aviation system plan with a role similar to the federal role and recommended by the airport's state or territory aviation authority to be a part of the NPIAS.
- Have a review by the FAA that finds no significant airfield design standard deficiencies, compliance violations, or wetland or wildlife issues.

Virginia's system of airports consists of 66 public-use airports, of which 47 are included in the NPIAS. Future chapters will analyze whether these NPIAS airports adequately serve the needs of Virginia. Included in Virginia's aviation system is a replacement airport for Grundy Municipal Airport that closed temporarily in October 2019. DOAV is working toward reopening Grundy's airport with enhanced facilities. This enhanced airport is referred to as the Grundy Replacement Airport in this report. DOAV has included the Grundy Replacement Airport in the Virginia system since this is one of the criteria for considering the airport for inclusion in the NPIAS. The classification of these 47 airports in the NPIAS provide some insight as to the composition of the Virginia aviation system.

The NPIAS classifies airports using two systems, one aimed at airports with commercial airline service and the other aimed at general aviation airports. The NPIAS refers to the first as an airport's category, and the second as the airport's role. These two classification systems and how they apply to Virginia's airports are explained in more detail in the following sections.

NPIAS Airport Categories

The NPIAS recognizes four categories of airports. They are:

- **Primary** – Any commercial service airport that enplanes more than 10,000 passengers annually.
- **Commercial Service** – Any publicly owned airport that has scheduled passenger service and at least 2,500 annual enplanements.
- **Reliever** – An airport designated by the Secretary of Transportation as relieving congestion at a commercial service airport and to provide more general aviation access to the overall community. As stated in the NPIAS, the FAA recognizes that a significant number of airports with reliever designation no longer meet the reliever status since the airports they are relieving are no longer considered congested. However, because the term is defined by statute in 49 U.S.C. § 47102, the FAA continues to track this category of airport.
- **General Aviation** - A public-use airport that is located in a state and that, as determined by the Secretary, does not have scheduled service, or has scheduled service with less than 2,500 passenger boardings each year.

Source: DOAV.

The primary airports are further classified into one of four hub designations based on their proportion of annual enplaned passengers.

- **Large Hub** – A primary airport that enplanes 1 percent or more of total U.S. passenger enplanements.
- **Medium Hub** – A primary airport that enplanes between 0.25 percent and 1 percent of total U.S. passenger enplanements.
- **Small Hub** – A primary airport that enplanes between 0.05 percent and 0.25 percent of total U.S. passenger enplanements.
- **Nonhub** – A primary airport that enplanes less than 0.05 percent of total U.S. passenger enplanements but more than 10,000 enplanements.

By designating these hub airports as primary airports, the NPIAS categorizes the other airports (Reliever, General Aviation, and Commercial Service) as nonprimary by default.

NPIAS Airport Roles

The NPIAS categories offer significant differentiation among the primary airports but lump most nonprimary airports into either the Reliever or General Aviation category. The FAA recognized this shortfall and created NPIAS airport roles that provide greater differentiation among the general aviation airports. The five NPIAS airport roles are:

- **National Airports** – These airports are typically found near major business centers and support the national aviation system by providing communities access to national and international markets. National airports offer alternatives to primary airports, resulting in very high levels of aviation activity with many jets and multiengine propeller aircraft. On average, National Airports are home to about 200 total based aircraft, of which nearly 40 are typically jets.
- **Regional Airports** – These airports are usually found in metropolitan areas serving large populations. They support regional economies by connecting communities to regional and national markets. Regional airports have high levels of activity with some jets and multiengine propeller aircraft. Total based aircraft at Regional Airports average 86 aircraft, of which three are jets.
- **Local Airports** – These airports provide access to markets within a state or immediate region. The predominant aviation activity at Local Airports is conducted by piston aircraft in support of business and personal needs. These airports typically accommodate flight training, emergency services, and charter flights. Local airports host an average of 32 based aircraft, all generally propeller driven.

- **Basic Airports** – These airports link the community to the national aviation system. Basic Airports support general aviation activities, such as emergency response, air ambulance service, flight training, and personal flying. Propeller-driven aircraft are the predominant aircraft at these airports, with an average of nine based aircraft per Basic Airport.
- **Unclassified** – Airports that are in the NPIAS but do not meet any of the criteria for the roles listed above.

The FAA introduced these airport roles in 2012 with its publication of the *General Aviation Airports: A National Asset* report. The FAA has subsequently included its airport role assessments and updates in the publication of its NPIAS report.

Table 3-1 shows the number of Virginia system airports in each NPIAS category and role as of 2023 and compares it to the data from the 2016 VATSP. The only change in NPIAS categories since the 2016 VATSP is that one general aviation airport has been moved out of the NPIAS. That airport is Grundy Municipal Airport, which was temporarily closed in October 2019. DOAV plans to reopen the airport, referred to as Grundy Replacement Airport (GDY) in this report, but it is not yet included in the NPIAS. Also note that although the table shows some minor changes amongst the roles overall, only 13 airports changed their NPIAS role since the 2016 VATSP. **Table 3-2** lists the 13 airports that changed their NPIAS role since 2016.

Table 3-1: Virginia Airports by NPIAS Categories and Roles

NPIAS Categories	Number of Airports	
	2023	2016
Primary Airports		
Large Hub	2	2
Medium Hub	1	0
Small Hub	1	2
Nonhub	5	5
Total	9	9
Nonprimary Airports by Category		
Commercial Service	0	0
Reliever	6	6
General Aviation	32	33
Total	38	39
Nonprimary Airports by Role		
National	2	1
Regional	11	12
Local	15	17
Basic	8	7
Unclassified	2	2
Not included in NPIAS	19	18
Total	**66**	**66**

Note: Total number of airports is calculated by combining the number of primary, nonprimary, and those airports not included in the NPIAS.
Source: NPIAS 2023-2027 and 2016 VATSP.

Table 3-2: Virginia Airport NPIAS Role Changes Since 2016

ID	Airport Name	NPIAS Role	
		2023	2016
JYO	Leesburg Executive	National	Regional
DAN	Danville Regional	Regional	Local
LUA	Luray Caverns	Local	Basic
SFQ	Suffolk Executive	Local	Regional
HLX	Twin County	Local	Basic
FKN	Franklin Regional	Basic	Local
MKJ	Mountain Empire	Basic	Local
EMV	Emporia-Greensville Regional	Basic	Other
FVX	Farmville Regional	Basic	Local
LNP	Lonesome Pine	Basic	Local
0VG	Lee County	Unclassified	Basic
0V4	Brookneal/Campbell County	Unclassified	Other
GDY	Grundy Replacement Airport	Not in NPIAS	Basic

Source: NPIAS 2023-2027 and 2016 VATSP.

There are multiple conditions that an airport can meet to determine its NPIAS role. If an airport does not meet any of the numerous conditions listed for a NPIAS role, then the airport falls into the Unclassified role.

Because of the multiple provisions for each NPIAS role, identifying the NPIAS role for each airport involves a significant amount of data collection followed by analysis of several conditions. DOAV sought an airport role classification system that was easier to follow and implement, as will be shown later. The NPIAS role process resulted in the NPIAS role assignments for each airport shown in **Table 3-3.** Virginia system airports not included in the NPIAS are listed in **Table 3-4.**

Table 3-3: NPIAS Airport Role and Category Classifications for Virginia's System Airports

ID	Airport Name	NPIAS Role	NPIAS Category
CHO	Charlottesville-Albemarle	Commercial Service	Primary
LYH	Lynchburg Regional/Preston Glenn Field	Commercial Service	Primary
PHF	Newport News-Williamsburg	Commercial Service	Primary
ORF	Norfolk International	Commercial Service	Primary
RIC	Richmond International	Commercial Service	Primary
ROA	Roanoke-Blacksburg Regional/Woodrum Field	Commercial Service	Primary
SHD	Shenandoah Valley Regional	Commercial Service	Primary
DCA	Ronald Reagan Washington National	Commercial Service	Primary
IAD	Washington Dulles International	Commercial Service	Primary
JYO	Leesburg Executive	National	Reliever
HEF	Manassas Regional/Harry P Davis Field	National	Reliever
MTV	Blue Ridge	Regional	General Aviation
CPK	Chesapeake Regional	Regional	General Aviation
CJR	Culpeper Regional	Regional	General Aviation
DAN	Danville Regional	Regional	General Aviation
PVG	Hampton Roads Executive	Regional	Reliever
OFP	Hanover County Municipal	Regional	General Aviation
FCI	Richmond Executive-Chesterfield County	Regional	Reliever
VJI	Virginia Highlands	Regional	General Aviation
BCB	Virginia Tech/Montgomery Executive	Regional	General Aviation
HWY	Warrenton-Fauquier	Regional	Reliever
OKV	Winchester Regional	Regional	General Aviation
MFV	Accomack County	Local	General Aviation
PTB	Dinwiddie County	Local	General Aviation

An Example of NPIAS Role Criteria

Airports in the National role must meet at least one of the following three sets of conditions:

- Condition 1
  - 5,000 or more instrument operations;
  - 11 or more based jets; and
  - 20 or more international flights or 500 or more interstate departures.
- Condition 2
  - 10,000 or more enplanements; and
  - at least 1 enplanement by a large, certificated air carrier.
- Condition 3
  - 500 million pounds or more of landed cargo weight (including weight of the aircraft).

Table 3-3: NPIAS Airport Role and Category Classifications for Virginia's System Airports (continued)

ID	Airport Name	NPIAS Role	NPIAS Category
FRR	Front Royal-Warren County	Local	General Aviation
LKU	Louisa County/Freeman Field	Local	General Aviation
LUA	Luray Caverns	Local	General Aviation
AVC	Mecklenburg-Brunswick Regional	Local	General Aviation
FYJ	Middle Peninsula Regional	Local	General Aviation
W96	New Kent County	Local	General Aviation
PSK	New River Valley	Local	General Aviation
OMH	Orange County	Local	General Aviation
RMN	Stafford Regional	Local	Reliever
SFQ	Suffolk Executive	Local	General Aviation
XSA	Tappahannock-Essex County	Local	General Aviation
HLX	Twin County	Local	General Aviation
W78	William M Tuck	Local	General Aviation
EMV	Emporia-Greensville Regional	Basic	General Aviation
FVX	Farmville Regional	Basic	General Aviation
FKN	Franklin Regional	Basic	General Aviation
HSP	Ingalls Field	Basic	General Aviation
LNP	Lonesome Pine	Basic	General Aviation
MKJ	Mountain Empire	Basic	General Aviation
TGI	Tangier Island	Basic	General Aviation
JFZ	Tazewell County	Basic	General Aviation
0V4	Brookneal/Campbell County	Unclassified	General Aviation
0VG	Lee County	Unclassified	General Aviation

Source: FAA NPIAS 2023-2027.

Source: Alan White.

Source: Alan White.

Table 3-4: Virginia System Airports Not Included in the NPIAS

ID	Airport Name	NPIAS Role	NPIAS Category
BKT	Allen C Perkinson Blackstone AAF	Not in NPIAS	Not in NPIAS
VBW	Bridgewater Air Park	Not in NPIAS	Not in NPIAS
LVL	Brunswick County	Not in NPIAS	Not in NPIAS
CXE	Chase City Municipal	Not in NPIAS	Not in NPIAS
W81	Crewe Municipal	Not in NPIAS	Not in NPIAS
W13	Eagle's Nest	Not in NPIAS	Not in NPIAS
W24	Falwell	Not in NPIAS	Not in NPIAS
GVE	Gordonsville Municipal	Not in NPIAS	Not in NPIAS
GDY	Grundy Replacement Airport	Not in NPIAS	Not in NPIAS
W75	Hummel Field	Not in NPIAS	Not in NPIAS
7W4	Lake Anna	Not in NPIAS	Not in NPIAS
W63	Lake Country Regional	Not in NPIAS	Not in NPIAS
W31	Lunenburg County	Not in NPIAS	Not in NPIAS
W90	New London	Not in NPIAS	Not in NPIAS
8W2	New Market	Not in NPIAS	Not in NPIAS
EZF	Shannon	Not in NPIAS	Not in NPIAS
W91	Smith Mountain Lake	Not in NPIAS	Not in NPIAS
AKQ	Wakefield Municipal	Not in NPIAS	Not in NPIAS
JGG	Williamsburg-Jamestown	Not in NPIAS	Not in NPIAS

Source: FAA NPIAS 2023-2027.

Source: DOAV.

Source: Nancy Lewis.

Virginia Airport Roles

DOAV desired an airport role methodology that is easier to implement and is transparent to stakeholders of the aviation system. To achieve that, the Plan looked at the reasons behind the method used in determining Virginia's airport roles in the 2016 VATSP.

Virginia's last system plan had four primary aims for its airport classification system. They were:

- Airport function – The airport role was intended to capture the way the airport functioned.
- Primary economic role – The airport role also sought to categorize airports by the level of economic activity that the airport generated.
- Optimal Airport Reference Code – The airport role was intended to help determine each airport's optimal airport reference code, a measure that determines airport geometry and layout to accommodate its most demanding aircraft.
- Funding category eligibility – The airport role was to be used to assist with distribution of state capital funding dollars.

Virginia realized that it was time to reassess its airport role methodology due to recent changes related to the four aims. For example, the FAA ceased to apply funding priority to Reliever Airports (as identified by the FAA in the NPIAS), which then questioned the applicability of using the Reliever role. DOAV sought to establish an airport role methodology that was tailored to the needs of Virginia. The updated aims of the new role methodology are to:

- Help guide DOAV in its funding decisions
- Better characterize airport function
- Provide a roadmap for development.

Peer Review of Roles

DOAV investigated how other states conducted the role analysis for their aviation systems. This effort included review of the airport classification methodologies of nine peer states as noted in **Chapter 1** and **Appendix A**. These states classified their airports into roles, with states using between three to six role designations. Based on some broad generalizations, these nine states used one of three methodologies to assign roles. Those methodologies were:

- Strict Criteria Method – Using a group of criteria, such as runway length, city population, and other factors, airport roles are assigned based on meeting or exceeding specific thresholds for some or all the criteria. An example is assigning airport roles based on primary runway length. All airports that exceed a specified runway length, such as 5,000 feet, are assigned a role, while airports with runways between 4,000 and 5,000 feet are assigned to a different role, and so on.
- Decision Tree Method – The decision tree method makes use of a series of objectively evaluated questions to arrive at an airport's role.
- Points Method – This method selects a number of objective criteria that have points assigned to them. Each airport's points are totaled, and the airports are listed in order by point total. Airports are then grouped, either by an objective measure (e.g., top quartile), or by a subjective assessment (e.g., an analyst selecting a breakpoint between airport groups based on which airports seem to belong together or not) and roles assigned to the groups.

Source: Alan White.

The strict criteria method offers the primary advantage of simplicity, especially if only one criterion is evaluated. This makes it easy to explain to interested parties. It also results in a simple implementation that is straight forward to update. The roles of individual airports can be updated when changes occur at those facilities. The downside is that this method can fail to adequately distinguish between airports. For example, a strict criteria method that uses

runway length will have a difficult time discriminating between airports with the same runway length where one caters to business jets, and the other to flight training. Of course, additional evaluation criteria can be added, but this complicates the analysis.

The decision tree method typically makes use of a flow chart that helps illustrate the logic used in assigning airport roles, which aids in explaining how the method works. Through the use of multiple criteria, many different combinations of airport characteristics can be evaluated, allowing this method to capture subtle differences between airports. A disadvantage of this method is that evaluating more than four or five criteria complicates the analysis significantly due to the increase in the number of possible combinations.

The points method is a good method for systems that have a large number of criteria for evaluation. Each criteria gets boiled down to a point value that can all be added together. Another advantage is that this method can evaluate any criteria that can have a point value assigned to it. Criteria can also be weighted by adjusting the range of points assigned to each criterion. An argument for avoiding this method is that it can be challenging to explain to stakeholders since it is difficult to visualize how the combination of points results in a particular role. Another downside is that assigning points to criteria is a subjective assessment. Finally, the main disadvantage of this method is that it is impossible to update individual airports. This is because this method assigns roles based on an airport's point total relative to all other airports in the system. Therefore, the only way to evaluate and update an airport with this methodology is by evaluating and updating all airports in the system so that a new relative ranking of all airports by points can be established. **Table 3-5** summarizes the pros and cons of the three methods.

Table 3-5: Airport Role Determination Methodologies

Method	Used by:	Pros	Cons
Strict Criteria	TN, PA, MD, NY	• Easily presented to stakeholders, decision-makers, and the public • Straight forward and easy to implement	• Lacks flexibility and customization • Overly simple, not as well suited for complex systems
Decision Tree	VA, SC, KY	• Easily presented to stakeholders, decision-makers, and the public • Uses few criteria but yields detailed results • Easy to customize	• Becomes more difficult to implement as number of criteria increase
Point System	GA, NC	• Captures nuances of complex systems • Very customizable • Easy to incorporate a large number of criteria	• Difficult to present to stakeholders, decision-makers, and the public • Point value assigned to criteria is subjective • Impossible to update individual airport since roles are based on relative scores (i.e., all airports must be updated, not just one)

Source: The Meehan Aviation Group.

Role Development Process

In selecting one of these approaches to assign airport roles, it was important to DOAV that the process:

- **Provided transparency** – The method needed to make it clear to stakeholders how an airport's role is determined.
- **Made it easy to apply in practice** – The method should make use of a limited number of easily evaluated objective criteria.
- **Emphasized funding** – The method needed to put the focus on funding by including criteria related to grants and financial sustainability.

Based on these elements, a decision tree approach was used to assign airport roles. The decision tree approach is simple to explain to stakeholders and, as will be shown later in the chapter, can be done by anyone with basic information about an airport, making the method very transparent. The decision tree approach can also be tailored to focus on

specific criteria so that the roles adequately capture those measures. As will be shown later, the decision tree method DOAV developed focused on a key funding aspect of Virginia's airports.

As part of the effort to emphasize funding in the airport role methodology, DOAV looked at the airport roles used in the 2016 VATSP and recommended changes. As shown in **Figure 3-1**, the three previous airport roles of Reliever Airport, General Aviation Regional Airport, and General Aviation Community Airport were condensed into two airport roles that were reevaluated and renamed Regional Business Airport and Community Business Airport.

These changes were made for two reasons. The first is that the Reliever Airport designation no longer received preferential funding considerations from the FAA, so there was no longer a valid reason for distinguishing it from other airport roles. Consolidating the airport roles simplified the system. The second reason related to the change in airport role names. This was done to better describe the function that these airports serve in the Virginia aviation system.

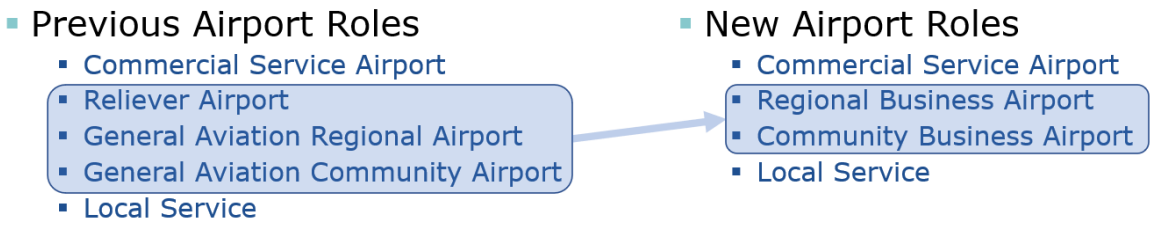


Figure 3-1: Comparison of Previous Airport Roles to New Airport Roles

Definition of Roles

With these changes, the descriptions of the airport roles were established as follows.

- **Commercial Service Airport** – Commercial Service Airports provide scheduled airline service for surrounding communities. Destinations are both domestic and, in some cases, international. Airports with established commercial service are included in this category. Commercial Service airports are eligible for air carrier entitlement and air carrier/reliever discretionary funding from the Commonwealth Aviation Fund.
- **Regional Business Airport** – Regional Business Airports serve a large segment of aviation, catering to higher performance aircraft, or filling significant demand for aviation services. Most aviation services and facilities needed by general aviation activity are found at these airports. Regional Business Airports are eligible for general aviation discretionary funding from the Commonwealth Aviation Fund. It is important to note that current Reliever Airports are eligible for Air Carrier/Reliever funding.
- **Community Business Airport** – Community Business Airports provide general aviation facilities and services to a smaller market segment than Regional Business Airports. The services at Community Business Airports may include fuel sales, aircraft rental, and pilot training. General Aviation Community airports are eligible for general aviation discretionary funding from the Commonwealth Aviation Fund.
- **Local Service Airport** – Local Service Airports generally have a lower level of operational activity than other general aviation airports. All Local Service Airports are non-NPIAS airports. Local Service Airports provide limited facilities and often have constraints on expansion capability. Commonwealth funding for Local Service Airports is limited to safety and preservation projects. Local Service airports are eligible for general aviation discretionary funding from the Commonwealth Aviation Fund. Like all airports, these airports must meet 5.1-7 of the Code of Virginia and 24VAC 5-20-140 licensing requirements.

Working with these airport roles, a process of developing a decision tree method of assigning airport roles was carried out. Multiple approaches were created using different sets of criteria, and DOAV then reviewed the resulting airport role outputs. Through this process, DOAV arrived at a decision tree method that used the following criteria:

- Commercial airline service
- NPIAS status and ownership
- Runway length
- Fuel available (jet fuel, avgas, or no fuel)
- Average based aircraft

These criteria were selected because they are objective and easily evaluated. Each is explained in more detail in the following section, along with icons to assist the reader in identifying their implementation in the airport role flow charts depicted later in this chapter.

Commercial Airline Service – The airports with scheduled commercial airline service have different funding rules than the general aviation airports, so it was important to break the commercial service airports into their own role. This was accomplished by identifying those airports with scheduled commercial airline service.

NPIAS status and ownership – For the general aviation airports, funding was a critical qualifier in airport role assessment. The role analysis first looked at the key aspect of AIP funding eligibility by assessing whether the airport was part of the NPIAS, and, therefore, eligible for AIP grants. Those airports that are not part of the NPIAS were further evaluated based on whether their owner is a public or private entity. Looking at airport closures in the past, the vast majority have been privately owned airports, which indicates that publicly owned airports are statistically more likely to continue operating as airports as compared to privately owned airports. DOAV wants aviation funding it provides to have the longest impact possible, so directing those resources to airports with long-term prospects is important. For this reason, airports that are not in the NPIAS that are publicly owned are regarded as having a higher potential for development and funding than those non-NPIAS airports that are privately owned.

Runway length – The length of an airport's primary runway is an indicator of what types of aircraft are likely to use the airport, which addresses how an airport functions. Longer runways can accommodate higher performance aircraft, which typically means aircraft powered by turbine engines – either turboprops or jet aircraft. Shorter runways—identified as those under 3,500 feet in length for this analysis—are generally used by less demanding aircraft that are typically powered by piston engines. The role analysis broke Virginia's airports into groups consisting of those with primary runways that are 5,000 feet or longer, those with runways between 3,500 feet and 5,000 feet, and those with runways less than 3,500 feet.

Fuel available – The types of fuel available at an airport can also indicate to a degree how that airport functions in the system. There are two forms of aircraft fuel predominately available at Virginia's airports – jet fuel and aviation gasoline (avgas). Jet fuel is used in aircraft with turbine engines – both turboprops and jet engines. Avgas is used in piston-powered aircraft. The role analysis assesses what fuel type is available at each airport, either jet fuel, avgas, or no fuel available. With two exceptions, every system airport in Virginia that has jet fuel available also has avgas. The two exceptions are Bridgewater Air Park (VBW) and Ronald Reagan Washington National Airport (DCA), both of which have jet fuel but no avgas.

Average based aircraft – The number of aircraft based at the airport serves as an indicator of the level of activity occurring at the airport. To mitigate large swings in based aircraft, for example from the startup of a new flight school, a three-year average is used so that large changes to based aircraft only have an impact if they are lasting changes.

The VATSP makes use of the following criteria for assigning general aviation airport roles:

- NPIAS status and ownership
- Runway length
- Fuel available
- Average based aircraft

Even though there are only a handful of evaluation criteria, there are more than 140 combinations of these items for general aviation airports, allowing the analysis to assess and differentiate among the system airports.

The role assignment process proceeds by logically assigning roles to airports with certain combinations of criteria. To facilitate this process, a flow chart was developed with decision points for each of the evaluation criteria to make it easy to determine which combinations of criteria were assigned to each airport role.

This flow chart is broken into three figures (**Figures 3-2** through **3-4**) corresponding to the three groups of general aviation airports under the NPIAS status and ownership criteria (NPIAS airports, non-NPIAS publicly owned airports, and non-NPIAS privately owned airports). **Figure 3-2** shows Flow Chart A, which is used for all airports that are part of the NPIAS. For those airports that are not part of the NPIAS, Flow Chart B (**Figure 3-3**) and Flow Chart C (**Figure 3-4**) are used, with public sponsor airports using Flow Chart B, and privately owned airports using Flow Chart C. The following hypothetical example illustrates how these charts were used to assign roles to each system airport.

Virginia Skies Airport is a privately owned airport that is in the NPIAS with the following parameters:

- No commercial airline service
- 4,500-foot runway
- Avgas available
- An average of 40 based aircraft over past three years

Starting with Flow Chart A, the first decision point is whether the airport has commercial airline service. Virginia Skies Airport does not, so the flow chart process proceeds to the next decision point, which is the NPIAS status of the airport. Since Virginia Skies Airport is in the NPIAS (private or public ownership of the airport is irrelevant when the airport is in the NPIAS), the flow chart proceeds to the runway length decision point. Virginia Skies Airport's 4,500-foot-long runway places it on the "Runway ≥ 3,500 feet" path, taking the flow chart to the next decision point, which involves fuel. Virginia Skies Airport does not have jet fuel, but does have avgas, so the flow chart follows the bottom "Avgas or No Fuel Available" path to where it is evaluated as a Community Business Airport. Under those conditions, there was no need to evaluate the average number of based aircraft at the airport over the past three years.

Source: DOAV.

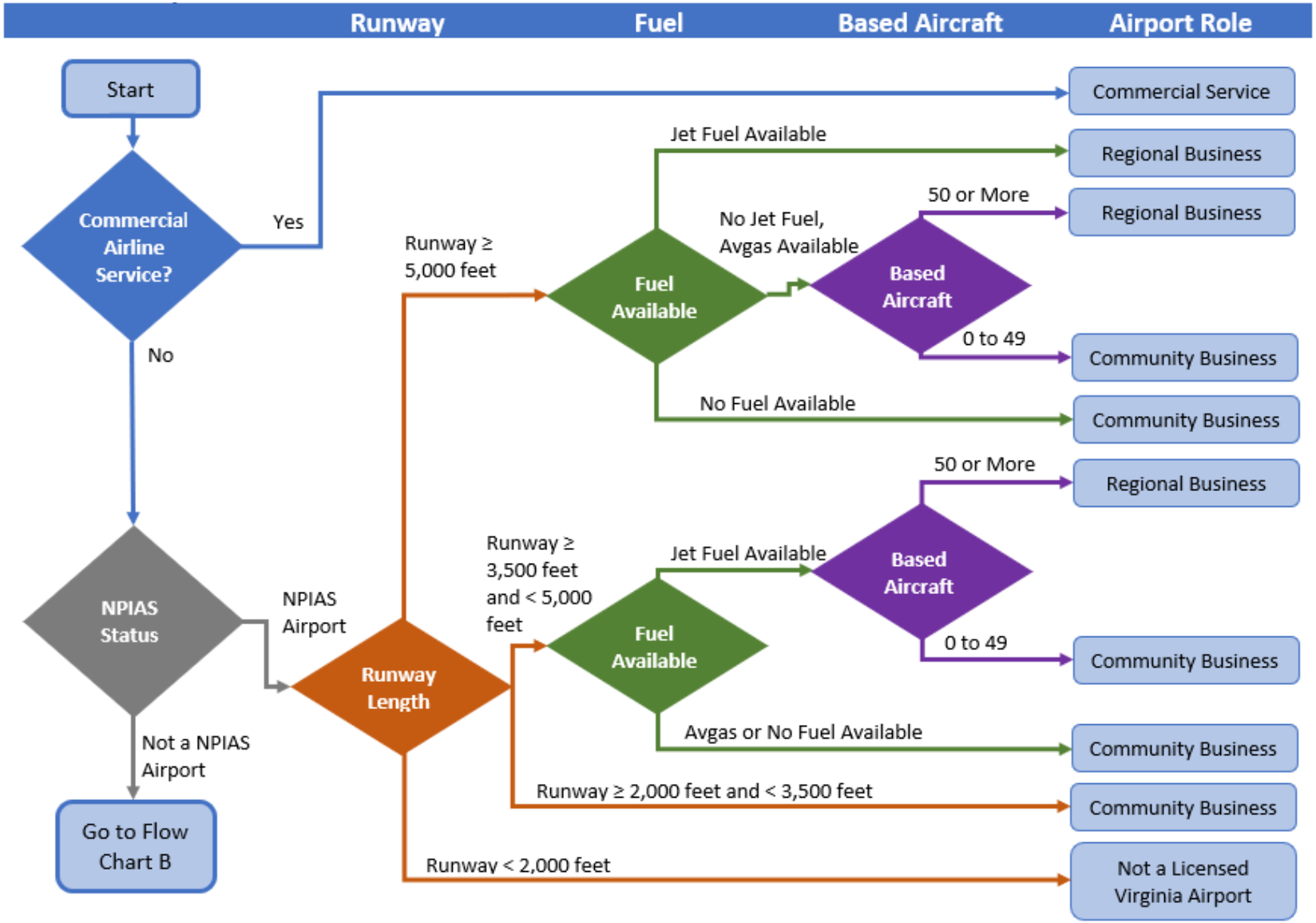


Figure 3-2: Flow Chart A – NPIAS Airports

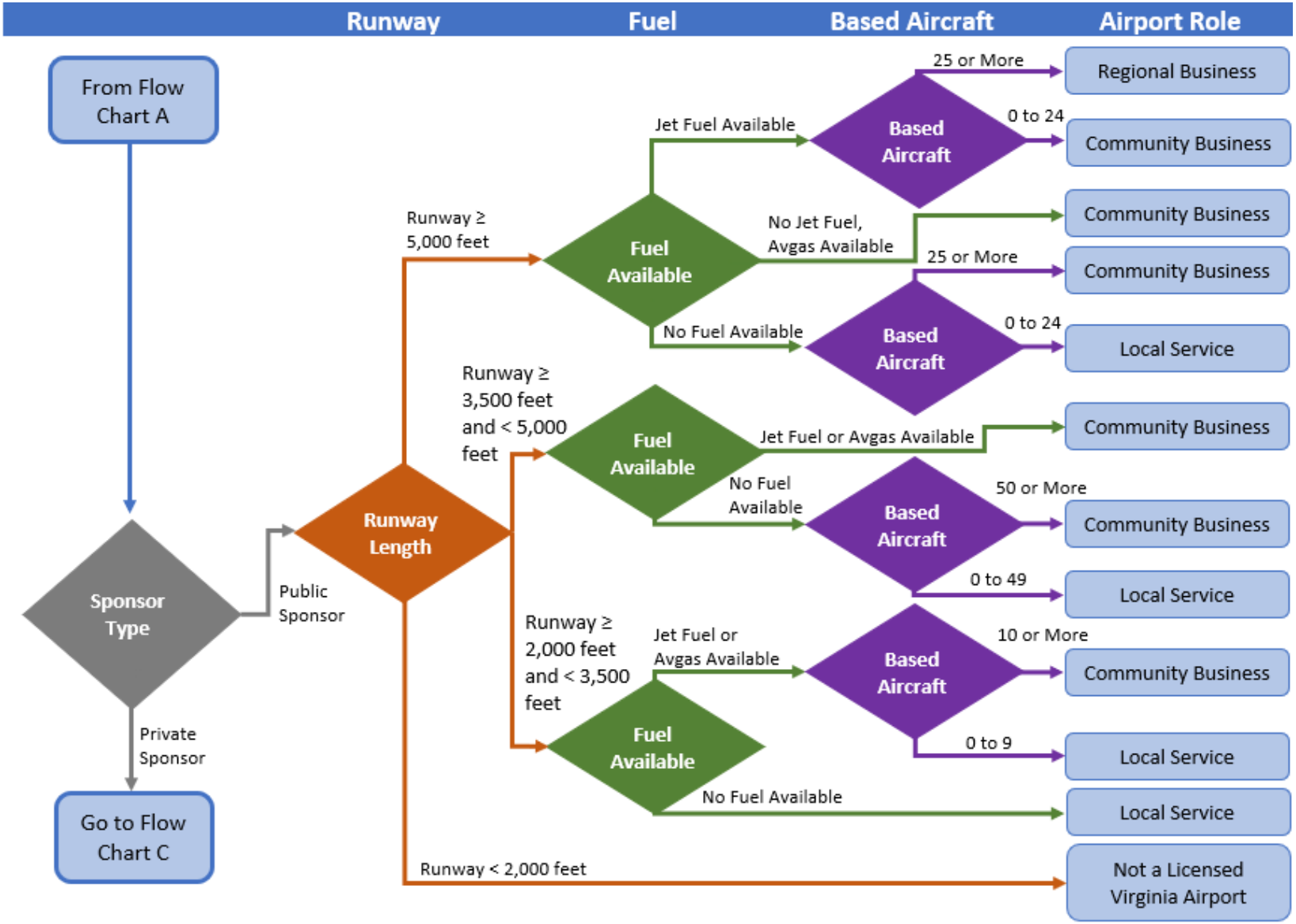


Figure 3-3: Flow Chart B – Non-NPIAS Publicly Owned Airports

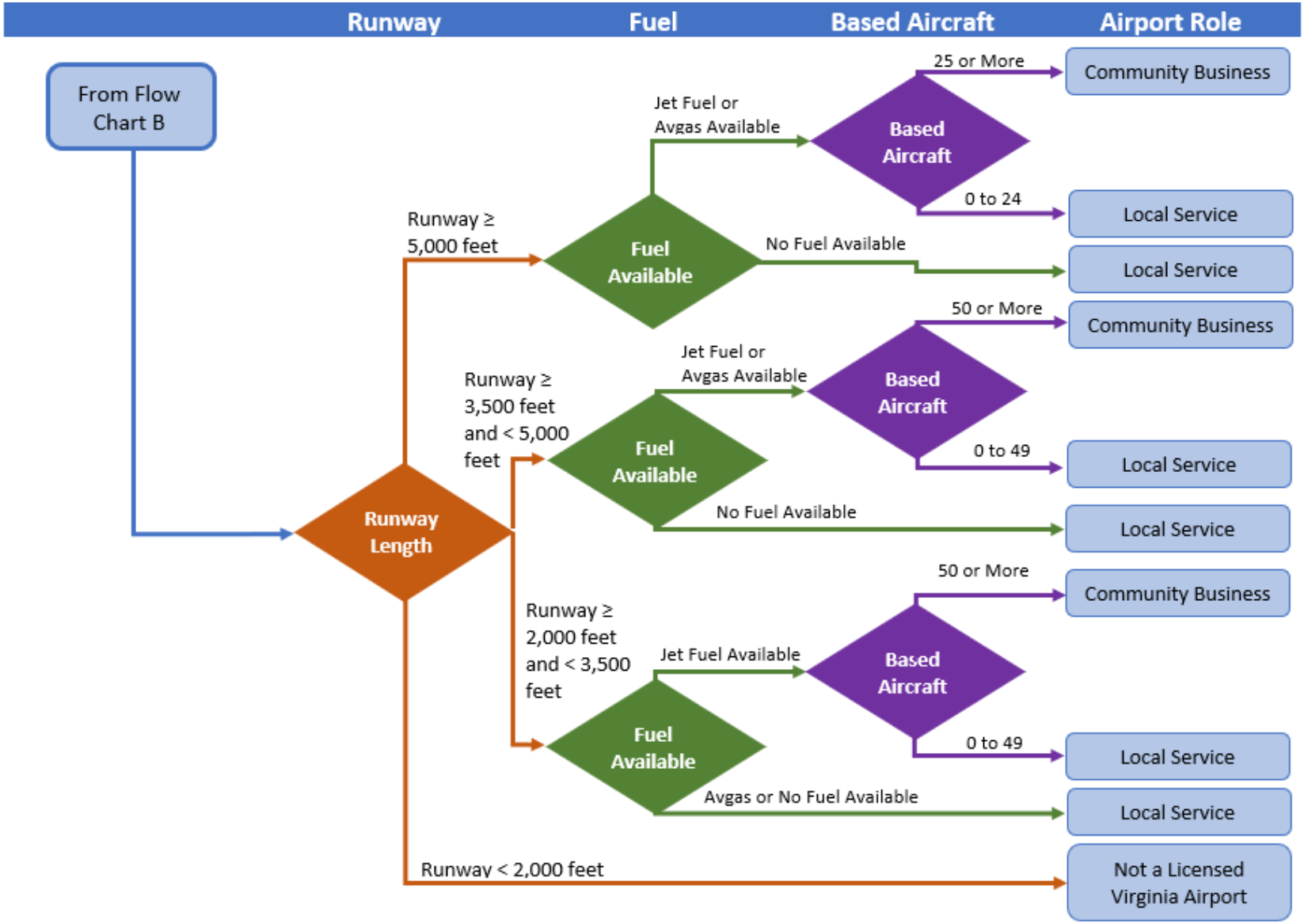


Figure 3-4: Flow Chart C – Non-NPIAS Privately Owned Airports

Results

Looking at Flow Chart A (**Figure 3-2**), it is apparent that if Virginia Skies Airport had jet fuel available, its role analysis would require an evaluation of its average based aircraft to determine if it is classified as a Community Business or Regional Business Airport. With an average of 40 based aircraft over the past three years, the analysis follows the "0 to 49" path, making it a Community Business Airport. It is worth noting that if in this case Virginia Skies Airport had an average of 50 or more based aircraft, it would fall into the Regional Business Airport role. When this decision tree approach is applied to Virginia's system airports, it classifies the 66 airports as shown in **Table 3-6**. **Table 3-7** shows each airport's role assignment along with the data from each airport that was used to determine its existing role. **Figure 3-5** depicts a map with each airport's role indicated.

Table 3-6: VATSP Roles

Airport Role	Number of Airports
Commercial Service	9
Regional Business	26
Community Business	20
Local Service	11
Total	66

Source: Mead & Hunt, Inc.

Table 3-7: Airport Role Classifications for Virginia's System Airports

ID	Airport Name	NPIAS Status	Ownership	Runway Length	Fuel Available	Average Based Aircraft	Airport Role
CHO	Charlottesville-Albemarle	NPIAS	Public	6,801	Jet fuel	62	Commercial Service
LYH	Lynchburg Regional/Preston Glenn Field	NPIAS	Public	7,100	Jet fuel	89	Commercial Service
PHF	Newport News-Williamsburg	NPIAS	Public	8,003	Jet fuel	136	Commercial Service
ORF	Norfolk International	NPIAS	Public	9,001	Jet fuel	86	Commercial Service
RIC	Richmond International	NPIAS	Public	9,003	Jet fuel	62	Commercial Service
ROA	Roanoke-Blacksburg Regional/Woodrum Field	NPIAS	Public	6,800	Jet fuel	97	Commercial Service
DCA	Ronald Reagan Washington National	NPIAS	Public	7,169	Jet fuel	1	Commercial Service
SHD	Shenandoah Valley Regional	NPIAS	Public	6,002	Jet fuel	85	Commercial Service
IAD	Washington Dulles International	NPIAS	Public	11,500	Jet fuel	63	Commercial Service
MFV	Accomack County	NPIAS	Public	5,000	Jet fuel	22	Regional Business
MTV	Blue Ridge	NPIAS	Public	5,002	Jet fuel	39	Regional Business
CPK	Chesapeake Regional	NPIAS	Public	5,500	Jet fuel	127	Regional Business

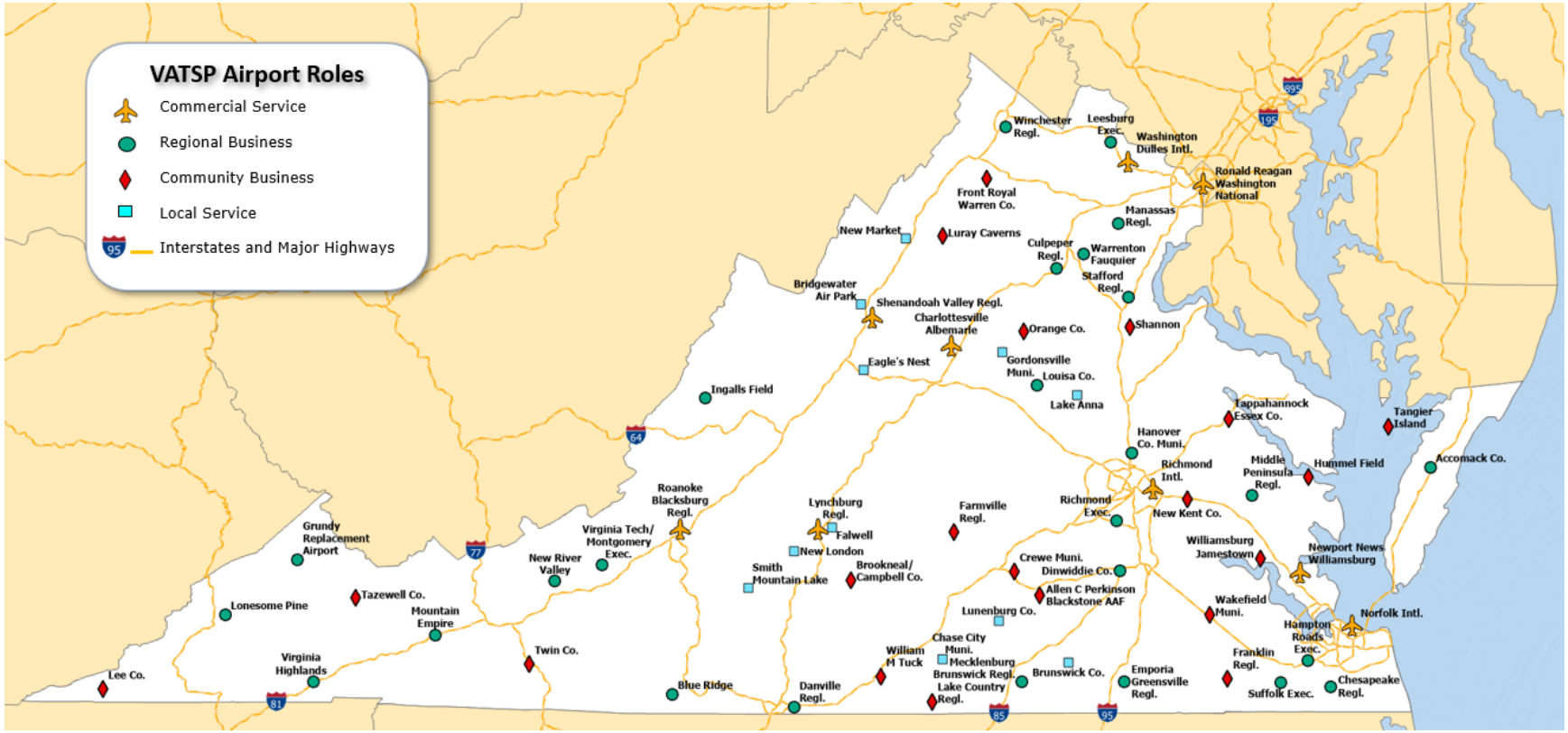
Table 3-7: Airport Role Classifications for Virginia's System Airports (continued)

ID	Airport Name	NPIAS Status	Ownership	Runway Length	Fuel Available	Average Based Aircraft	Airport Role
CJR	Culpeper Regional	NPIAS	Public	5,000	Jet fuel	163	Regional Business
DAN	Danville Regional	NPIAS	Public	5,900	Jet fuel	45	Regional Business
PTB	Dinwiddie County	NPIAS	Public	5,002	Jet fuel	57	Regional Business
EMV	Emporia-Greensville Regional	NPIAS	Public	5,010	Jet fuel	9	Regional Business
GDY	Grundy Replacement Airport	NPIAS	Public	5,100	Jet fuel	0	Regional Business
PVG	Hampton Roads Executive	NPIAS	Private	5,350	Jet fuel	159	Regional Business
OFP	Hanover County Municipal	NPIAS	Public	5,402	Jet fuel	108	Regional Business
HSP	Ingalls Field	NPIAS	Public	5,600	Jet fuel	4	Regional Business
JYO	Leesburg Executive	NPIAS	Public	5,500	Jet fuel	240	Regional Business
LNP	Lonesome Pine	NPIAS	Public	5,280	Jet fuel	31	Regional Business
LKU	Louisa County/Freeman Field	NPIAS	Public	4,300	Jet fuel	53	Regional Business
HEF	Manassas Regional/Harry P Davis Field	NPIAS	Public	6,200	Jet fuel	393	Regional Business
AVC	Mecklenburg-Brunswick Regional	NPIAS	Public	5,002	Jet fuel	33	Regional Business
FYJ	Middle Peninsula Regional	NPIAS	Public	5,000	Jet fuel	38	Regional Business
MKJ	Mountain Empire	NPIAS	Public	5,252	Jet fuel	18	Regional Business
PSK	New River Valley	NPIAS	Public	6,201	Jet fuel	37	Regional Business
FCI	Richmond Executive-Chesterfield County	NPIAS	Public	5,500	Jet fuel	116	Regional Business
RMN	Stafford Regional	NPIAS	Public	6,000	Jet fuel	63	Regional Business
SFQ	Suffolk Executive	NPIAS	Public	5,007	Jet fuel	68	Regional Business
VJI	Virginia Highlands	NPIAS	Public	5,500	Jet fuel	67	Regional Business
BCB	Virginia Tech/Montgomery Executive	NPIAS	Public	5,501	Jet fuel	46	Regional Business
HWY	Warrenton-Fauquier	NPIAS	Public	5,000	Jet fuel	139	Regional Business
OKV	Winchester Regional	NPIAS	Public	5,498	Jet fuel	104	Regional Business
BKT	Allen C Perkinson Blackstone AAF	Non-NPIAS	Public	5,333	Jet fuel	7	Community Business
0V4	Brookneal/Campbell County	NPIAS	Public	3,798	Avgas	3	Community Business
W81	Crewe Municipal	Non-NPIAS	Public	3,300	Avgas	15	Community Business
FVX	Farmville Regional	NPIAS	Public	4,400	Jet fuel	15	Community Business
FKN	Franklin Regional	NPIAS	Public	4,977	Jet fuel	16	Community Business
FRR	Front Royal-Warren County	NPIAS	Public	3,008	Avgas	53	Community Business
W75	Hummel Field	Non-NPIAS	Public	2,167	Avgas	29	Community Business

Table 3-7: Airport Role Classifications for Virginia's System Airports (continued)

ID	Airport Name	NPIAS Status	Ownership	Runway Length	Fuel Available	Average Based Aircraft	Airport Role
W63	Lake Country Regional	Non-NPIAS	Public	4,488	Avgas	6	Community Business
0VG	Lee County	NPIAS	Public	5,003	Avgas	8	Community Business
LUA	Luray Caverns	NPIAS	Public	3,126	Jet fuel	24	Community Business
W96	New Kent County	NPIAS	Public	3,602	Avgas	45	Community Business
OMH	Orange County	NPIAS	Public	3,200	Jet fuel	43	Community Business
EZF	Shannon	Non-NPIAS	Private	2,999	Jet fuel	97	Community Business
TGI	Tangier Island	NPIAS	Public	2,426	No fuel	0	Community Business
XSA	Tappahannock-Essex County	NPIAS	Public	4,300	Jet fuel	30	Community Business
JFZ	Tazewell County	NPIAS	Public	4,299	Jet fuel	14	Community Business
HLX	Twin County	NPIAS	Public	4,204	Jet fuel	21	Community Business
AKQ	Wakefield Municipal	Non-NPIAS	Public	4,337	Avgas	21	Community Business
W78	William M Tuck	NPIAS	Public	4,003	Avgas	21	Community Business
JGG	Williamsburg-Jamestown	Non-NPIAS	Private	3,204	Jet fuel	56	Community Business
VBW	Bridgewater Air Park	Non-NPIAS	Private	4,034	Jet fuel	43	Local Service
LVL	Brunswick County	Non-NPIAS	Public	3,020	No fuel	5	Local Service
CXE	Chase City Municipal	Non-NPIAS	Public	3,400	No fuel	3	Local Service
W13	Eagle's Nest	Non-NPIAS	Private	2,004	Avgas	38	Local Service
W24	Falwell	Non-NPIAS	Private	2,932	Avgas	16	Local Service
GVE	Gordonsville Municipal	Non-NPIAS	Public	2,300	No fuel	17	Local Service
7W4	Lake Anna	Non-NPIAS	Private	2,558	No fuel	2	Local Service
W31	Lunenburg County	Non-NPIAS	Public	3,000	Avgas	2	Local Service
W90	New London	Non-NPIAS	Private	3,164	No fuel	34	Local Service
8W2	New Market	Non-NPIAS	Private	2,920	Avgas	25	Local Service
W91	Smith Mountain Lake	Non-NPIAS	Private	3,058	Avgas	26	Local Service

Source: Mead & Hunt, Inc.



Source: Cignus, LLC.

Figure 3-6: Virginia's Existing Aviation system

Facility, Equipment, and Service Targets

Part of the reason DOAV establishes airport roles is so that each airport has a system-level plan for airport development. This is accomplished by assigning recommended facilities, equipment, and services (FE&S) for each airport role.

Lacking these recommended FE&S does not prevent an airport from functioning in its assigned role. Rather, these are recommended improvements that will optimize the airport's ability to function in that role and provide direction for future development. Additionally, not all recommended improvements are necessarily feasible, and coordination with local planning endeavors, especially an airport's master planning and airport layout planning efforts, is encouraged.

Similarly, airports may exceed these FE&S recommendations. These recommended targets should be considered minimum FE&S for each airport role, not specific targets that airports in that role must meet.

Another aspect to these FE&S is that they provide a means for DOAV to measure its progress toward some of its goals for the aviation system. Evaluating the percentage of airports that meet or exceed their FE&S recommendations can give DOAV an idea of how close they are to accomplishing their goal. Tracking this percentage over time allows DOAV to determine whether they are trending toward or away from their goal. **Table 3-8** lists each FE&S, along with the recommended targets by airport role. The analysis of how well Virginia's airports meet or exceed their recommended FE&S targets is found in **Chapter 8**.

Table 3-8: Recommended Facility, Equipment, and Service Targets for Virginia's System Airports by Airport Role

Performance Measure	Commercial Service	Regional Business	Community Business	Local Service
Primary Runway Length	6,000 feet	5,000 feet	3,500 feet	2,000 feet
Primary Runway Width	150 feet	75 feet	50 feet	50 feet
Primary Runway Strength	Dual Wheel = 60,000 lbs.	Single Wheel = 30,000 lbs.	Single Wheel = 12,500 lbs.	Preserve existing
Primary Runway Instrumentation (ALS, RW lights, VGSI)	MALSR, HIRLs, PAPI	REILS (or approach lights), MIRLs, PAPI	REILS (or approach lights), MIRLs, PAPI	Preserve existing
Taxiway System	Full parallel	Full parallel	Partial parallel	Stub
Automated Weather Reporting	ASOS or AWOS III on field, 24/7	ASOS or AWOS III on field, 24/7	ASOS or AWOS on field, 24/7	No target
Visual Guidance (rotating beacon, windcone, segmented circle)	Rotating beacon, lighted windcone/segmented circle at non-towered airports	Rotating beacon, lighted windcone	Rotating beacon, lighted windcone	Rotating beacon, windcone
IAP Minimums on Primary Runway (ceiling and visibility in feet and statute miles, respectively)	200 and 1/2	250 and 1	500 and 1	1,100 and 3
Remote Towers	Any airport without ATCT	Any airport without ATCT and 3 or more based jets	No target	No target
Terminal Facilities	Per Master Plan	Based on DOAV terminal building objectives to represent the total terminal space needed	Based on DOAV terminal building objectives to represent the total terminal space needed	1,236 sq. ft. of public use space

Table 3-8: Recommended Facility, Equipment, and Service Targets for Virginia's System Airports by Airport Role (continued)

Performance Measure	Commercial Service	Regional Business	Community Business	Local Service
Hangar Space	100% of based aircraft	100% of based aircraft	100% of based aircraft	Preserve existing
Fueling Available	Jet fuel and avgas	Jet fuel and avgas	Avgas	Preserve existing
Fuel Delivery	24/7 jet fuel and avgas with card reader	24/7 jet fuel and avgas with card reader	24/7 jet fuel and avgas with card reader	Preserve existing
Snow Removal Service	Airport staff	Airport staff	No target	No target
Snow Removal/Maintenance Equipment	Snow removal equipment, mower, tractor, vehicle attachments, front end loader, truck, debris sweeper, other maintenance equipment as needed	Snow removal equipment, mower, tractor, vehicle attachments, front end loader, truck, debris sweeper	Mower, tractor, vehicle attachments, front end loader, truck, debris sweeper	Preserve existing
Ground Transportation	On-site rental car	Rental car access	Rental car access	Preserve existing
Airport Parking (non-revenue)	1 space per every 2 airport/tenant employees (assumes 3 shifts)	1 space per airport/tenant employee + 1.5 spaces per based aircraft departure on average day in peak month	1 space per airport/tenant employee + 1.5 spaces per based aircraft departure on average day in peak month	1 space per airport/tenant employee + 1.5 spaces per based aircraft departure on average day in peak month
Airport Parking (revenue)	100 parking space per 100,000 enplanements	No target	No target	No target
Pavement Maintenance	PCI ≥ 70	PCI ≥ 70	PCI ≥ 70	PCI ≥ 70
Utilities	Electricity, water, sewer, communications	Electricity, water, sewer, communications	Electricity, water, sewer, communications	Electricity, communications

Source: Mead & Hunt, Inc.

Performance Measure Descriptions

Each of the performance measures identified in Table 3-8 is discussed below. It is important to remember that the targets for each FE&S are not requirements, but are minimum objectives intended for the airport to best serve its role. Each airport's master plan, as well as unique circumstances, will dictate what types of facilities are feasible and needed at an individual airport.

- **Primary Runway Length** – Aircraft with higher speeds and payloads generally need longer runways to take advantage of their full capabilities. As a result, airports with greater business potential generally need longer runways to accommodate more demanding aircraft and this is reflected in the runway length targets. Commercial Service Airports have a primary runway length target of 6,000 feet. Regional Business Airports, which can serve a mix of business jets, should strive for a primary runway of at least

5,000 feet. Community Business Airports, which tend to focus more on turboprops and piston aircraft, are recommended for 3,500-foot or longer primary runways. Local Service Airports should meet the Virginia airport licensing standard of at least a 2,000-foot runway.

- **Primary Runway Width** – Airports that cater to larger aircraft generally need wider runways to accommodate the wider landing gear of larger aircraft. Therefore, Commercial Service Airports are recommended to have 150-foot-wide primary runways, while Regional Business Airports are recommended for 75-foot-wide runways. Community Business Airports and Local Service Airports have a runway width target of 50 feet so that they meet Virginia airport licensing standards.
- **Primary Runway Strength** – The strength of runway pavement, expressed in terms of the aircraft weight (based on landing gear configuration) that can be supported on a regular basis, can limit what types of aircraft operate at an airport. Operations by aircraft that exceed the weight bearing capacity of a runway may not immediately damage the runway pavement, but repeated operations will accelerate the deterioration of the pavement. To support the operations of heavier aircraft, Commercial Service Airports are recommended to maintain their primary runway strength at a minimum of 60,000 pounds for dual wheel aircraft. Regional Business Airports should have a primary runway with a minimum, single-wheel weight-bearing capacity of 30,000 pounds. Community Business Airports have a target of 12,500 pounds for single wheel aircraft, which is adequate for small- to medium-sized turboprop aircraft. Local Service Airports should maintain their existing runway strength.

Source: Heather Ream.

- **Primary Runway Instrumentation** – This FS&E includes three runway-related items – runway approach lights, runway lights, and visual glide slope equipment.
  - Approach lighting systems (ALS) assist pilots in identifying the runway threshold environment, helping them transition to the landing phase of their flight by providing visual guidance and orientation to flight crews during the final approach phase of the flight. Approach lighting systems are a prerequisite for some types of instrument approach procedures and are a recommended FE&S target for Commercial Service Airports where the greatest utility can be obtained from an approach lighting system. Runway end identifier lights (REIL) are recommended for Regional Business Airports and Community Business Airports. REILs are an economical answer to aiding pilots in identifying the runway environment without taking up extensive real estate that is required for more complex approach lighting systems. Local Service Airports should preserve their existing approach lights, if any.
  - Airports with runway lighting have greater utility since this permits night operations. Additionally, runway lighting can enhance the effectiveness of an instrument approach by making the runway environment easier for pilots to identify during periods of low visibility. The target for runway lighting calls for high intensity runway lights (HIRL) at commercial service airports, where maximum runway utility is called for, and medium intensity runway lights (MIRL) at Regional Business Airports and Community Business Airports. Local Service Airports should preserve their runway lights, if any.
  - Visual glide slope indicators assist pilots in guiding their aircraft to the runway threshold along a safe and stable descent. Visual glide slope indicators (the most common being a precision approach path indicator, or PAPI) provide visual feedback to the pilot on his vertical position relative to a fixed path that descends smoothly to the runway. Such systems enhance safety by ensuring obstacle clearance and proper aircraft positioning for a safe landing. PAPIs are a target for all but Local Service Airports, which should strive to preserve any existing visual glide slope indicators.

Source: DOAV.

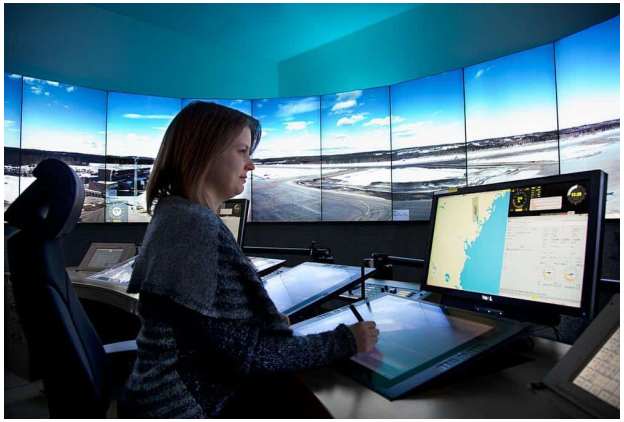
- **Taxiway System** – The type of taxiway system at an airport is important for reasons of safety and efficiency. Without taxiways, aircraft must use the runway to back-taxi in order to line up for takeoff and to exit the runway after landing. This increases runway occupancy times for aircraft, which is both inefficient and increases collision risks for aircraft. Commercial Service and Regional Business

Airports are expected to accommodate larger aircraft, which tend to be less maneuverable, giving them a greater need for taxiways. For this reason, full parallel taxiways are recommended for Commercial Service and Regional Business Airports. Community Business Airports serving more maneuverable aircraft can increase safety and efficiency with partial parallel taxiways without incurring the expense of a full parallel taxiway. Therefore, partial parallel taxiways are recommended for Community Business Airports. Local Service Airports are recommended for turnaround stubs.

- **Automated Weather Reporting** – Weather conditions, especially as they relate to visibility, determine if an aircraft is capable of getting into an airport. Knowing what those weather conditions are ahead of time greatly assists pilots with flight planning. It is also of use when making a diversion decision. Weather reporting at most airports is automated, by either an Automated Weather Observing System (AWOS) or Automated Surface Observing System (ASOS). Automated weather reporting is recommended for all except Local Service Airports.
- **Visual Guidance** – This FE&S captures two items intended to assist pilots in identifying the airport and providing guidance for wind direction and velocity. These are an airport rotating beacon and visual wind indicators.
  - An airport rotating beacon is an alternating white and green light that aids pilots in identifying the airport from a distance, especially at night. It is also used to signal during the day when weather conditions are below visual flight rule minimums at airports with weather reporting capability. It is a fundamental component of any lighted airport and therefore a target for all system airports.
  - A windcone provides a reliable, easy to use and maintain mechanism for visually indicating wind direction and speed. It is a fundamental component of any airport and therefore a target for all airports. Some models are capable of lighting for use at night, which is recommended for all but Local Service Airports.
  - A segmented circle provides visual indications of wind and runway traffic patterns through the use of a windcone and landing strip and direction indicators. It is employed at airports without air traffic control tower services, so it is recommended for those Commercial Service Airports that lack air traffic control services around the clock.

Source: Mead & Hunt, Inc.

- **Instrument Approach Procedure Minimums on Primary Runway** – The type of instrument approach affects the overall utility of an airport and can make it possible to land during inclement weather. Virginia's aviation system is so well developed that every system airport has an instrument approach procedure, so DOAV's objective is to achieve incremental improvements in the approach minimums (cloud ceiling and flight visibility) where feasible. At Commercial Service Airports, the recommended target for its primary runway approach is a 200-foot cloud ceiling and ½ statute miles of flight visibility, typically referred to as 200 and ½. Regional Business Airports are urged to achieve a 250 and 1. Community Business Airports have a recommended target of 500 and 1, while minimums for Local Service Airports are recommended at 1,100 and 3.
- **Remote Towers** – A recent development in the area of air traffic control is the implementation of remote towers. These are "virtual" air traffic control towers that are staffed by remote controllers that make use of a network of on-airport video cameras to monitor and control aircraft operations. Virginia's Leesburg Executive Airport (JYO) is among the first airports in the U.S. to successfully trial this technology. The system is recommended for airports that fall short of the need for a conventional air traffic control tower but would greatly benefit from the added air traffic separation services a remote tower could provide. Airports with a mix of jet and piston aircraft, which typically have greatly varying approach characteristics, are prime candidates for the safety benefits offered by air traffic control towers. For these reasons, a remote tower is recommended at any Commercial Service Airports that lack a conventional air traffic control tower, and at Regional Business Airports without a conventional air traffic control tower that have three or more based jets.



Source: DOAV.

- **Terminal Facilities** – Airports that are expected to handle general aviation passenger traffic have a need for a terminal/administration building where passengers can take shelter from the weather and environment, as well as provide a central meeting point for parties coming to the airport. Terminal buildings also provide essential services for passengers and pilots. Terminal facilities can range in size based upon several factors, the most important being the type of users. Buildings can range from a small pilot room for flight planning and resting to a large multi-room building that provides services for multiple uses. A terminal building provides visitors with their first impression of a community, so it is important for a terminal building to be welcoming and provide a positive experience for the visitor. Specific areas or uses in a terminal building can include waiting areas, restrooms, pilots lounge, vending, conference rooms, and airport manager offices. For this reason, a terminal building is recommended for all airports.

  Source: DOAV.

  The recommended space for these facilities varies based on airport role. Terminal buildings for Commercial Service Airports are designed for the airline and passenger demands expected at that airport and should be based on the master plan for that particular airport. For Regional Business Airports and Community Business Airports, the recommended terminal building size is based on DOAV's Terminal Building Area Calculator, a formula that DOAV uses to estimate terminal needs. This calculator uses annual aircraft operations to estimate the portion of the terminal that is eligible for state funding. This portion is approximately 70 percent of the average terminal building's size and was adjusted to reflect total terminal building size needed. Local Service Airports are recommended for a terminal building with 1,236 square feet of public space.
- **Hangar Space** – Aircraft storage is a key component of airport infrastructure, especially as the cost of aircraft has risen and incentivized aircraft owners to protect their investment. The target for hangar space at all airports except Local Service Airports is to provide adequate hangar space for all based aircraft at the airport. Doing so makes aircraft storage available to aircraft owners. Depending upon local conditions, additional hangar space may be needed at airports that have high transient aircraft activity, or demand for aircraft services such as maintenance or painting. Local Service Airports should strive to maintain existing hangar space.
- **Fueling Available** – In order for an airport to fulfill its designated classification, it must provide the basic services to the users of the airport. Fuel is the most fundamental of these services, with users of turbine engine aircraft needing jet fuel and the users of nearly all piston engine aircraft needing 100LL avgas. All system airports, except for Local Service Airports, are encouraged to be able to fuel piston aircraft, and those airports with significant amounts of jet traffic are encouraged to have jet fuel (i.e., Commercial Service Airports and Regional Business Airports). If Local Service Airports have any fuel capability, they should preserve it.
- **Fuel Delivery** – In addition to the types of fuel available, when and how it is delivered is important. It is recommended that all airports, except Local Service Airports, make fuel available 24 hours per day through self-fueling equipment, which is typically equipped with a credit card reader. If Local Service Airports have any fuel delivery systems, they should preserve them.
- **Snow Removal Service** – Winter use of airports in many parts of Virginia depends upon the ability to remove snow from the airfield. The two means of providing snow removal at an airport are either for the airport to own, maintain, and operate the snow removal equipment (referred to as on-airport), or contract with another party to provide the snow removal services as needed (referred to as off-airport). On-airport snow removal provides greater reliability, but at higher cost, while off-airport snow removal is typically less expensive but may not be as responsive in situations where the provider may have higher priority snow clearance duties than keeping the airport clean. Commercial Service Airports and Regional Business Airports, where maximum operational efficiency is important for supporting the maximum economic potential of these airports, are recommended for on-airport snow removal, while the other airports have no target.
- **Snow Removal/Maintenance Equipment** – To support the on-airport snow removal target for Commercial Service Airports and Regional Business Airports, it is recommended that these airports obtain adequate snow removal equipment. The other airports have no target for snow removal equipment since they may opt for off-airport snow removal service.

- **Ground Transportation** – Providing ground transportation services to visitors who arrive in Virginia by air is important to airports fulfilling their system role. For Commercial Service Airports, efficient movement from aircraft to ground transportation is a critical element of making the most of air transportation, so the target for these airports is to have on-site rental car services. For Regional Business Airports and Community Business Airports, on-site rental car service may not be financially feasible, so rental car access through a pick-up service or rental car delivery on demand service is an appropriate target for these airports. Local Service Airports should maintain the rental car access they have, if any.
- **Airport Parking (non-revenue)** – The amount of automobile parking available is an important component of providing adequate services to airport users. This Plan breaks parking into revenue-generating parking (generally found only at larger Commercial Service Airports) and non-revenue-generating parking, which is found at all airports. Airports need adequate parking for employees of the airport, employees of businesses on the airport, and customers of the airport and its businesses. For Commercial Service Airports, it is recommended that the airport provide one auto parking space for every two employees (airport or business tenant employee) on the airport. For all other airports, it is recommended that the airport provide one auto parking space for every employee and add 1.5 auto spaces for every based aircraft departure on an average day in the peak month.

Source: Mead & Hunt, Inc.

- **Airport Parking (revenue)** – Parking that generates revenue typically does so from airline passengers, so the target for this facility is only applied to Commercial Service Airports. For every 100,000 annual enplanements, it is recommended that the airport have 100 auto parking spaces. With the growth of transportation network companies, such as Lyft and Uber, and the promise of innovative transportation business models, there may be reduced demand for parking at airports in the future. It is recommended that DOAV periodically re-evaluate the ratio of recommended parking spaces to enplanements.
- **Pavement Maintenance** – Maintaining an airport's pavement is a key component of an airport fulfilling its role in an aviation system. The industry standard for evaluating pavement status is a calculated pavement condition index (PCI) that scores pavement on a scale of 1 to 100. All airports are recommended to maintain their pavement at a PCI value of 70 or greater.
- **Utilities** – Key infrastructure elements of an airport include electricity, water, sewer, and internet access. All airports, except Local Service Airports, are recommended to have electricity, water, sewer, and internet access. The utility targets for Local Service Airports, which can be more remote than other airports, are electricity and internet access. Refer to the inventory in the appendix for the availability of public water and sanitary sewer services at Regional Business and Community Business Airports.

In addition to developing targets for the various airport roles in the Virginia aviation system, this Plan also considered the minimum requirements necessary for an airport to be included in the system. Virginia has two sets of airport minimum standards that are detailed in the next section.

Minimum Facilities of the VATSP

The VATSP evaluates airport facilities using two sets of minimum requirements. The first is a set of licensing requirements found under the *Virginia Administrative Code 24VAC5-20-140 Minimum requirements of licensing*. The second comes from the definitions of a Basic Airport Unit as stipulated in the *Virginia Department of Aviation Airport Program Manual* as revised in March 2021.

Licensing of Virginia Airports

Airport licensing requirements for Virginia's airports are established in the Code of Virginia § 5.1-7 *Licensing of airports and landing areas*, which calls for licensing of an airport open to the public (whether privately or publicly owned) by DOAV. The licensing process, which also applies to runway extensions, involves DOAV inspecting the proposed airport or runway extension, evaluating the conditions, and ensuring that the facility meets the minimum requirements for airports. Periodic renewals of the license are required. Details of the licensing process are stipulated in Virginia Administrative Code, under 24VAC5-20-120 *Licenses*, 24VAC5-20-140 *Minimum requirements for licensing* and, 24VAC5-20-145 *Waiver of minimum requirements*.

Virginia Administrative Code 24VAC5-20-120 *Licenses* stipulates that:

- Airports and landing areas, except private landing areas as set forth in § 5.1-7.2 of the Code of Virginia, shall be licensed by the department pursuant to § 5.1-7 of the Code of Virginia and 24VAC 5-20-140. Private landing areas as defined in § 5.1-7.2 of the Code of Virginia shall only be registered as provided for in 24VAC 5-20-170, which requires that private airports within five miles of a licensed public use airport are required to be licensed, while those beyond five miles only require registration.
- Airports and landing areas that are issued licenses pursuant to § 5.1-7 of the Code of Virginia shall be open to the general public on a nondiscriminatory basis. An application for a license shall be signed by the airport sponsor, under oath, on a form prescribed by the department and submitted to the department accompanied by the required supporting documents as specified on the form. An initial license, or renewal thereof, will be issued following department review and determination of compliance with § 5.1-7 of the Code of Virginia and 24VAC 5-20-140. A license shall remain in effect for the period specified until modified, suspended, or revoked by the department.
- Airport sponsors proposing to add or extend runways of an airport or landing area shall apply for a modified license pursuant to § 5.1-7 of the Code of Virginia.
- If an airport or landing area should continually cease to be open to the public for one year, and the airport sponsor wants to reopen the facility to the public, the airport sponsor must reapply for a license in accordance with § 5.1-7 of the Code of Virginia and 24VAC 5-2-120 and must be in compliance with 24VAC 5-20-140.
- Licenses must be renewed every seven years or at the discretion of the department based on demonstrated need. License expirations shall be staggered in accordance with criteria set by the department, which include, but are not limited to, changes in legislation, standards, policy, processes, and procedures.

Licensing Regulations for Virginia's Airports

Code of Virginia § 5.1-7 Licensing of airports and landing areas

Virginia Administrative Code:

- 24VAC5-20-120. *Licenses*,
- 24VAC5-20-140. *Minimum requirements for licensing*
- 24VAC5-20-170. *Private airports or landing areas*

Virginia Administrative Code 24VAC5-20-140 *Minimum requirements for licensing* stipulates minimum criteria for several different types of airport license. This includes conditions for issuing licenses for heliports, seaplane bases, day/Visual Flight Rules (VFR) use only airports, and standard airports. For purposes of this Plan, the focus will be on the requirements for a day/VFR use only license, and a standard license. The requirements are similar for either license. The standard license minimum requirements are:

- An effective runway of at least 2,000 feet in each direction
- A minimum runway width of 50 feet
- A runway safety area length equal to the length of the runway plus 100 feet at each end of the runway, or longer
- A runway safety area width of 120 feet or wider, centered on the runway centerline
- An unobstructed approach surface of 15:1 at each end of the runway
- An approach surface that is centered along the runway centerline and that begins at the threshold at a width of 250 feet, expands uniformly for a distance of 2,250 feet to a width of 700 feet, and continues at the width of 700 feet for a distance of 2,750 feet
- An unobstructed runway object free area length equal to the length of the runway, or longer
- A minimum unobstructed runway object free area width of 250 feet or wider, centered on the runway centerline
- If an airport has an approach surface to either end of the runway with an obstruction, it must have a displaced threshold located down the runway at the point where the obstruction clearance plane intersects the runway centerline.

The minimum requirements for a day/VFR use only are the same as those listed above with two notable exceptions:

- The approach surface is centered along the runway centerline and that begins at the threshold at a width of 120 feet, expands uniformly for a distance of 500 feet to a width of 300 feet, and continues at the width of 300 feet for a distance of 2,500 feet.
- There is no runway object free area requirement.
- There is no requirement for a displaced threshold for obstructions in the approach surface.

As stipulated in Code of Virginia § 5.1-7 *Licensing of airports and landing areas*, any airport with a license issued before October 1, 1995, that did not meet one or more of the above listed criteria is exempt from that requirement. Subsequent analysis will call out those airports that are grandfathered under this exemption.

Basic Airport Unit

In December 2004, the Virginia Aviation Board (VAB) passed a resolution defining the facilities that comprise the Basic Airport Unit. Those facilities consist of:

- Runway
- Airport lighting system
- Visual navigational aids
- Stub taxiway
- Aircraft parking apron
- Terminal facility
- Automobile parking
- Airport access road
- Fuel facility
- A terminal that provides adequate shelter from inclement weather, electric lighting, accessible public phone, and restroom facilities.

Source: Heather Ream.

The Basic Airport Unit does not define any minimum size or quantity for any of these facilities. The only stipulation is that a system airport should have these facilities. Subsequent analysis will assess the system airports that meet the definition of the Basic Airport Unit and document those airports that are lacking any of these facilities.

Summary

The Virginia aviation system consists of 66 airports that support numerous types of aviation activity throughout the state. These airports may be classified into various roles through the NPIAS, and these classification systems suit the purposes for which they were intended. However, DOAV has used its own system of airport roles to address its purposes. Because of changing conditions, DOAV recognized the need to revisit its airport roles and decide whether changes were needed. DOAV examined how other states made use of their airport role classifications and system plans, with a particular focus on how those airport roles were used to allocate funding.

After assessing the Virginia aviation environment, DOAV determined that it could better serve aviation users by revising its process for assigning airport roles. It also concluded that four airport roles would best serve the aviation system:

- Commercial Service Airport
- Regional Business Airport
- Community Business Airport
- Local Service Airport

These airport roles will assist DOAV in evaluating the performance of the Virginia aviation system, both at the individual airport level and the system as a whole. Through the use of judiciously assigned facility, equipment, and service targets, each airport will be assessed for how suitable it is for its assigned role. This will also aid DOAV in identifying potential facility improvements that could enhance the performance of Virginia's aviation system.

DOAV is also responsible for the licensing of airports in Virginia. Part of the licensing process involves ensuring that airports meet certain minimum requirements that primarily focus on maintaining safe operating conditions at the airports. DOAV is supportive of Virginia Airports meeting Basic Airport Unit standards. These are facilities that the VAB determined should be found at each Virginia airport. Subsequent analysis will ascertain whether Virginia's airports are meeting these standards.

Chapter 4: Issues Affecting Virginia Airports

The aviation industry has seen major changes over the last decade and continues to adapt to new business models, aircraft types, and technological innovations. Airports and state aviation systems across the country are facing significant issues across a variety of areas. At the forefront are the continuing efforts to recover from the COVID-19 pandemic and manage the safety, security, and underlying health of the aviation system to ensure continued economic growth and sustainability. In addition to this, Virginia airports and the Virginia Department of Aviation (DOAV) are also well positioned to be leaders in the integration of Uncrewed Aircraft Systems (UASs) and Advanced/Urban Air Mobility (AAM/UAM) concepts into existing airspace and airport infrastructure. Vertiports, futuristic aircraft design concepts, and sustainable aviation fuels are expected to bring substantial changes to airport and airspace operations in Virginia. These and other advanced airport and Air Traffic Management (ATM) concepts are supported by the continuous adoption of Next Generation Air Transportation System (NextGen) systems and technologies, including artificial intelligence (AI) and machine learning (ML) strategies for data analytics purposes and to improve operations and management across the aviation system. These emerging technologies will have impacts on operational procedures, regulatory policy and guidance, investment planning, and the supporting infrastructure. The current near-term issues that impact Virginia airports are:

- COVID-19 Pandemic Recovery Impacts
- Uncrewed Aircraft Systems
- Advanced Air Mobility
- Vertiports
- UAS Traffic Management
- Remote Towers
- Electric Vehicles
- Future Aircraft Concepts
- Sustainable Aviation Fuels
- NextGen Concepts and Systems
- Artificial Intelligence and Machine Learning

Each of these topics is discussed in more detail below.

COVID-19 Pandemic Recovery

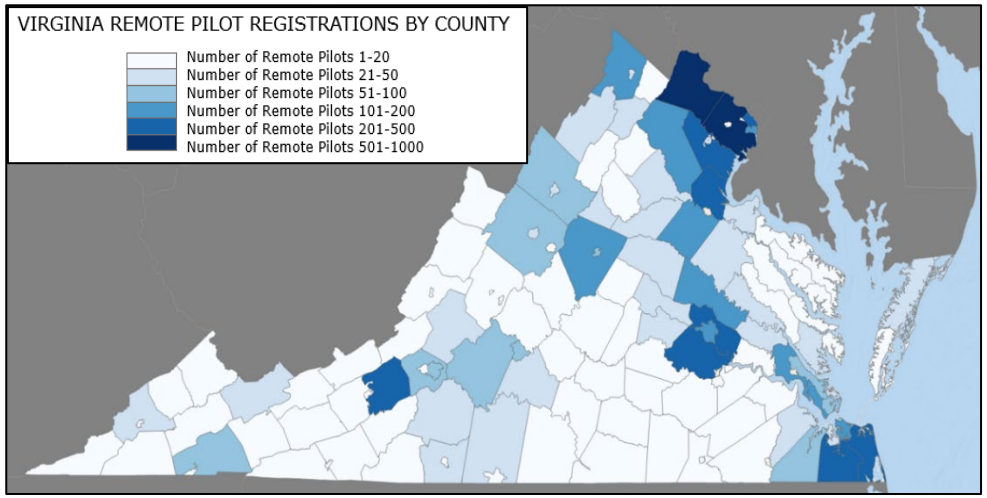
Since the beginning of the COVID-19 pandemic in 2020, airports in Virginia and across the country have seen severe impacts on passenger travel demand and resulting airline service. According to a recent International Civil Aviation Organization (ICAO) Economic Impact Study published early in 2022, total domestic U.S. airline seat capacity is still 10 percent to 15 percent below 2019 levels with the international market nearly 25 percent lower. With the Delta and Omicron variants prevalent across the world, international travel restrictions and advisories are expected to remain in place at least through early 2023, further slowing the recovery of the aviation sector in the United States.

Although aviation demand forecasting has been difficult given the continued impacts and re-emergence of COVID variants, the overall Virginia air transportation system appears to be on track for a recovery. The impacts on Virginia general aviation (GA) airports have largely been negligible, and, while business-related GA travel in large urban areas has seen some reduction in demand, activity in smaller and more rural areas seems to have recovered to nearly 2019 levels. The topics of airport and air travel demand are discussed in detail in **Chapter 5**.

Airports and operators – commercial service and GA – are managing the myriad of COVID-19 restrictions and guidelines that have been imposed by various federal and state agencies. Commercial service airports have implemented policies and developed pandemic preparedness plans to minimize future impacts on passenger safety and ultimately travel demand.

Uncrewed Aircraft Systems (UAS)

The demand for UAS operations has seen a significant increase in Virginia over the last several years. Virginia has been a leader in UAS research, development, and implementation for over a decade and continues to embrace the integration of the various platforms into the recreational and commercial market. The commitment to advance the integration of UAS into day-to-day operations is documented in the 2014 report *The Future of Unmanned Vehicle Systems in Virginia.* Further economic and aviation system benefits are explored in the *Commonwealth of Virginia Unmanned Aerial Systems Strategic Economic Development Plan* published in 2017. Both of these reports reinforce the commitment of the Commonwealth to advancing the use and integration of UAS operations and the economic benefits to be gained.



Source: Cignus, LLC.

Figure 4-1: FAA Remote Pilot Registrations by County

UAS operations and users are divided into recreational and commercial with federal and state guidance and policies further delineated by uncrewed aerial vehicle (UAV) weight. Federal guidance under 14 CFR Part 107 specifies that commercial operators gain a remote aircraft pilot certification registered with the Federal Aviation Administration (FAA) and that recreational users pass the FAA TRUST certification – or recreational drone license – test before flying uncrewed aerial vehicles (UAV). To date, the FAA lists more than 860,000 drone registrations and 260,000 registered remote pilots across the country. More than 7,000 active remote pilot certifications are listed across Virginia. The majority of these pilots are registered in large metropolitan areas including Washington, D.C., Richmond, Norfolk, and Charlottesville. County registrations – as illustrated in **Figure 4-1** – show the highest number of registrations in Northern Virginia's Fairfax and Loudoun counties.

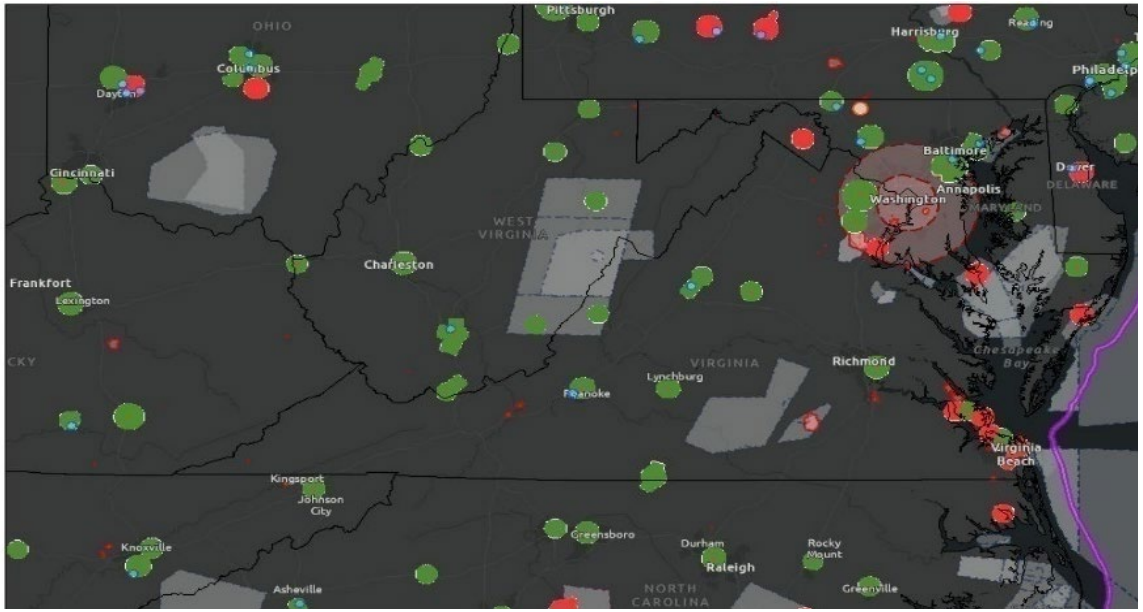
A UAS is the combination of UAV – alternatively called a drone – with a ground control station, or GCS, which manages the operation and communication with the UAV. The GCS also manages communication with external elements including air traffic control (ATC) if necessary. Airframes classified as small UASs (sUAS) can weigh up to 55 lbs. with larger platforms requiring registration as traditional aircraft under 14 CFR Part 47. Flights in Class G (uncontrolled) airspace below 400 feet are generally allowed with the exception of certain airspace. Flights in controlled airspace (Class B, C, D, and E) are only allowed with prior FAA authorization from the FAA's Low Altitude Authorization and Notification Capability (LAANC) or DroneZone. LAANC is available at 726 airports nationwide, including these 10 Virginia airports:

- Charlottesville-Albemarle (CHO)
- Danville Regional (DAN)
- Ingalls Field (HSP)
- Lynchburg Regional/Preston Glenn Field (LYH)
- Norfolk International (ORF)
- Shenandoah Valley Regional (SHD)
- Newport News-Williamsburg (PHF)
- Richmond International (RIC)
- Roanoke-Blacksburg Regional/Woodrum Field (ROA)
- Washington Dulles International (IAD)

The FAA manages and monitors access to airspace for UASs through an industry partnership with several service providers and through a web portal called B4UFly (https://b4ufly.aloft.ai/). This portal provides drone operators with no-fly zones as well as other flight guidance based on location including boundaries for Special Use Areas, Temporary Flight Restrictions (TFRs), national parks, Class B/C/D controlled airspace, and LAANC managed airspace. **Figure 4-2** provides a snapshot of the B4UFly website focused on Virginia with LAANC managed airspace marked in green and no-fly zones in gray colors. Virginia UAS operators should also consult the Virginia Flight Information Exchange (VA-FIX) program that provides state and local data to UAS service suppliers and pilots for improved planning and safety analysis.

The use of UASs across the state for recreational and commercial purposes is growing, even with state and local agencies. In addition to traditional hobby sUAS operators, commercial applications and demand have increased significantly over the last five years. This includes research and development, training, and operational platforms for:

- Real Estate and Insurance
- Construction Inspections
- Urban Planning Studies
- News/Entertainment
- Agricultural/Forestry/Land Monitoring
- Law Enforcement
- Disaster Response



Source: FAA UAS Data on a Map.

Figure 4-2: FAA No-Fly Zones including LAANC

To mitigate the impacts of commercial and recreational UASs on airport operations, more airports may want to consider integrating with the FAA's LAANC platform to manage UAS airspace reservations and restrictions more proactively in the airport vicinity. In addition to these wide-spread applications for commercial UASs, several airports have started to extend the use of UAS to on-airport applications. Six of the Virginia airports that participated in the survey indicated a based UAS presence on the airport. Several others noted increasing levels of near airport UAS activity, with two airports, Front Royal – Warren County (FRR) and Allen C Perkinson Blackstone AAF (BKT), indicating that they host UAV and UAS test locations. In the case of FRR, the airport is host to a commercial manufacturing, testing, and training facility for a service provider and original equipment manufacturer of UAS with a focus on airfield inspections. At BKT, a UAS support services, research and development (R&D), and logistics facility is located on airport property, primarily to support military R&D, operations, and training.

Although UAS operations on or near airports will likely be overseen by commercial entities with significant hands-on experience, airports still need to understand the operational impacts and safety risks associated with such applications and have knowledgeable staff on hand to oversee studies and manage operational risks.

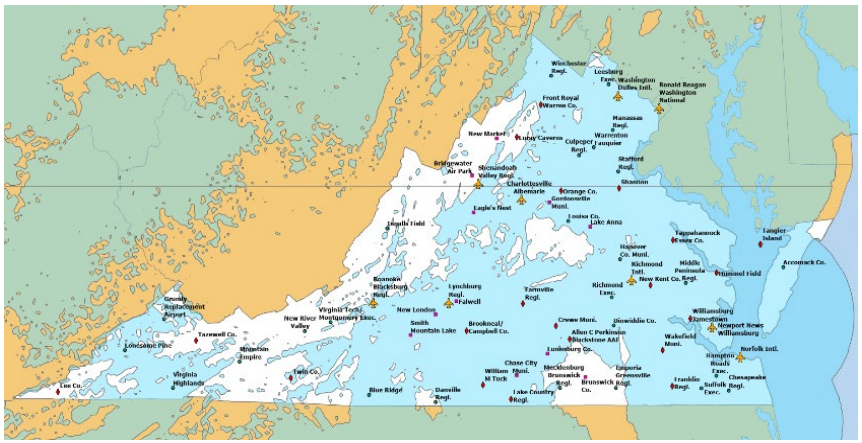
Other on airport applications include the use of UASs to conduct infrastructure and airplane inspections. In fact, three airports indicated that they are currently using UASs for runway inspections. Compared to manual inspections, aerial inspections using UAVs can provide higher accuracy information much faster using AI/ML to analyze airport imagery data and provide geospatial visualizations. The same company that operates at FRR is also working with the FAA to define repeatable standardized processes and procedures for using sUAS to supplement pavement management inspections using drone-mounted sensors for the delineating, analyzing, maintaining, and reporting of airport pavement data. In response to the growing UAS market and to ensure continued oversight, DOAV in 2019 developed a detailed report entitled *Unmanned Aircraft System (UAS) 2019 Guide for Virginia Airports.* This document provided detailed regulatory, security, safety, and management guidance for airport operators regarding sUAS operations on airport property. It also provided checklists for on-airport and near-airport sUAS operators including information on counter UAS technologies. Other potential airport-centric uses for UASs include

Source: DOAV.

on-airport deliveries, perimeter security, animal control, and flight/navigation system testing and verification. However, none of these other uses were noted by Commonwealth airports in the survey.

Virginia is host to one of seven official UAS Test Sites, called the Mid-Atlantic Aviation Partnership (MAAP), designated by the FAA at Virginia Polytechnic Institute & State University. The R&D system currently in place with MAAP provides an ideal conduit for UAS innovation in terms of communication, navigation, and surveillance technologies and advanced safety and operational concepts for the advancement of UAS integration in the National Airspace System (NAS). Areas that continue to show a heavy research focus include enhanced UAS detect and avoid systems, surveillance/navigation systems, and risk/safety management, ultimately with a view on longer range beyond visual line of sight (BVLOS) operations. Many of the technologies, procedures, and policies being developed for uncrewed aircraft will eventually feed into the integration of AAM/UAM operations into the NAS, which is expected to use a phased approach. Integration is expected to gradually evolve from initial proof-of-concept operations to a highly automated environment capable of high density and complex operations. The National Aeronautics and Space Administration (NASA) has outlined this phased approach using UAM Maturity Levels (UML) 1 through 6. To address initial NAS integration requirements and impacts, the FAA has similarly introduced a UAM Concept of Operations (Version 1.0 in 2020) that defines notional UAM use cases and proposed UAM operating environments. The current FAA concept includes the use of dedicated UAM airspace corridors, self-separation concepts, and integration with – and evolution of – the existing UTM system for automation and traffic management services.

As technologies, policies, and operating concepts mature, AAM stakeholders will need to adapt to changing requirements for infrastructure, procedures, and intermodal integration. Although the UTM platform is evolving through continued growth in UAS operations, issues with communication, navigation, and surveillance capabilities still need to be resolved to enable higher density and more complex AAM operations. For instance, issues with frequency saturation, message security, Automatic Dependent Surveillance – Broadcast (ADS-B) coverage, and overall UAS Traffic Management (UTM) system capacity will need to be addressed by federal and state authorities as well as local airports. Specifically, low altitude ADS-B coverage gaps in suburban areas may limit UTM system functions and impact operations. As AAM vehicles are expected to operate just above the 400-foot UAS ceiling, ADS-B coverage between 500 and 1,000 feet may be critical to enable broader geographic operations in a safe manner. As **Figure 4-3** shows, ADS-B service capabilities at 500 feet above ground level (AGL), depicted as the shaded blue areas, are well established on the eastern side of Virginia, but some mountainous and rural areas still lack full ADS-B coverage.



Source: FAA.

Figure 4-3: ADS-B Coverage at 500' AGL

Current research continues to focus on the localized impacts of high density AAM operations surrounding vertiports where ADS-B bandwidth is expected to be problematic for higher density operations. Alternatives including long range Wi-Fi and other Internet Protocol-based networking solutions are some of the concepts currently under consideration for high-density AAM operations.

Many of the guidelines required for a broader adoption of UAS operations across airports and the NAS are still being developed by federal/state governments alike. For instance, FAA recommendations on BVLOS operations were published in March 2022 through an

Advisory Rulemaking Committee (ARC) publication. Since only select larger UAS platforms are allowed to use ADS-B Out capabilities due to anticipated frequency saturation problems in high density airspace, Remote ID is designed to provide a limited range (Wi-Fi/Bluetooth) broadcast capability for other vehicles, law enforcement, and other interested parties to locate and identify UAVs.

The ARC publication also recommends changes to FAA regulations, approaches, licensing, sense and avoid technologies, and other aspects to ensure a risk-based and safer integration of UAS operations with manned aircraft. Historically, the FAA has allowed industry to drive UAS business, technology, and integration concepts. With the anticipation of UAS operations becoming more complex, extending their range, and increasing the density of operations, regulations and equipment requirements still need to be formalized and the UTM needs to take on a larger role in terms of traffic, safety, and service management.

Advanced Air Mobility (AAM)

The concept of AAM is focused on the broad integration of electric vertical takeoff and landing (eVTOL) aircraft into the NAS. In many ways, AAM is essentially a scaled-up version of UASs in terms of vehicle size, supporting infrastructure, and automation systems required to ensure safe and efficient integration. In fact, AAM operations are expected to operate just above the current UAS altitude restriction of 400 feet using dedicated corridors to safely segregate vehicles and operations with commercial, military, and GA traffic. Depending on range and function, AAM operations can generally be segregated into UAM or Regional Air Mobility (RAM) concepts and, although initially expected to be piloted, can eventually also include uncrewed mobility platforms. Operational characteristics and use cases for each concept include:

Urban Air Mobility (UAM)	Regional Air Mobility (RAM)	Uncrewed Aircraft Systems (UAS)
• Local operations near metropolitan areas • Novel vertiport infrastructure • eVTOL and potentially short/conventional takeoff and landing vehicles • Limited passenger capacity (up to 4)	• Regional operations between metropolitan areas • Partially based at smaller airports • Longer range electric conventional/short takeoff and landing (eCTOL/eSTOL) aircraft • Larger capacity focused on regional connector market	• Local commercial work or cargo delivery • Operate from vertiports, airports, and smaller control stations • Typically, eVTOL aircraft

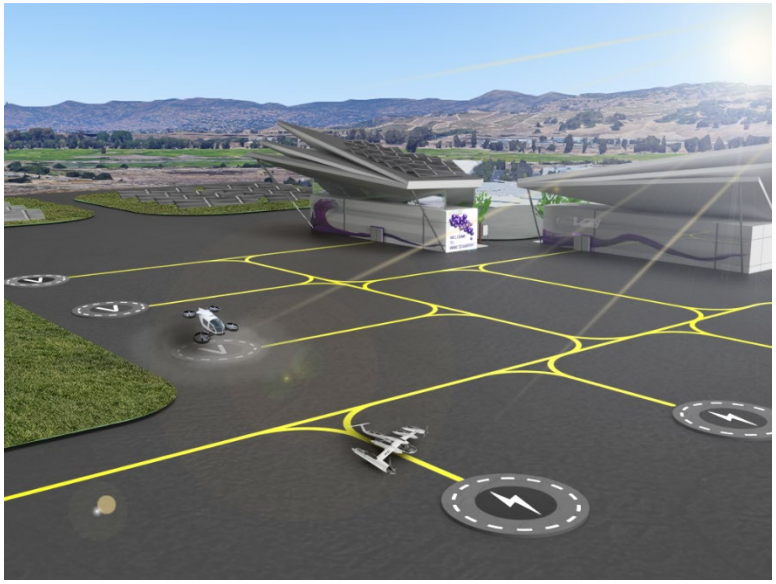
NASA has been spearheading the integration of AAM for many years and continues to support the development of aircraft vehicle platforms, traffic management systems, and operational procedures for a variety of AAM use cases, including:

- Passenger transportation and air taxi applications
- Cargo/package delivery
- Emergency services and public interest, including air ambulance and Emergency Medical Transport (EMT)
- Aerial services, including infrastructure inspection and photography.

The first AAM use cases based on emerging eVTOL vehicles will likely include cargo and medical transport services, with passenger transport following soon thereafter. The introduction of air taxi and commuter platforms at competitive prices as well as airline plans to use AAM platforms to feed hub airport demand alone promise to change how the public thinks about transportation options. Vehicle types will vary by market and range and are expected to include eVTOL as well as eCTOL and eSTOL aircraft.

Although detailed standards and guidance are still under development by NASA and the FAA, the amount of use cases, vehicle designs, and vertiport development concepts are rapidly growing. This will require attention from state and local agencies to ensure that federal planning and policy requirements align with regional implementation strategies and industry needs.

Nevertheless, there are many questions that airports need to ask themselves in terms of land availability, vertiport location, integration with existing operations, security, electrical infrastructure, and connectivity to existing terminals or other modes of transportation. Underutilized airports may be able to promote the use of their facilities for eVTOL aircraft. But, to ensure sustainable AAM operations, airports should define their individual business cases and economic impacts for hosting AAM vehicles and services. This may include collaborating with existing airport fixed base operators (FBOs) given their expertise in providing these services today.



Source: Mead & Hunt, Inc.

According to the survey conducted across all Virginia airports, more than half (39 airports) indicated that they have started to assess the impact of AAM operations on their airfield and electric infrastructure. Most responses indicate a bias towards re-purposing helipads and GA ramps and re-fitting the apron areas with electric charging capabilities. Several Virginia GA airports have indicated that they are considering AAM – or eVTOL – aircraft operations at their facilities. A vast majority of Virginia airports are within range of Virginia's major metropolitan areas, which opens up the commuter transport and regional mobility markets across most of central and eastern Virginia. Considering anticipated AAM ranges of 75 and 150 nautical miles (nm) based on proposed vehicle type designs for the UAM market, one way commute distances of 30nm and 75nm are likely to represent common use cases. This provides access to metropolitan areas located on Virginia's eastern shores to nearly 70 percent (within 30nm) and 81 percent (within 75nm) of the total Virginia population. The cost of procuring land for dedicated vertiports in urban areas may be substantial. Even heliport conversions or the use of existing airport facilities will require significant electrical infrastructure upgrades and updated security protocols. Much of this will only be feasible with public-private partnerships (P3) or other cooperative ventures, which presents an opportunity for Virginia to shape the local AAM environment. An increased burden on the electrical infrastructure for battery charging presents a pathway to use alternative and sustainable energy sources. This may also provide an additional opportunity for P3 to offset installation and maintenance costs.

AAM vehicles are being developed by several companies – including large aerospace manufacturers such as Boeing and Airbus – and business plans are in place for operators to capitalize on this emerging market. Aircraft manufacturing companies are targeting certification, testing, and initial entry to the market as early as 2024. Given the vehicles being introduced, early adoption is expected to focus on markets within 75nm of urban centers prioritizing cargo, medical flights, and air taxi connector operations to/from urban areas and airports. In fact, major airlines, including United Airlines and American Airlines, have already committed significant funding to AAM vehicle manufacturers such as Archer and Vertical Aerospace for aircraft to support regional connectivity with their hub airports.

The introduction of eVTOL aircraft will likely have a larger impact on Virginia airports and the aviation system in terms of necessary ground infrastructure for power generation and electric vehicle charging capabilities. Although historically electric aircraft have seen issues with range and flight endurance primarily due to battery capabilities, improved battery technologies and vehicle platforms are starting to be introduced as part of AAM concepts. These eVTOL aircraft are expected to operate across the state at existing airports, heliports, and newly developed vertiports in urban and sub-urban areas. Given the strategic locations of airports across Virginia and the existing infrastructure for passenger travel, it is likely that AAM companies and operators may lean towards operating out of these existing facilities for inter-city and regional travel.

Source: Mead & Hunt, Inc.

Hosting eVTOL aircraft at airports requires strategic planning regarding the integration of battery charging stations with the existing airport electrical infrastructure. A combination of low voltage and rapid charging stations will be needed to service AAM/UAM vehicles. The airport survey showed that 23 percent (or 15 out of Virginia's 66 airports) are currently planning for the integration of eVTOL aircraft, both in terms of electrical infrastructure and hangar and parking spaces dedicated to these types of operations.

The introduction of new AAM/UAM operational concepts and technologies also requires specialized skills and a supporting workforce. Several universities in Virginia already offer specializations in UASs that include the design, manufacture, and maintenance of electric aircraft, batteries, and supporting infrastructure. The need for these skills will only increase when eVTOL vehicles finally take off.

The need for renewable and sustainable energy to support the growth of UAS and AAM/UAM operations provides an opportunity for airports to leverage airport-owned land and infrastructure for revenue generation. This includes offsetting electricity grid requirements with sustainable on-airport energy generation such as solar farms. Although only one airport in Virginia, Warrenton-Fauquier (HWY), noted the use of solar and geothermal power for on-airport purposes, airports across the state could see benefits from integrating these sustainable energy sources into their infrastructure. The installation of these types of sustainable power sources is a significant capital expenditure that might not be covered by federal or state funds but may be offset by additional airport charges and P3s.

Vertiports

One of the prominent factors that will impact transportation planning at the local and regional levels is the introduction of vertiports into the existing airport and airspace infrastructure. Vertiports are dedicated AAM operating hubs that provide passenger movement facilities along with takeoff/landing, vehicle storage, and battery charging capabilities. The initial expectation is that AAM operations will focus on reusing or repurposing existing GA apron and heliport facilities that have already been approved by the FAA. However, several companies are already working on designs and concepts for dedicated vertiports in major metropolitan areas around the country, including the re-purposing of existing heliports on high-rise buildings. Larger facilities with multiple vertiports operating as AAM hubs in close proximity, also called vertiplexes, with highly integrated arrival and departure operations are also envisioned as demand grows.

To address the growing need for regulatory guidance in the development of vertiports, the FAA's Office of Airports is developing a new vertiport Advisory Circular (AC) specifically for eVTOL aircraft. Engineering Brief No. 105 – "Vertiport Design" was published in March 2022 with final guidance expected in the coming years. The EB provides interim guidance for existing safety-critical vertiport elements and is intended for manned VTOL operations in visual flight rule (VFR) conditions using specific aircraft performance and design criteria. The final AC is expected to provide expanded guidance on advanced operations including autonomy, different propulsion methods, instrument flight rule (IFR) conditions, and more aircraft types and performance characteristics. NASA is also working on integrated traffic management systems and applications for vertiports, which will eventually be deployed to the UTM platform. Both the FAA and NASA are actively conducting research into AAM operational concepts, technologies, safety, and traffic management concepts to support future operations and regulatory guidance.

Vertiports, whether based on existing facilities or newly developed, are an integral part of the AAM system. Aviation and transportation planners will need to adapt to vertiport design strategies that cater to different business processes, vehicle types, and operating procedures. Some of the areas that will require attention are:

Source: DOAV.

- **On-Airport versus Purpose-Built Vertiports.** Land availability may dictate where vertiports are developed. Vertiports located on airport property may benefit from existing airport and FBO facilities and the close proximity to passenger terminals but may be limited by existing operations. Newly developed vertiports have more freedom in terms of operations but may need to adapt their business models to the given location, facility services, and connectivity to other modes of transport.
- **Airport Airside versus Landside.** Depending on airport land availability and business concepts, vertiports may be located either airside or landside. Benefits exist for both locations in terms of intermodal connectivity, security, regulatory impacts, and supporting infrastructure. Airside vertiports will need to ensure segregation between AAM vehicles and fixed-wing aircraft and will have to observe airport obstacle free areas. Siting of vertiports on airport property will be critical to minimizing impacts on existing

operations while enabling efficient connectivity between takeoff/landing pads and existing terminal facilities. Landside vertiports may require completely new planning in terms of integration with airport operations. The survey conducted for this effort indicates a bias towards re-using airside facilities in terms of existing GA and FBO aprons as well as on-airport heliports. This is likely because airport operators understand the impacts of increased flight operations and demand on the airfield and GA/FBO operators have already shown a willingness to adopt AAM operational concepts. Landside vertiports, on the other hand, still require analysis in terms of operational and safety impacts, connectivity to airside operations, and commercial viability.

- **System Automation and Information Management.** Virginia has several metropolitan areas that are candidates for AAM operations in an urban and suburban setting. Several airports in Virginia are also in ideal locations to consider the development of dedicated vertiports. Given the anticipated future growth in AAM traffic levels, once operations commence in the 2024/25 timeframe, AAM traffic management systems, UTM services, and other aircraft platforms need to be able to access local and regional information on topics such as noise abatement rules, regulatory issues, and intermodal connectivity. Virginia's Flight Information Exchange (VA-FIX) system[2] is an initial step towards supporting automation and traffic management systems. Additional integration projects with regards to information and existing operational systems can ensure situational awareness for AAM operators and maximize aviation safety as demand for AAM grows.
- **Security.** Aircraft and passengers at commercial airport facilities operate within known security boundaries and protocols. Passengers arriving or departing at an airport are generally assumed to have passed security checks at their origin airports. For airside vertiports, security facilities may need to be provided to screen connecting passengers and luggage arriving from other origin vertiports which operate at a lower trust level. Whether these security services are provided by airports or the Transportation Security Administration (TSA) is yet to be determined. For vertiports located landside, security may well be the sole responsibility of airport operators and may depend on the level of federal funding and the relative impacts on airport operations.
- **Supporting infrastructure.** Given the predominant use of eVTOLs at vertiports, electricity may become an issue. Airports and vertiport developers should engage with local authorities and electricity providers to evaluate power grid capabilities at selected locations. Where possible, alternative renewable energy sources can be explored to meet sustainability goals set forth by DOAV and individual airports. Facilities such as weather reporting systems and ground-based systems that augment the existing Global Positioning System (GPS) used for navigation may also need to be adapted to provide more complete and accurate data and handle higher frequency operations and increasingly mobile and maneuverable air vehicles. Aircraft rescue and firefighting equipment, training, and procedures will need to be updated to consider a predominantly electric infrastructure with potential future hybrid fuel sources for eVTOL aircraft on the horizon.
- **Noise and Environmental Impacts.** Although AAM vehicles are expected to predominantly use electric propulsion methods, noise concerns and environmental impacts associated with operations, battery storage, and supporting equipment remain an issue. These will need to be managed across all stakeholders including DOAV, local officials and agencies, and vertiport operators.
- **Land Use and Permitting.** Whether adapting existing heliports for eVTOL operations or designing new vertiports at existing airports or dedicated locations, DOAV and other Virginia regulatory agencies will be required to issue operating licenses. Building and fire codes may need to be updated to address large scale

Source: Richard Lewis.

[2] The VA-FIX pilot program promotes safety and open access to information for UAS stakeholders by providing state and local government information on key safety and policy concerns regarding the integration of UAS operations into the NAS. See https://doav.virginia.gov/programs-and-services/aviation-technology/virginia-flight-information-exchange/ for more information.

battery storage and power infrastructure. Land use and zoning plans and practices may also need to be adapted to address novel commercial business types. Greater involvement with metropolitan planning organizations and planning district commissions will be necessary to address land use issues as they become more pressing.

- **Funding.** Significant investments into AAM technologies and vertiports have already been made by a variety of aviation industry stakeholders. A majority of these investments assume privately owned vertiport infrastructures with some potential for vertiports owned by aircraft manufacturers or maintenance, repair, and overhaul facilities. Irrespective of the ownership, vertiports will likely challenge power grids in a similar manner to electric vehicles. Several survey responses indicated current or planned infrastructure upgrades to provide electric charging stations at GA, FBO, and corporate hanger locations. Based on the survey responses, some airports have also started to explore partnerships with commercial businesses to install and manage electric charging stations, mainly for dedicated R&D sites. Vertiport supporting infrastructure, security services, intermodal connectivity, and other factors similar to airports will also need to be funded and managed.
- **Community Integration.** AAM operations will undoubtedly have a large impact on the community in terms of travel options, connectivity, and alternative delivery services. Although aircraft designs are predominantly electric, noise concerns, environmental impacts, and public perception remain significant factors to consider. NASA has been spearheading a community outreach initiative and is also working on community integration platforms to ensure that the general public is educated on AAM designs, operational impacts, and safety concerns. Local and state governments may also consider more targeted community outreach efforts and platforms to address and manage AAM operational, safety, and community impacts.

Vertiports do not operate in a vacuum and require passenger connectivity to other modes of transportation. Akin to electrical infrastructure, this factor should be a consideration when determining the location and size of vertiports and an early discussion point with local and state agencies.

UAS Traffic Management (UTM)

The backend infrastructure that supports UAS operations in the NAS is the UTM, which is based on a collaboration between several federal agencies and industry stakeholders. UTM manages UAS traffic in the NAS entirely segregated from the FAA's ATM systems. It takes a service-oriented approach where government and industry partners deploy drone registration, airspace reservation, flight management, and supporting service functions and provide access to users, operators, and other integrators. In line with this philosophy, DOAV has recently started to explore VA-FIX as a value-added service to UTM. VA-FIX was designed as a catalyst for collaboration among state and local agencies and UAS industry by creating an open, public information hub that everyone can use. As a software service deployed to UTM and available to operators, VA-FIX has the potential to be adapted for AAM operations and possibly address operational safety, regulatory, and noise concerns in a more dynamic fashion.

Source: DOAV.

The current approach to managing UAS traffic in the NAS is through airspace segregation and reservation. Services deployed to UTM provide registration, notification, and basic traffic management services to stakeholders but refrain from managing individual UAV traffic and trajectories. This is likely because only larger, FAA approved airframes integrate ADS-B Out location broadcasts for traffic management purposes. Smaller UAVs, according to the latest FAA guidance, are only expected to comply with Remote ID requirements to broadcast identification and location information on a local network. As UTM evolves along with AAM/UAM concepts, capabilities to integrate enhanced flight information broadcast over local and 5G cellular networks will likely evolve.

Automated vertiport traffic management systems will require this type of information for traffic sequencing, route planning, and irregular operations management. Community engagement platforms that educate vertiport and eVTOL operators as well as the general public on local/state regulations and procedures may also be helpful to manage concerns. DOAV will also need to continue its involvement with the FAA and UAS industry to ensure that agency priorities are communicated and integrated into the overall UAS system.

Remote Towers

The FAA manages and operates air traffic control towers (ATCT) at many of the nation's busiest airports. These ATCTs are federally staffed and funded. ATCT may also be staffed by private companies licensed under the FAA's Federal Contract Towers (FCT) program. A more recent FAA program called Remote Towers (RT) presents an additional opportunity for smaller non-towered GA airports through the use of fully virtual ATC environments for traffic management and situational awareness.

Currently still in the pilot program stage, the FAA has designated two initial sites for system trials focused on VFR operations at previously non-towered airports: Virginia's Leesburg Executive Airport (JYO) and Northern Colorado Regional (FNL) in Fort Collins, Colorado. As the initial pilot program airport, Leesburg Executive started in 2014 as a P3 between Saab, Virginia SATSLab, and the Town of Leesburg. Having been operational for nearly six years, the FAA's Air Traffic Services organization recently issued its Operational Viability Decision on the Saab Remote Tower system in September 2021, and subsequently has authorized the continued provision of ATC services using the RT system at Leesburg Executive. Northern Colorado Regional Airport is expected to receive an Operational Viability Decision soon using an RT system developed by Searidge Technologies.

Source: Leesburg Executive Airport.

The RT program is expected to progress through additional trial and pilot program stages to assess the viability of RT systems in increasingly complex environments. Following the initial non-towered airport installations operating in VFR meteorological conditions, subsequent pilot programs are anticipated to focus on replacing aging FAA-owned FCTs, and eventually IFR operations. Pilot program test sites are expected to favor the mid-Atlantic region due to their proximity to other FAA facilities.

Source: Leesburg Executive Airport.

Using information collected from these initial pilot programs, the FAA issued, in February 2022, a revised draft AC entitled *Remote Towers (RT) Systems for Non-Federal Applications*, which clarifies the processes and requirements for implementing RT services at single runway airports in Class D airspace environments. Specifically, the AC identifies:

- RT system approval requirements and standards
- Processes used to certify RT systems
- Processes used to commission a non-federal RT facility.

The FAA has also issued a document entitled *Remote Tower (RT) Systems Minimum Functional and Performance Requirements for Non-Federal Applications* (v3.0 in January 2022) to guide future implementations. RT installations also need to consider AC 90-93 *Operating Procedures for ATCT that are not Operated by, or Under Contract with, the United States (Non-Federal)* to ensure minimum operational requirements are considered.

One of the greatest challenges for the RT program has been the assurance of equivalent levels of safety and more directly the integration of safety requirements and the mapping to system requirements, designs, and architectures. Significant focus has been placed on verification and validation efforts to validate concepts, systems, and operations throughout the entire RT implementation

process including system design approvals (SDAs), siting, installation, and commissioning. This focus is also the reason the FAA does not anticipate additional applications for system certifications until standards and guidance have been finalized.

Near-term impacts and implementations of RT systems appear limited across Virginia. Although Leesburg Executive has a certified RT system in operation, the current standards only apply to VFR single runway operations in Class D airspace. This, and the cost and maintenance of installations, are likely the reasons why, according to the survey, only five Virginia airports had considered RT systems.

Although the full range of benefits may not be achievable until RT systems, processes, and guidance have evolved to include FCT and full VFR/IFR conditions, it is clear that RT operations have the potential to improve airports. Expected benefits include cost savings from:

- Reduced control tower facility maintenance and operating costs
- More efficient use of ATC staff through the ability to serve multiple airports
- Limited requirements to maintain local ATM systems in favor of centralized RT systems
- Better level of service to operations outside of core airport hours as well as non-scheduled traffic such as ambulance and search-and-rescue operations.

In addition to these economic benefits, RT systems also present the potential for improving operations at smaller airports, including:

- Improved traffic pattern safety and reduced incident potential
- Improved traffic efficiency and reduced delays
- Reduced airspace conflicts with surrounding facilities

Full scale implementations will require airports to work with system integrators like Saab and Searidge Technologies to assess the feasibility of installing and commissioning at the local level. Given the relatively significant estimated costs of installation, operation, and maintenance, airports may consider funding options through P3 to maximize the potential of RT systems. RT system benefits should also be considered alongside of anticipated AAM operations at airports across Virginia, although these combined impacts have yet to be fully explored.

Another potential opportunity is increased involvement with upcoming FAA Remote Tower pilot programs, which will focus on replacing existing FCTs with RTs. There are only two FCTs in Virginia: Charlottesville-Albemarle (CHO) and Lynchburg Regional/Preston Glenn Field (LYH). Out of these two FCTs, Charlottesville-Albemarle may present the best opportunity to replace an aging facility with an updated RT system. The proximity to Washington, D.C. may also favor Virginia facilities for the next RT pilot program stages.

Source: DOAV.

Electric Vehicles

Sustainability is a key focus area for many airports and the aviation industry as a whole. This was recognized by DOAV in a 2016 report entitled *Virginia Airports Sustainability Management Plan,* which provided a strategic approach to airport planning, development, asset management, and resource protection, including financial, environmental, community relations, and other factors. Under the energy and emissions focus areas, energy efficiency, alternative transportation fuels, and on-airport energy generation were noted as key enablers to support sustainability practices. Until recently, electric vehicle platforms were limited to automobiles and ground support vehicles. However, aircraft manufacturers, along with federal agencies such as NASA and the FAA, are working on the development, manufacturing, and integration of electric aircraft into the NAS.

Electric Aircraft

The development of electric aircraft offers potential benefits including:

- Reduced emissions and improved air quality
- Reduced on/off-airport noise
- Reduced maintenance and ownership costs.

The continued integration of electric aircraft and vehicles will require more robust connections to the Virginia electrical grid for battery recharging stations. Charging stations can be configured to be low voltage or rapid charge capable depending on the application, customer needs, battery life expectancy, and the airport connections to the electrical grid. As business cases mature for AAM/UAM operations, commercial battery charging, and maintenance facilities may appear near designated vertiport locations that provide charging and replacement services using a mix of rapid and slow charging technologies.

Both electric ground and air vehicle applications are expected to grow in demand, particularly as on-airport UAS applications and AAM/UAM grow. This electrical infrastructure needs to be able to integrate fast and slow charging solutions at select locations on the airfield and designated facilities or hangars. Airports should ensure that appropriately sized power connections to the main power grid in combination with sustainable energy sources support this infrastructure.

Electric Ground Vehicles

Many airports across Virginia are already using electrically powered ground support equipment (GSE). The airport survey showed that nearly 25 percent of all airports have already adopted the use of battery powered vehicles for GSE. These platforms are clean and cost-effective alternatives to internal combustion vehicles that can be used across the airport for tugs/tows, refueling, and baggage carts. When considering the integration of electric GSEs, airports should consider a strategic and phased implementation approach that considers the life cycles of existing GSE along with needed updates to electrical infrastructure, regulations, and operational needs and configurations. Combinations of rapid-charging and opportunity-charging points across the airport should be considered to minimize downtime and reduce implementation and maintenance costs.

Source: Heather Ream.

Airports with the need for landside transportation are also starting to integrate electric buses and shuttles. In March 2022, Washington Dulles International Airport announced the purchase of zero-emission electric buses as a replacement to the existing diesel-powered fleet. These buses can operate throughout an entire shift without the need to recharge.

Additional landside applications for charging stations are focused on parking structures for personal electric vehicles (EVs). As the use of EVs and hybrid vehicles continues to grow, airports are also expanding the amount of parking spaces that provide electric charging ports. According to the survey, eight Virginia airports offer electric charging capabilities throughout their parking structures. This includes primarily the large commercial airports such as Dulles International (IAD), Ronald Reagan National (DCA), Richmond International (RIC), and Norfolk International (ORF), but smaller airports such as Lynchburg Regional (LYH) and Warrenton-Fauquier (HWY) are also following suit. An even split of rapid versus

low voltage charging capabilities have been observed across all Virginia airports that have implemented these charging stations in their parking structures. There appears to be a bias towards the use of rapid charging stations for EVs, based on observed airport parking preferences and the relatively small difference in costs associated with installation. Shenandoah Valley Regional Airport (SHD) installed slow charging stations and found one advantage was that nearby interstate travelers did not stop in for a recharge because of the time necessary. But the long charging time was perfectly suited for airport travelers that were leaving their vehicles in parking for multiple days. The benefit of reducing environmental footprints is an opportunity that many airports are already embracing. The conversion of existing gasoline powered vehicles into electric equivalents is an ongoing effort that has already been observed at airports across the Commonwealth. These efforts support the Commonwealths sustainability goals and a continued commitment to the environment.

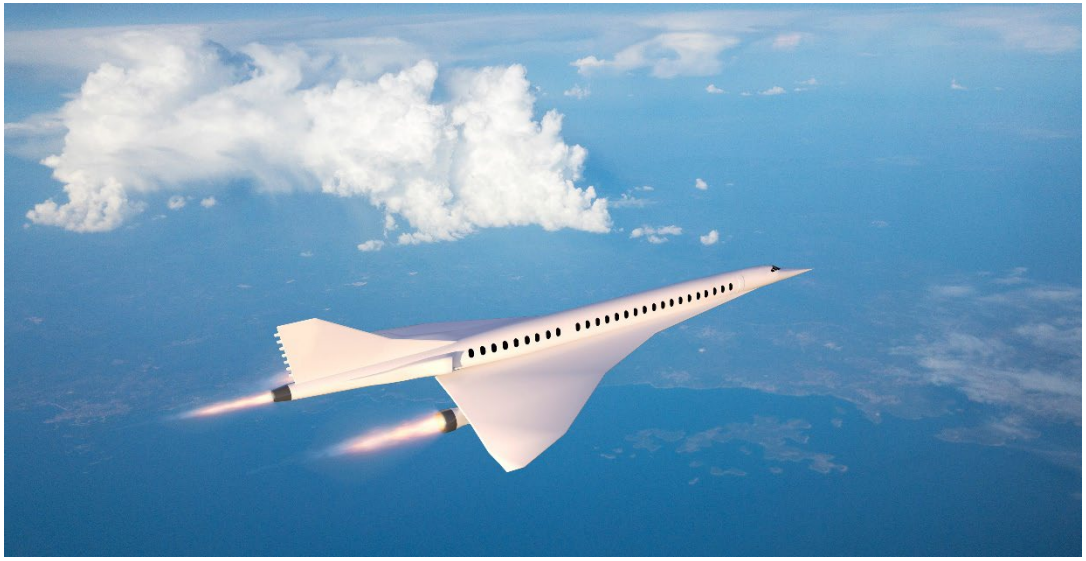
Future Aircraft Concepts

In addition to the introduction of AAM aircraft into the NAS and the development of vertiports across Virginia, other new aircraft concepts may change airport planning and operations. One such example is airlines re-introducing supersonic aircraft to commercial service airports. In 2021, United Airlines made a commitment to purchase a series of aircraft from Boom Supersonic with an anticipated introduction date set in 2029. The Boom Overture aircraft has a seating capacity similar to a regional jet, but the airframe and aircraft design is adapted to supersonic flight. The current expectation is that supersonic aircraft will operate much like conventional commercial aircraft at and near airports and only fly at supersonic speeds at higher altitudes across the NAS.

To prepare for new supersonic aircraft and enable a more wide-spread use, NASA is currently investigating the impacts of supersonic flight over the continental United States. Previously only certified in oceanic airspace due to sonic boom impacts, current NASA research is focused on mitigating and managing these noise impacts overpopulated areas using novel designs and procedures.

A more fundamental change that may impact airspace and airport operations across the country is likely to be the continued growth and evolution of the commercial space transportation industry. The demand for space vehicles using vertical launch and recovery platforms is expected to grow over the coming decades to support a variety of business ventures including orbital supply missions, space exploration, and space tourism. This includes existing and planned launch operations at Virginia's Mid-Atlantic Regional Spaceport, one of nearly two dozen spaceports licensed by the FAA across the United States. Additional horizontal take-off and landing vehicles are also currently being developed and tested, which have the potential of greatly reducing the cost of access to orbit. The use of existing airport runways and adapted supporting infrastructure and facilities for space vehicles may create new opportunities and business cases for GA airports.

For either of these operational concepts and business cases, a forward-thinking focus on operational and technological sustainability and relevant community impacts is needed to ensure successful early-stage adoption and continued growth.



Source: Mead & Hunt, Inc.

Sustainable Aviation Fuels

According to the U.S. Department of Energy (DOE), sustainable aviation fuel (SAF) reduces greenhouse gas (GHG) emissions compared to conventional piston and jet fuel options. In fact, existing piston-engine fuels still contain lead, but are slowly being replaced with lead-free options. According to the Environmental Protection Agency (EPA), GHG emissions have generally shown a decline across the aviation industry when compared to 1990 (even at the pre-Covid levels). But SAF has the potential to significantly reduce the aviation GHG footprint, which currently makes up 9 percent to 12 percent of U.S. transportation GHG emissions (see https://www.epa.gov/system/files/documents/2022-05/420f22018.pdf).

On the GA front, the FAA has been working with industry stakeholders including aircraft manufacturers, fuel suppliers, and the EPA to develop and commercialize new lead-free high-octane alternatives to avgas 100 low lead (LL) since 2010 through industry groups such as the Piston Aviation Fuel Initiative. Based on these efforts, nearly 70 percent of GA power plants are now qualified for drop-in unleaded fuel. However, the remaining 30 percent of engines, all of which require higher octane fuel, account for nearly 80 percent of the total avgas use across the Unites States, leaving a large part of the fleet waiting for more environmentally friendly fuel options. The challenge to find a successful and safe alternative that is equally acceptable and desired by the public, pilots, and regulators remains. With this in mind, the FAA joined aviation and petroleum industry stakeholders in February of 2022 in a public-private partnership with the goal of lead-free aviation fuel for piston-engine aircraft by 2030. The initiative, called Eliminate Aviation Gasoline Lead Emissions, will focus on investments, policy, and necessary industry actions to operate lead-free without compromising safety and the economic and public benefits of the GA industry.

Source: Mead & Hunt, Inc.

Jet aviation is equally keen on replacing existing fuels with more environmentally friendly options including biofuels. As the commercial aviation market and demand grows, SAFs are seen as a critical enabler for decoupling emissions and carbon growth from market growth. Depending on the source and thermochemical production process, SAF biofuels made from renewable biomass and recycled carbon waste products can match petroleum-based jet fuel performance at a fraction of the carbon footprint. They can also reduce emissions by up to 80 percent in a full life cycle.

According to a recent SAF Technical Pathway Report published by the DOE, the airline industry has committed to carbon-neutral growth in international commercial aviation beginning in 2021 and U.S. airlines have set a goal to reduce carbon dioxide emissions by 50 percent in 2050 compared to 2005 levels. This mainstream goal can only realistically be achieved when SAF prices match or beat petroleum-based jet fuel costs, which requires significant research, development, and investments in production technologies, supply chains, and ultimately airline commitment to drive demand. Although many current transportation policies and approaches are still leaning towards diesel as a renewable fuel in contrast to the commercial airline jet market, the production of biofuels is expected to scale up rapidly over the coming decade as the commercialization potential grows and environmental policies adapt.

For SAF implementation, stakeholders – including regulators, operators, and manufacturers – need to focus on:

- Improving SAF production and aircraft engine technologies
- Improving recycling and agricultural supply chain processes
- Forming unified global markets and agreements to address the carbon emission gap
- Implementing policies that reduce investment risks and support new market entries
- Committing to implementation policies with matching investment timeframes.

Given its location on the East Coast, airline commitments and demand in the region, the GA market size, and technological capabilities, Virginia is well positioned to support R&D as well as further the adoption of SAFs across the GA and commercial aviation community. DOAV has supported SAF research efforts by the University of Virginia's Center for Risk Management of Engineering Systems as far back as 2011. That research has highlighted that the waste products of Virginia's timber industry are an excellent feedstock for the creation of SAF. Coupled with the Colonial and Plantation pipelines running through the state, Virginia is well positioned to lead the development of the SAF market.

Regulatory agencies, operators, and other stakeholders need to jointly develop and implement federally and globally recognized standards that build on regional and local sustainability models through policy incentive frameworks that focus on aviation rather than other transportation modes and energy alternatives. Support for SAF R&D and demonstration projects can also be leveraged to engage in P3 for fuel production and supply and ultimately accelerate SAF price reductions and support industry-wide adoption.

NextGen Concepts and Systems

The FAA's NextGen is a modernization effort focused on the definition and implementation of operational, technological, and procedural improvements to the NAS. The goal is to increase NAS safety, capacity, predictability, and access while reducing noise and environmental impacts inherent to aviation. NextGen introduces various technologies, systems, and operational procedures that allow aircraft to safely operate in congested airspace, fly more direct routes, and overall reduce system delays. The following list contains some of the relevant components that make up NextGen and may impact Virginia airports, airlines, operators, and the aviation system as a whole:

- ADS-B
- System Wide Information Management
- Performance Based Navigation Procedures
- Trajectory-Based Operations (TBO)
- NextGen Weather
- Geographic Information Systems (GIS)
- Enroute and Terminal Automation System Updates
- Communication System Updates

While many of these upgrades are transparent to airport operators and state regulators, some of the components have defined impacts on operations and policy decisions. These include ADS-B, TBO, Information Management, and GIS.

Automatic Dependent Surveillance – Broadcast (ADS-B)

ADS–B is a surveillance technology by which aircraft use satellite navigation to determine and broadcast their positions to other aircraft as well as ground automation systems. Part of NextGen, ADS-B was originally intended as a secondary radar system replacement that provides higher frequency and accuracy of location information for aircraft throughout all phases of flight. ADS-B avionics broadcast aircraft information, position data, and limited flight intent even in areas where radar coverage may be degraded. ADS-B is supported by a terrestrial communications infrastructure to receive and re-broadcast messages for a variety of stakeholders.

As of 2020, ADS-B Out capabilities are mandated in the United States for aircraft operating in Class A, B, and C airspace, as well as certain other controlled airspace. Future concepts such as AAM and UAS (for BVLOS operations) are also depending on ADS-B to support operational concepts and automation systems. Ensuring adequate low-level ADS-B coverage across Commonwealth airspace will be essential to enabling these emerging concepts as well as operations in radar-limited locations.

Source: Nancy Lewis.

Trajectory Based Operations (TBO)

Various NextGen components call for ATC services to transition to TBO in the near future. Four-dimensional trajectories (4DT) are representations of predicted flight paths and trajectories along an aircraft's entire route. TBO will provide improved knowledge of the estimated time of departure and the arrival time at each waypoint along the entire route of flight. Shared via datalink systems, this will ensure the ground automation systems are aware of clearances provided to the flight deck, resulting in a consistent view of the 4DT across the NAS. TBO is expected to support enhanced traffic flow planning and increasingly improve the ability to handle demand-capacity imbalances or off-nominal events in a more strategic and efficient manner. The improved predictability associated with TBO may also lead to a reduction in the separation buffers that controllers use to account for uncertainty and a significant decrease in the use of less efficient tactical maneuvers issued to maintain safe separation. TBO provides the ability for aircraft to fly the most optimal route and for ground automation systems to manage NAS resources based on ground-generated estimates of aircraft arrival times along the route. Airports, vertiports, and other service providers will be able to offer navigation and traffic management services based on vehicle avionics and navigation performance, commonly known as performance-based navigation.

While ADS-B provides limited aircraft intent information, trajectory definitions provide the entire predicted aircraft path, which can be used by traffic flow management applications for strategic and tactical planning purposes. TBO is expected to play a significant role in future AAM/UAM and UAS BVLOS applications to ensure operational predictability and continually assess flight path conformance.

System Wide Information Management (SWIM)

SWIM and advanced datalink technologies support the sharing and negotiation of flight, airport, and weather information between aircraft and ground automation systems. Using standard XML-based protocols, information that is normally available through dedicated sources and applications can be shared across all SWIM network connected systems. SWIM enables the sharing of consistent flight data between all stakeholders (FAA, Department of Defense, Department of Homeland Security, flow management systems, airport operators, aircraft operators, and aircraft systems) and facilitates more informed real-time decision making while also increasing situational awareness, ultimately leading to capacity and safety improvements across the board. SWIM data models are organized around specific international standards including:

- Flight Information Exchange Model (FIXM) data for aircraft flight and flow information
- Aeronautical Information Exchange Model (AIXM) data for airport-related information
- Weather Information Exchange Model (WXXM) data for NextGen weather information

The SWIM information management and sharing capabilities support a key objective for the ATM community in support of an interoperable global air traffic management system. It gives stakeholders – including aircraft and airport operators – seamless information access and interchange capabilities between all providers and users of ATM information and services. This supports existing and future business processes, concepts, and applications for airport and aircraft operators at large, medium, and small airports. Particularly for smaller airports, the development of mobile applications that connect GA operators with relevant local traffic, weather, and regulatory information is a current focus for the FAA and industry.

Source: Mead & Hunt, Inc.

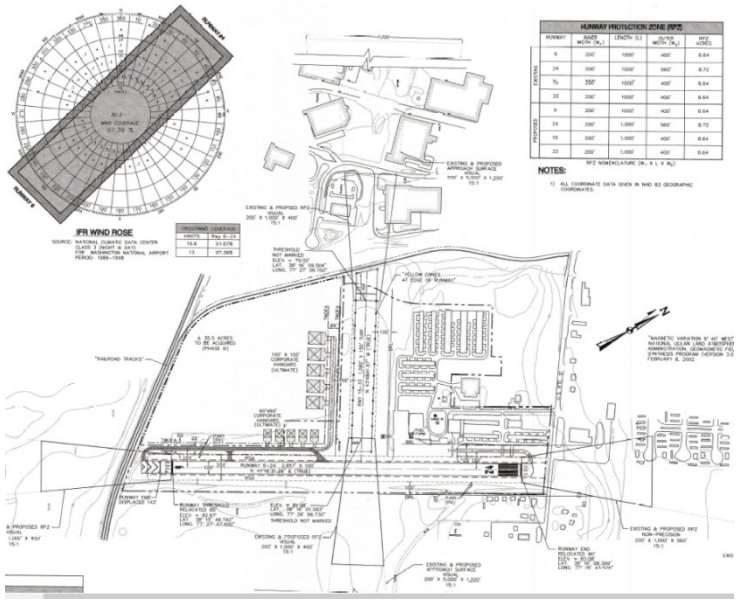
Using information sharing platforms such as SWIM, applications can be developed for airports – commercial service and GA – which integrate airport and flight information with additional data sources, such as ADS-B, to provide value-added services in areas such as:

- UAS/AAM traffic flow management
- AAM fleet management
- Ground/airborne-based sense and avoid
- GA airport & vertiport self-separation
- UAS/AAM/GA pilot advisory tools
- UAS BVLOS operations

Many of these applications can integrate AI/ML to study patterns in operations and provide for pathways to a safer NAS.

Geographic Information Systems (GIS)

Another area where standardized and centralized information management can support Virginia airports is in the area of GIS. Many airports lack GIS expertise and frequently contract out geospatial tasks to consultants including tasks such as the development of ALPs, land use compatibility, and obstruction analyses. As online GIS platforms become more mainstream and relevant FAA, and DOAV, data sources are standardized and made available online, GIS analyses may increasingly be carried out by airport staff. Using the FAA's Airport Geographic Information System, a part of the Airport Data and Information Portal, standard airport GIS artifacts can be maintained to help store planning, design, construction, and engineering information in standardized databases to leverage reports and applications for better decision-making purposes.



Source: DOAV.

Artificial Intelligence and Machine Learning (AI/ML)

Despite the potential advantages of using UASs in these capacities and the efficiency and accuracy of the data collected, many airports today do not fully understand or use existing information and data analytic functions at their disposal. Operational, financial, and administrative information is collected and stored but rarely used to make decisions.

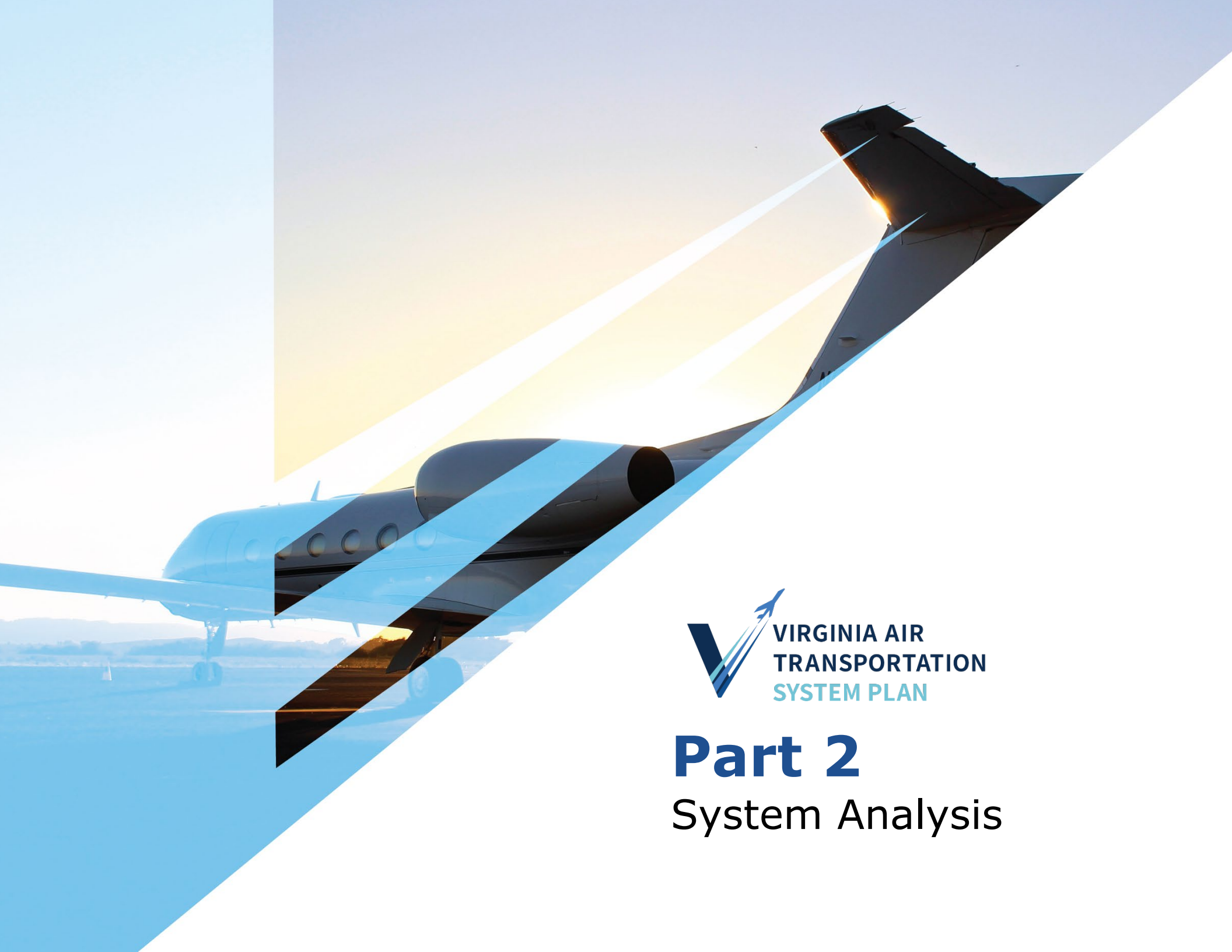
The application and integration of AI/ML concepts as part of airport and aviation data analytics processes is already prevalent across the industry. Data analytics dashboards and ML algorithms are used to provide actionable and real-time insights in areas such as airport airside and landside operations, terminal processes, passenger trends and demographics, and energy consumption. These analytical concepts are combined with AI algorithms and functions including object recognition capabilities in passenger terminals and on airside aprons. Together, AI and ML provide airports with tools to develop accurate digital models of their operations and processes based on a combination of historic and real-time data. These can be used to provide prediction, alerting, and optimization functions to operators, managers, and front-line staff.

Like the rest of the United States, most airports across Virginia do not have dedicated capabilities and resources to embrace the integration of AI and ML concepts into daily operations or even periodic planning functions. Information is increasingly formatted and intended for integrated analytics platforms and functions at the local, regional, and state levels. However, the automation functions to ingest, process, merge, and ultimately extract results need to be developed and maintained to gain value from these concepts.

Summary

The Commonwealth of Virginia continues to embrace novel aviation, aircraft, and air traffic concepts. This includes the integration of AAM concepts into day-to-day operations as well as continued research and development into remote tower systems. Virginia's existing focus on the UAS market and its broad expertise in relevant technologies and operations provides a conducive environment for these emerging concepts.

As new concepts, aircraft types, technologies, aviation fuels, and analytical processes promise to reshape the aviation industry over the next decades and change the way the population thinks about transportation, it is important to ensure that planning practices, investment decisions, regulatory policies, and a community platform are aligned to maximize the respective benefits.



VIRGINIA AIR TRANSPORTATION SYSTEM PLAN

Part 2

System Analysis

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Technical Report Summary

As previously mentioned, the technical report is divided into three parts to effectively present the findings of the Virginia Air Transportation System Plan (VATSP) update. Part 2 of the VATSP takes the concepts developed in Part 1 and applies them to the Commonwealth's system of 66 public-use airports. Part 2 contains the following chapters:

- Chapter 5: Activity Forecasts
- Chapter 6: Inventory
- Chapter 7: Alternatives Analysis

Source: Richard Lewis.

Chapter 5 – Activity Forecasts evaluates both historical and anticipated trends for the commercial service and general aviation airports to project system and airport specific demand. These forecasts include analysis of data such as enplanements at the commercial service airports as well as based aircraft and the number of operations across the entire system of airports. Conducting forecasting in the period right after the COVID-19 pandemic has offered unique challenges to the forecasting process, which are discussed in the chapter.

Chapter 6 - Inventory summarizes the inventory of the Virginia aviation system and provides information on activity and facilities at each of the 66 public-use airports. This included a robust dataset of more than 100 facilities or features across the entire system. A summary of the findings is contained in Chapter 6, while the more detailed tables of each element are contained in **Appendix B**.

Chapter 7 - Alternatives Analysis shows the facility, service, and equipment objectives that were developed for airports in each airport role and provides the determination of system wide needs. This chapter takes a deeper dive into the ability of the existing system of airports to meet the objectives outlined as part of this VATSP update. A significant number of items are assessed in this chapter which review the specific facility, service, and equipment offered at each airport, compared to their specific role needs, as outlined in **Chapter 3**.

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Chapter 5: Activity Forecasts

The aviation activity forecasts for this update of the Virginia Air Transportation System Plan (VATSP) are an important step in assessing how to meet the current and future needs of the state aviation system. This VATSP is unique in that the forecasts must take into consideration the dire impact that the COVID-19 pandemic has had on the commercial aviation industry. General aviation (GA) has also been negatively impacted by COVID-19 but not to the same extent as commercial aviation.

Virginia is not immune to the many factors influencing commercial air service and GA in the U.S. A primary objective of the commercial service airport forecasts is to identify both the foundational factors that are influencing the U.S. commercial air service market today and other factors impacting commercial service that may result in a structural change in the future.

The data analysis and summary for both GA and commercial service facilities in the Commonwealth are included in the following sections:

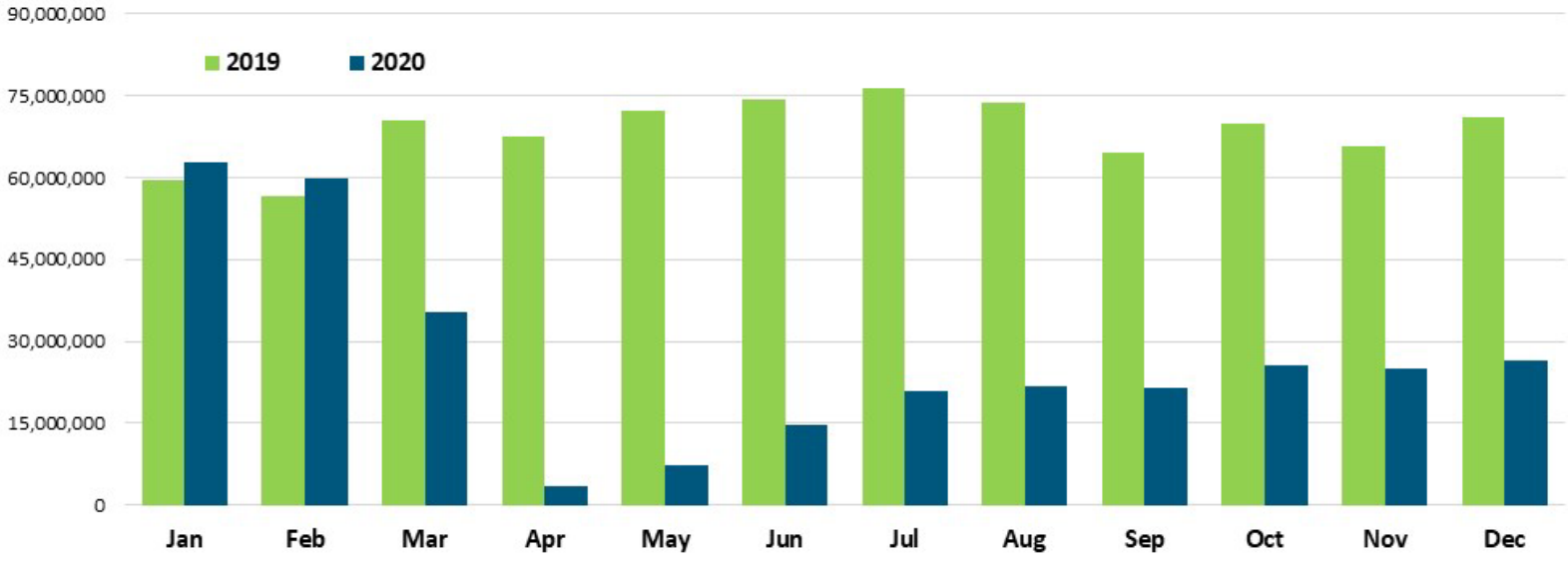
- COVID-19's Impact on the U.S. Commercial Service Aviation Industry
- Virginia's Commercial Service Airports
- The Impact of COVID-19 on Virginia's Commercial Service Airports
- Forecast of Recovery for the Virginia Commercial Service Airports
- Commercial Service Aviation Forecasts
- General Aviation Airport Forecasts
- General Aviation in Virginia
- Overview of the GA Forecast
- Comparison to the Terminal Area Forecast (TAF)
- Summary of Aviation Forecasts for the Virginia Aviation System

Source: Keith Holt.

COVID-19's Impact on the U.S. Commercial Service Aviation Industry

On March 11, 2020, the World Health Organization declared COVID-19 a pandemic. The world came to a standstill. The impact on the economy and the commercial aviation industry was swift and significant. The U.S. unemployment rate was 3.5 percent in February 2020 and 14.7 percent in April of 2020. Nearly 15 million workers had lost their jobs.

As shown in **Figure 5-1**, the industry bottomed out in April and reached its lowest point for the week ending April 14, 2020, when Transportation Security Administration (TSA) passenger throughput was 4.2 percent of 2019.[1] International travel was the first to be cut while domestic travel cuts occurred soon after, resulting in the months of April and May experiencing passenger declines of 95 percent and 90 percent, respectively. The year of 2020 ended with an overall U.S. passenger decline of 61 percent, a loss of nearly 500 million passengers.



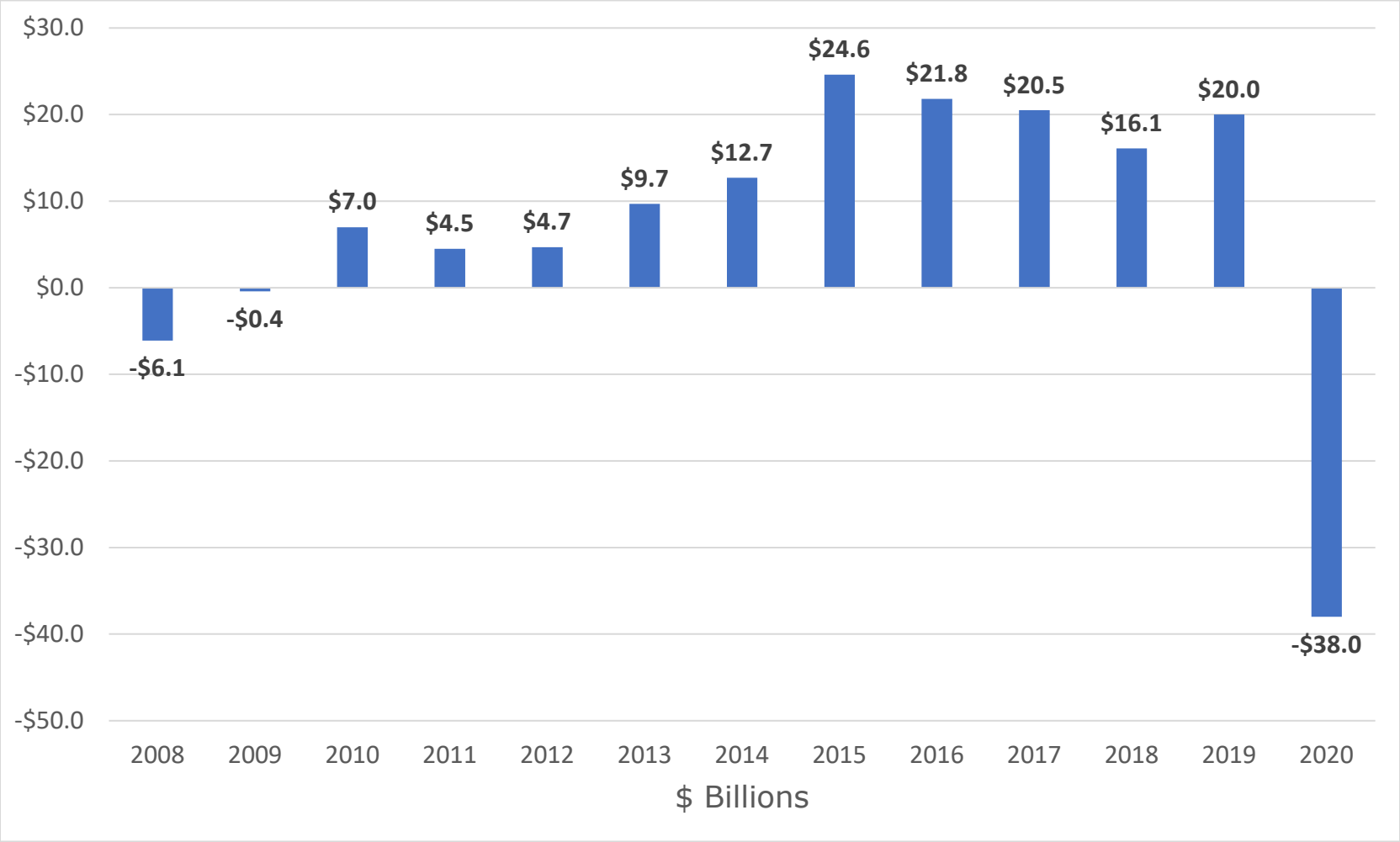
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
% Change from Prior year	5%	6%	-50%	-95%	-90%	-80%	-73%	-71%	-67%	-63%	-62%	-63%

Source: TSA Daily Reports.

Figure 5-1: Nationwide TSA Throughput, January 2019 – December 2020

[1] TSA passenger throughput measures the number of passengers that clear TSA at an airport. It does not include connecting passengers that do not re-clear. TSA passenger throughput is reported daily, and the weekly average (the seven days ended) became the accepted metric for measuring the impacts from COVID on passenger traffic.

As shown in **Figure 5-2**, for the period of 2009 to 2019, U.S. airlines earned a combined $141 billion. As the nation quickly went into lock-down and passenger traffic disappeared, airline financial losses accelerated, ending 2020 with a historic loss of $38 billion. In comparison, the tragic events of 9/11 led to a $15 billion loss for the airline industry, and the Great Recession of 2007-2009 resulted in a loss of $6 billion— the impact of the 2020 carrier loss was more than double 9/11 and more than six times that of the recession.

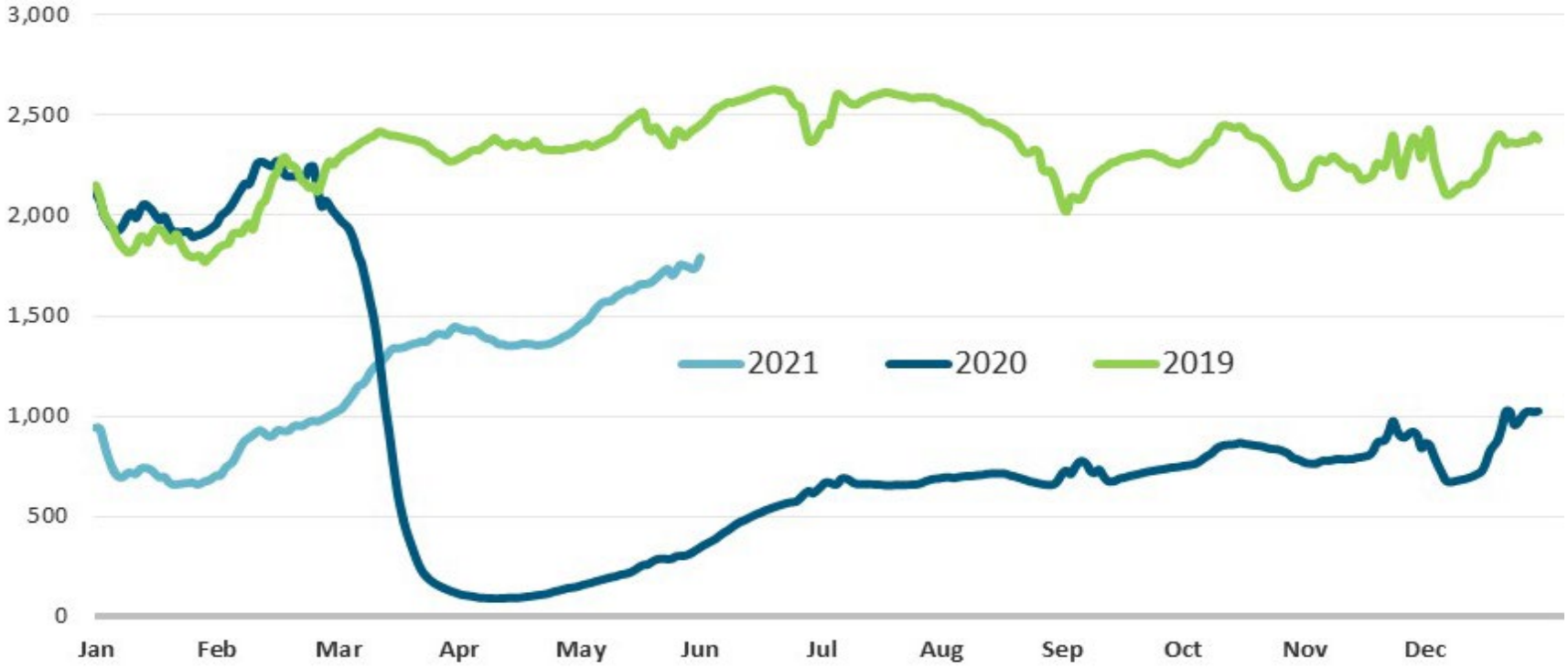


Source: U.S. Airline Financial Reports.

Figure 5-2: U.S. Airline Operating Profit (Loss), CY 2008 – CY 2020 ($ Billions)

Passenger traffic has had an uneven recovery. COVID-19 hit the West Coast and East Coast particularly hard in the early stages of the pandemic and significantly impacted passenger volumes in markets such as Los Angeles, San Francisco, New York, Boston, and Washington D.C. Passenger traffic began to rebound in June and July of 2020 even though international travel restrictions were in place and business travel was curtailed. However, the recovery was short lived, and passenger volumes remained steady until the 2020 holiday season.

As shown in **Figure 5-3**, throughout the first half of 2021, domestic leisure travel led the recovery. The seven-day average dated June 6, 2021, for TSA passenger throughput was down 27 percent from the same period in 2019. As discussed by the U.S. airlines in their earnings calls, business sector travel is only beginning to show signs of a nascent return. While there is little question regarding the pent-up demand stemming from COVID-19 fatigue, the longer-term question is whether the pent-up demand is a leisure bubble or if it is sustainable. The return of business and international travel is particularly important to the network carriers of American Airlines, Delta Air Lines and United Airlines, the three largest carriers serving Virginia. At the time the forecast was conducted, the network carriers expected that business travel would start to return in the fall of 2021. Due to travel restrictions and quarantines, international travel was not expected to recover in earnest until the summer of 2022.



Source: TSA Daily Reports.

Figure 5-3: Nationwide Seven-Day Average TSA Throughput, Jan 1, 2019 – June 6, 2021

Virginia's Commercial Service Airports

Virginia is served by nine commercial service airports, as summarized in the table below and illustrated in **Figure 5-4**. Two airports are large hubs, while the remaining seven commercial service airports are small (two) or non-hub airports (five).[2]

Airport Name	Code	Hub Type
Ronald Reagan Washington National	DCA	Large Hub
Washington Dulles International	IAD	Large Hub
Norfolk International*	ORF	Small Hub
Richmond International	RIC	Small Hub
Charlottesville-Albemarle	CHO	Non-Hub
Lynchburg Regional	LYH	Non-Hub
Newport News/Williamsburg	PHF	Non-Hub
Roanoke-Blacksburg Regional	ROA	Non-Hub
Shenandoah Valley Regional	SHD	Non-Hub

*Norfolk International was classified as a small hub airport when Virginia system forecasts were evaluated.
Source: FAA Enplanement Database.

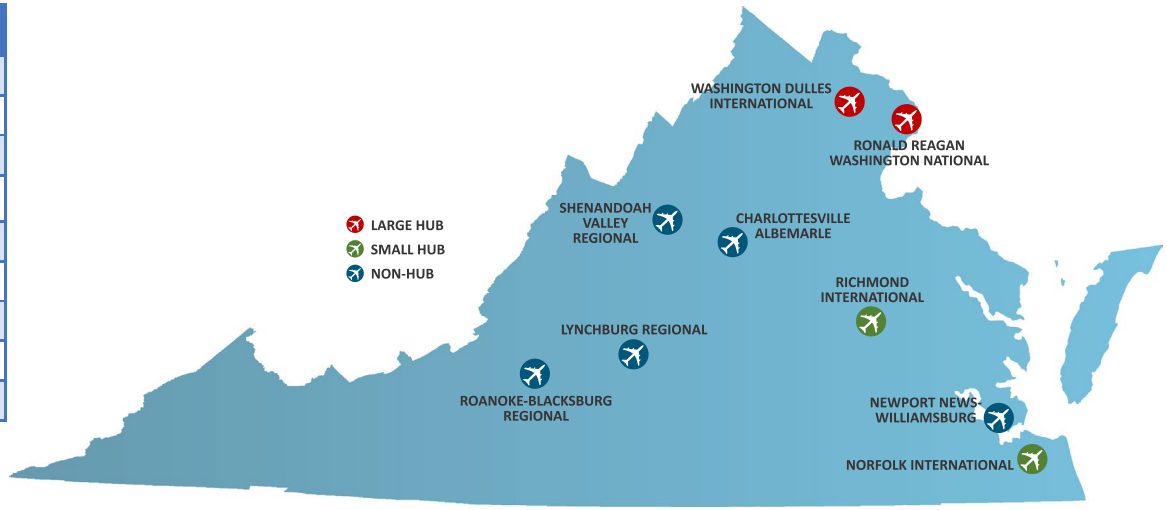


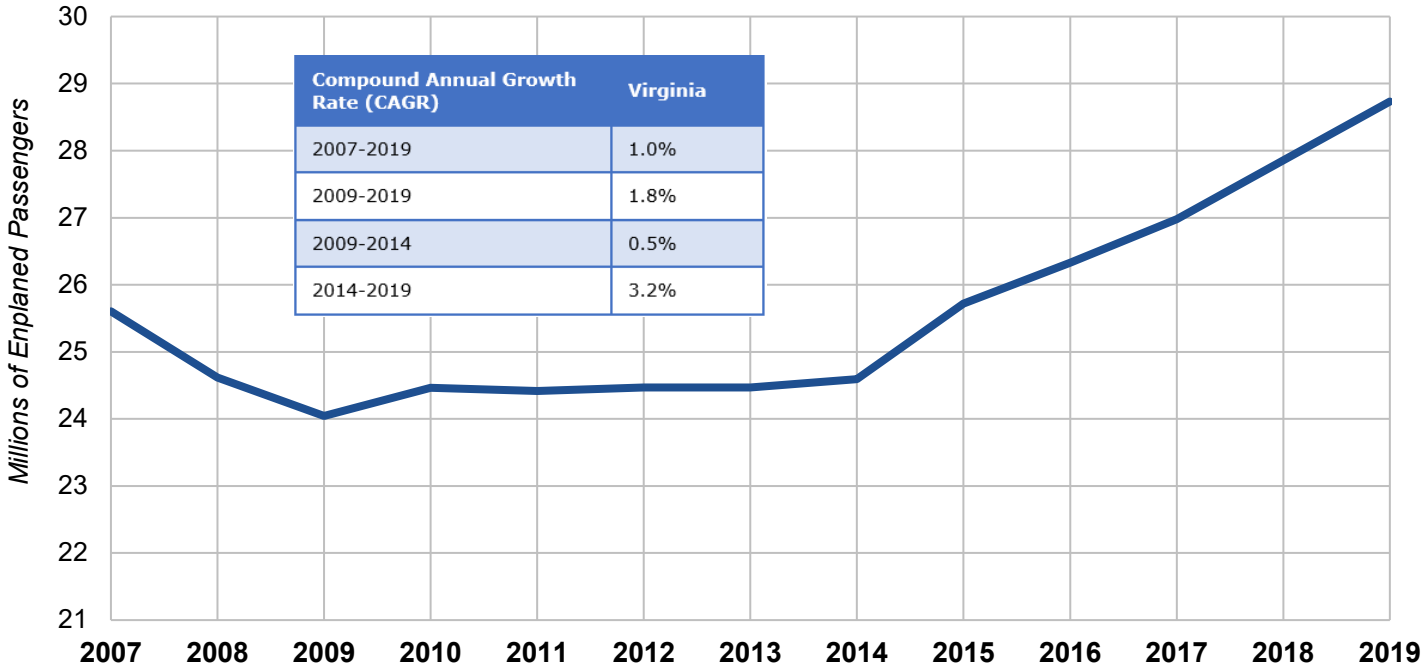
Figure 5-4: Virginia Commercial Service Airports

Commercial air service in Virginia has had its ebbs and flows over the past decades. In 2019, Virginia's commercial service airports served 28.7 million enplaned passengers. From 2007-2019 Virginia's enplaned passengers grew at an average of 1.0 percent per annum.

From 2007 to 2009, Virginia's enplaned passengers declined. For the five-year period from 2009 to 2014, Virginia's passenger traffic was relatively flat. Ronald Reagan Washington National (Reagan National) added 3.2 million passengers during this timeframe; however, passenger declines at Washington Dulles International (Dulles International), Newport News-Williamsburg, and Norfolk International, dampened the overall growth for Virginia.

2 Large Hub is defined as an airport that receives 1 percent of the annual U.S. commercial enplanements. Medium Hub is defined as an airport that receives 0.25 to less than 1 percent of the annual U.S. commercial enplanements. Small is defined as an airport that receives .05 to less than .25 percent of the annual U.S. commercial enplanements. Non-Hub is defined as an airport that received less than .05 percent but more than 10,000 of the annual U.S. commercial enplanements.

Figure 5-5 and Table 5-1 illustrate that the five years prior to the pandemic saw significant growth in passengers in Virginia, with an average annual growth rate of 3.2 percent. All airports in Virginia, except Newport News-Williamsburg, experienced growth. During this period, Virginia's commercial service airports added a total of 8.2 million passengers, with Richmond International, and the two large hub airports, Dulles International and Reagan National, accounting for 82 percent of this growth.



Compound Annual Growth Rate (CAGR)	Virginia
2007-2019	1.0%
2009-2019	1.8%
2009-2014	0.5%
2014-2019	3.2%

Source: FAA Air Carrier Activity Information System (ACAIS).

Figure 5-5: Virginia Enplaned Passengers, CY 2007 – CY 2019

Virginia's small hub airports have historically experienced higher growth rates compared to Virginia's large and non-hub airports. Since 2007, Reagan National's growth doubled that of Dulles International. However, beginning in 2014, Dulles International began to grow at a similar rate with Reagan National at 2.7 percent per year.

Richmond International, Norfolk International, Charlottesville-Albemarle, and Shenandoah Valley were the fastest growing airports in the state over the past five years. From 2014 to 2019, there were multiple service additions including:

- Frontier Airlines and Allegiant Air started service at Norfolk International. Allegiant Air and Spirit Airlines started service at Richmond International.
- United Airlines added Chicago O'Hare at Charlottesville-Albemarle.
- SkyWest began operating at Shenandoah Valley to Chicago O'Hare and Dulles International with a United Airlines codeshare.

Table 5-1: Virginia's Commercial Service Airports Enplaned Passengers

	Enplaned Passengers				Compound Annual Growth Rates		
	2007	2009	2014	2019	2007-19	2009-19	2014-19
Large Hubs							
Reagan National	9,038,174	8,490,288	10,115,546	11,595,454	2.1%	3.2%	2.8%
Dulles International	11,789,441	11,132,098	10,415,948	11,884,117	0.1%	0.7%	2.7%
Total VA Large Hubs	**20,827,615**	**19,622,386**	**20,531,494**	**23,479,571**	**1.0%**	**1.8%**	**2.7%**
Small Hubs							
Richmond International	1,805,992	1,649,284	1,671,096	2,190,907	1.6%	2.9%	5.6%
Norfolk International*	1,867,307	1,701,246	1,488,114	1,990,864	0.5%	1.6%	6.0%
Total VA Small Hubs	**3,673,299**	**3,350,530**	**3,159,210**	**4,181,771**	**1.1%**	**2.2%**	**5.8%**
Non-Hubs							
Roanoke-Blacksburg	348,634	297,588	305,496	361,131	0.3%	2.0%	3.4%
Charlottesville-Albemarle	187,078	180,462	250,666	387,922	6.3%	8.0%	9.1%
Newport News/Williamsburg	513,381	498,205	259,082	211,487	-7.1%	-8.2%	-4.0%
Lynchburg Regional	55,785	86,366	78,876	93,206	4.4%	0.8%	3.4%
Shenandoah Valley Regional	4,907	8,364	9,422	17,584	11.2%	7.7%	13.3%
Total VA Non-Hubs	**1,109,785**	**1,070,985**	**903,542**	**1,071,330**	**-0.3%**	**0.0%**	**3.5%**
Total Virginia	**25,610,699**	**24,043,901**	**24,594,246**	**28,732,672**	**1.0%**	**1.8%**	**3.2%**

*Norfolk International was classified as a small hub airport when Virginia system forecasts were evaluated.
Source: FAA ACAIS.

Except for Charlottesville-Albemarle, Virginia's commercial service airports have experienced a decline in operations since 2007. This is a result of increasing aircraft size. The decline in operations continued during the 2014-2019 period with Charlottesville-Albemarle and Norfolk International seeing operations increase, as shown in **Table 5-2**.

Table 5-2: Virginia Commercial Service Airport's Historical Operations

Historical Operations at Virginia Commercial Service Airports								
	Historical Operations				Compound Annual Growth Rate			
	2007	2009	2014	2019	2007-09	2009-14	2014-19	2007-19
Large Hub Airports								
Reagan National	273,969	267,794	282,377	265,273	-1.1%	1.1%	-1.2%	-0.3%
Dulles International	355,733	319,538	274,170	252,515	-5.2%	-3.0%	-1.6%	-2.8%
Small Hub Airports								
Richmond International	84,278	72,869	65,071	63,505	-7.0%	-2.2%	-0.5%	-2.3%
Norfolk International	75,955	65,470	52,974	54,882	-7.2%	-4.1%	0.7%	-2.7%
Non-Hub Airports								
Charlottesville Albemarle	21,549	20,749	20,200	29,184	-1.9%	-0.5%	7.6%	2.6%
Roanoke-Blacksburg	32,430	25,748	19,754	17,223	-10.9%	-5.2%	-2.7%	-5.1%
Newport News/Williamsburg	25,546	21,189	14,031	10,318	-8.9%	-7.9%	-6.0%	-7.3%
Lynchburg Regional	6,573	5,538	6,155	5,290	-8.2%	2.1%	-3.0%	-1.8%
Shenandoah Valley	1,776	2,003	2,095	1,372	6.2%	0.9%	-8.1%	-2.1%

Source: US DOT T-100.

All of Virginia's commercial service airports have experienced an increase in seats per operation since 2014, as illustrated in **Table 5-3**. Newport News-Williamsburg is the only airport to experience a decline in seats per departures since 2007.

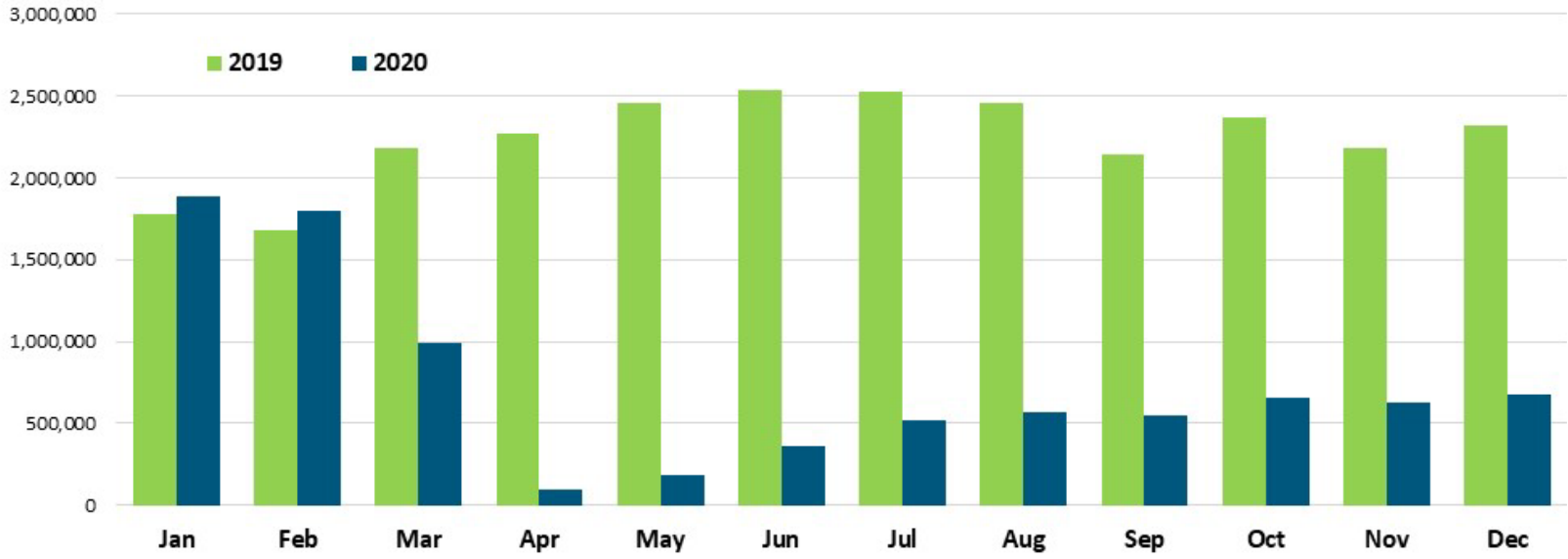
Table 5-3: Virginia Commercial Service Airport's Seats per Departure

Commercial Service Seats Per Departure at Virginia Airports						
Airport Name					Absolute Change	
	2007	2009	2014	2019	2007-19	2014-19
Large Hub						
Dulles International	101	103	107	124	22	17
Reagan National	96	93	96	103	7	7
Small Hub						
Richmond International	73	75	80	95	22	15
Norfolk International	77	79	82	93	16	11
Non-Hub						
Newport News/Williamsburg	81	76	59	66	-16	7
Roanoke-Blacksburg	49	50	54	60	12	7
Lynchburg Regional	43	45	50	56	13	7
Charlottesville-Albemarle	40	41	47	55	15	8
Shenandoah Valley	25	34	34	50	25	16

Source: US DOT T-100.

The Impact of COVID-19 on Virginia's Commercial Service Airports

Commercial service airports in Virginia, like many airports in the Northeast, have been impacted significantly by COVID-19. The nine commercial service airports combined saw a decline of 96 percent and 93 percent for April and May 2020, respectively, illustrated in **Figure 5-6.**



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
% Change from Prior year	6%	7%	-54%	-96%	-93%	-86%	-79%	-77%	-74%	-72%	-71%	-71%

Source: TSA Daily Reports.

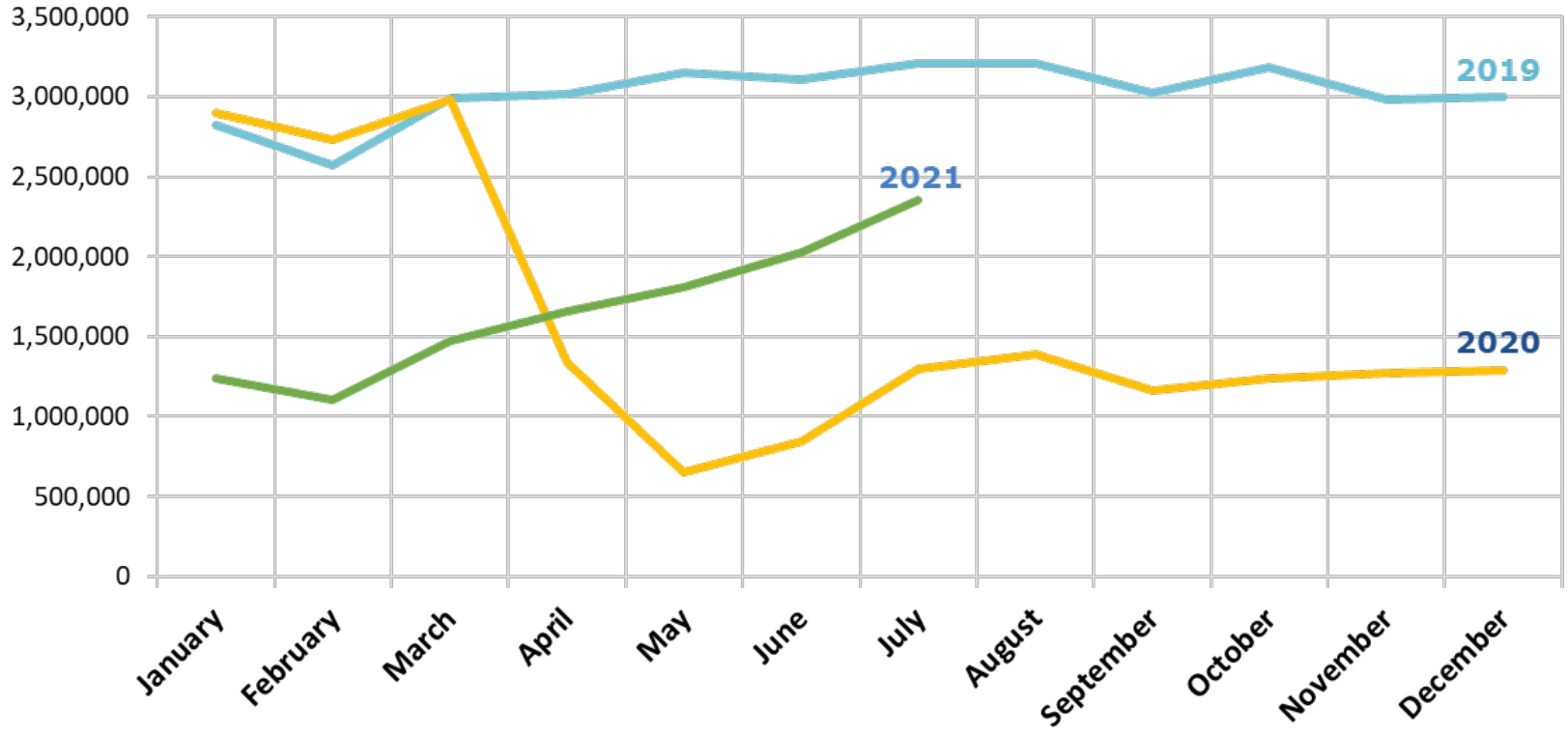
Figure 5-6: Virginia TSA Passenger Throughput, January 2019 – December 2020

Recovery was slow through the rest of 2020, lagging the national monthly averages by three to nine percentage points. Virginia's commercial service airports ended 2020 with December's TSA passenger throughput down 71 percent, behind the national decline of 63 percent (**Figure 5-7**).

Source: TSA Daily Reports.

Figure 5-7: Percent Change in TSA Throughput, Virginia vs. Nationwide, January 2020 – December 2020

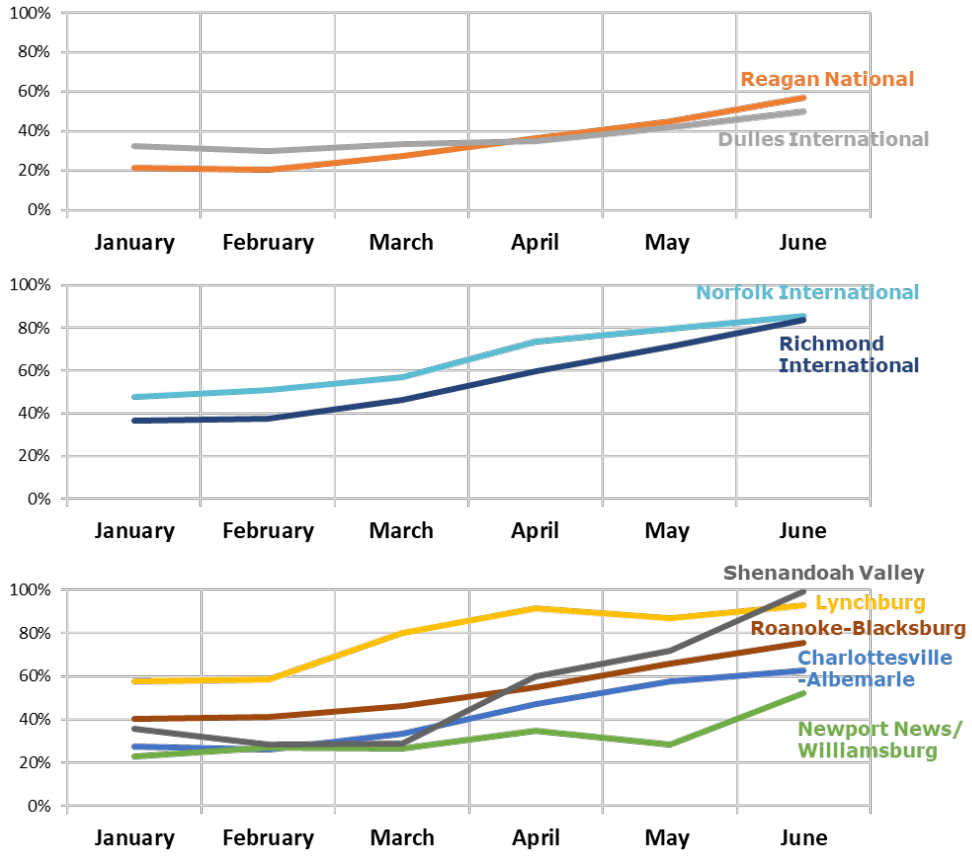
The road to recovery for Virginia has been accelerating since March of 2021. To date, the recovery has been led by leisure passengers heading to sun and fun markets and mountain retreats such as Fort Myers, Florida, and Yellowstone National Park. The airlines have been adding seats as bookings are increasing. Seat departures for all commercial service airports in Virginia for the month of July 2021 was 74 percent of the same month in 2019 (**Figure 5-8**). Contributing to the recovery rate is the entrance of Breeze Airways at Norfolk International and Richmond International, along with United Airlines adding a third connecting bank at Dulles International.



Source: Innovata Schedules, via Cirium.

Figure 5-8: Monthly Seat Departures from Virginia, January 2019 – July 2021

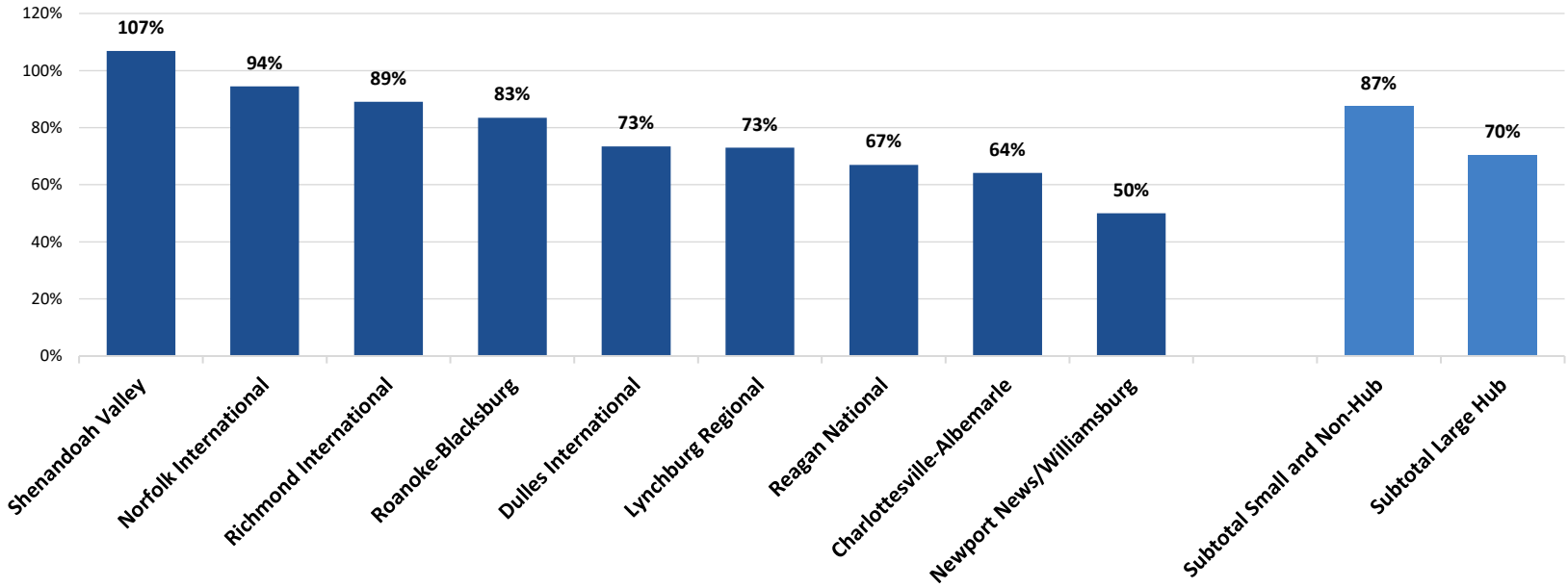
Recovery across the various airports within Virginia has been uneven. Dulles International and Reagan National passengers are recovering slower than the other commercial service airports in Virginia because of their dependence on business and/or international travel. By June of 2021, the two large hub airports had recovered less than 60 percent of their 2019 TSA passenger throughput. In June, Richmond International and Norfolk International recorded 84 percent and 85 percent of their 2019 TSA passenger throughput, respectively. Of the non-hub airports, Shenandoah Valley and Lynchburg Regional are recovering the fastest. In June 2021, both airports were above 90 percent of their 2019 TSA passenger throughput (**Figure 5-9**).



Source: TSA Daily Statistics.

Figure 5-9: TSA Passenger Throughput by Month in 2021 as a Percent of 2019

As of July 2021,[3] the seven small and non-hub airports have recovered at a rate of 87 percent, compared to the large hub airports at 70 percent, as noted in **Figure 5-10**. The large hub airports are expected to recover at a quicker pace when business and federal government-related travel returns, and international restrictions are lifted.



Source: Innovata Schedules, via Cirium.

Figure 5-10: Seat Departure Recovery, July 2021 vs. July 2019

[3] At the time this document was written, July 2021 was the most recent available data. Since then, there has been a surge in COVID-19 cases due to the Delta and Omicron Variant that has slowed air travel recovery. The airlines believe this slowdown is temporary. The airlines are also experiencing a pilot shortage that will slow the recovery of service especially at non-hub airports.

Forecast of Recovery for the Virginia Commercial Service Airports

The projected year for recovery back to 2019 passenger levels varies by Virginia commercial service airport as shown in **Table 5-4**. As discussed below, the recovery year reflects each commercial service airport's passenger recovery to date. The forecasted year of recovery for the two large hub airports is:

- 2025 for Dulles International
- 2024 for Reagan National

As of July 2021, Dulles International TSA passenger throughput was at 61 percent of its 2019 levels, while Reagan National was at 63 percent. The reliance on international traffic at Dulles International and business passengers at Reagan National will cause these two airports to continue to lag the nation and the other commercial service airports in Virginia in recovery.

The recovery of the small and non-hub airports in Virginia is more accelerated than the large hub airports. The forecasted year of recovery for the small and non-hub airports is 2023, except for Lynchburg Regional and Newport News-Williamsburg, which are expected to fully recover in 2025 and 2026, respectively. The forecasted year of recovery is based on two factors: 1) The latest available data including TSA passenger throughput data for June and July 2021. The July recovery rates ranged from a low of 52 percent at Newport News-Williamsburg to a high of 115 percent at Shenandoah Valley. In addition, two Virginia commercial service airports, Richmond International and Norfolk International, have welcomed the presence of a new Ultra Low-Cost Carrier (ULCC), Breeze Airways, which has resulted in recoveries of 92 percent and 95 percent, respectively. 2) The continued surge in COVID-19 cases through the fall and winter of 2021 along with a pilot shortage that will delay the recovery of service in the short-run to the non-hub airports.

Source: DOAV.

As of July 2021, Charlottesville-Albemarle had recovered to 66 percent but remains a market with strong fundamentals. Charlottesville-Albemarle grew at a rate of 9.1 percent per year from 2014-2019 and the lack of recovery to date is due in part to Charlottesville-Albemarle's dependence on the University of Virginia, which returned to in person learning in the fall of 2021.

The recovery rates of the Virginia commercial service airports' enplanements outpace the FAA's 2020 TAF at Norfolk International, Charlottesville-Albemarle, Roanoke-Blacksburg and Shenandoah Valley. This is because the TAF was prepared in 2020, prior to the availability of COVID-19 vaccines and the unexpected resurgence of leisure travel.

In contrast, Reagan National and Dulles International have experienced lower historic growth and are expected to lag due to their dependence on business and international travel.

Table 5-4: Virginia's Commercial Service Airport Historical Enplanements, TSA Passenger Statistics and Forecast Year of Recovery Compared to TAF

Virginia Airport	Total Enplanements						CAGR 2014-19	TSA Statistics Percent of 2019		Forecast Year of Recovery	2020 TAF Year of Recovery
	2014	2015	2016	2017	2018	2019		June 2021	Week of July 19th		
Large Hubs											
Reagan National	10,115,546	11,242,375	11,470,854	11,506,310	11,366,771	11,595,454	2.8%	57%	63%	**2024**	2024
Dulles International	10,415,948	10,363,974	10,596,942	11,024,306	11,621,623	11,884,117	2.7%	50%	61%	**2025**	2025
Small Hubs											
Norfolk International	1,488,114	1,515,200	1,602,631	1,694,329	1,846,031	1,990,864	6.0%	85%	95%	**2023**	2025
Richmond International	1,671,096	1,740,391	1,777,648	1,822,486	2,048,691	2,190,907	5.6%	84%	92%	**2023**	2023
Non-Hubs											
Charlottesville-Albemarle	250,666	274,767	295,930	334,347	352,816	387,922	9.1%	63%	66%	**2023**	2024
Lynchburg Regional	78,876	75,824	75,465	82,489	83,392	93,206	3.4%	93%	92%	**2025**	2025
Newport News/Williamsburg	259,082	202,104	199,421	197,994	195,573	211,487	-4.0%	52%	52%	**2026**	2025
Roanoke-Blacksburg	305,496	300,181	305,212	309,341	330,063	361,131	3.4%	76%	84%	**2023**	2024
Shenandoah Valley	9,422	5,536	5,442	6,605	12,179	17,584	13.3%	99%	115%	**2023**	Does Not Recover to 2019

Note: The FAA does not forecast Shenandoah Valley recovering to its 2019 passenger levels during the forecast period.
Source: FAA ACAIS; TSA Passenger Throughput Statistics; FAA Terminal Area Forecast.

Source: Heather Ream.

Commercial Service Aviation Activity Forecasts

The forecasts of aviation activity for Virginia's commercial service airports were prepared using a combination of methodologies. They include a review of recent industry trends and expectations of recovery from COVID-19 to inform near-term forecasts, and statistical analyses of the relationship between historical demand and local and national economic conditions to inform the longer-term forecasts. This is similar to the methodology used by the FAA to develop the TAF. The FAA notes the TAF assumes a demand driven forecast for aviation services based upon local and national economic conditions, as well as conditions within the aviation industry, and is developed independent of the ability of the airport and air traffic control system to furnish the capacity required to meet demand.

Table 5-5 through **Table 5-10** and **Figure 5-11** through **Figure 5-16** discuss the methodology and forecast results on an aggregate level. This is followed by a more detailed discussion of the results for each airport.

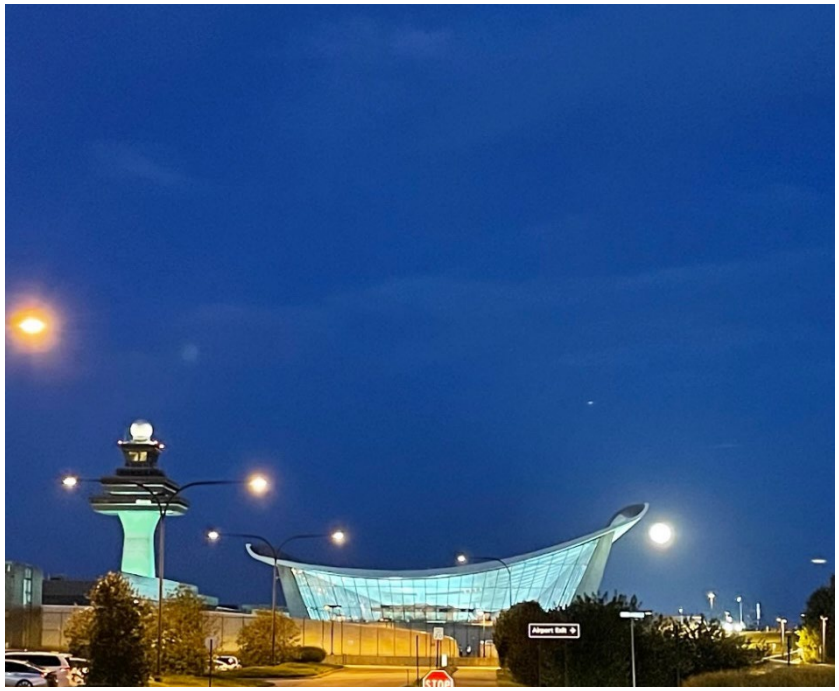
Overview of Methodology

The annual forecasts of passenger and aircraft activity at the nine commercial service airports in Virginia were developed using a combination of both a bottom-up (short-term) microeconomic methodology and a top-down macroeconomic methodology. However, given that several of the airports serve overlapping service areas, predicting future traffic levels at individual airports was not done in isolation, and the analysis considered the trends and dynamics occurring at all airports in the region. As a result, the forecast was developed using a two-step process.

- A forecast of the O&D[4] passenger activity in the (1) Northern Virginia/Washington Metropolitan Market and (2) the small and non-hub airports in Virginia was developed based on historical relationships with macroeconomic variables and COVID-19 recovery assumptions from the base year 2019 through 2044; and,
- The demand was allocated to the individual airports based on its historic share of the region.

Bottom-Up Forecasts

The bottom-up forecast developed for Virginia's commercial service airports was based on the short-term network and fleet planning decisions by airlines and the expected recovery from COVID-19. In 2020, passenger traffic was negatively impacted by shelter in place orders designed to create social distancing to decrease the spread of COVID-19. As with other exogenous shocks and recoveries, passenger demand is forecast to return to the previous trend between three and six years following the event.



Source: Kristen Long.

4 O&D is Origin and Destination passengers meaning that the passenger either starts or ends their trip at the airport, as compared to connecting passengers, who neither start nor end their trip at the airport.

Table 5-5: COVID-19 Recovery Year Assumptions

Virginia Airport	Recovery Year	
	Forecast	2020 TAF
Large Hubs		
Reagan National	2024	2024
Dulles International	2025	2025
Small Hubs		
Norfolk International	2023	2025
Richmond International	2023	2023
Non-Hubs		
Charlottesville-Albemarle	2023	2024
Lynchburg Regional	2025	2025
Newport News-Williamsburg	2026	2025
Roanoke-Blacksburg	2023	2024
Shenandoah Valley	2023	TAF does not include Shenandoah Valley recovering to 2019

Source: VATSP Forecast.

Top-Down Forecasts

To estimate long-term trends for Virginia's large hub commercial service airports, the forecast examined the statistical relationship between economic trends and historical traffic volumes. Regressions were run for the three commercial service airports (Dulles International, Reagan National, and Baltimore) in the Northern Virginia/Washington Metropolitan Market.[5] The O&D passenger activity in the Northern Virginia/Washington Metropolitan Market was broken out by region: Domestic, Canada, Latin America, Trans-Atlantic, and Trans-Pacific. For each of these market segments, a variety of independent variables were tested against historic O&D passenger traffic data to identify the variables that show the best correlation with historic traffic developments.

In regard to Virginia's small and non-hub commercial service airports, regressions were run for all of the small and non-hub commercial service airports individually; however, not all airports yielded statistically significant results. Richmond International, Norfolk International, Newport News/Williamsburg, and Charlottesville-Albemarle yielded regressions with meaningful results, but Roanoke-Blacksburg, Lynchburg Regional, and Shenandoah Valley did not (likely due to leakage). Therefore, the small and non-hub airports were grouped into a single category. The single category included Virginia's small and non-hub commercial service airports: Richmond International, Norfolk International, Roanoke-Blacksburg, Charlottesville-Albemarle, Newport News/Williamsburg, Lynchburg Regional, and Shenandoah Valley.

The approach taken in the VATSP is similar to the approach in the previous Virginia Air Transportation System Plan. The previous plan used a regression analysis that tested the correlation between enplanements and real personal income over the period 1990-2012. However, upon performing the regression analysis for this forecast, using data from 1990-2019, Virginia Gross Domestic Product (GDP) and population/employment yielded a stronger correlation.

[5] Northern Virginia/Washington Metropolitan Market (IAD, DCA and BWI) is forecasted as one market because they share the same market and leak passengers to each other depending on the individual airports share of air service and level of airfares.

For each market segment, a variety of independent variables were tested against historic O&D passenger traffic data to identify which variables had the best correlation with historic traffic developments. The independent variables tested included GDP by region, population, personal income per capita, and employment. The final models were selected based on statistical fit, parameter robustness, and the plausibility of the parameter estimates produced. The most effective models were those based on GDP (as well as dummy variables in some cases in 2001 and 2002 to capture the impacts of the 9/11 terrorist attacks, and 2009 for the Great Recession).

The table below presents a summary of the traffic models, including the independent variables and regression output.

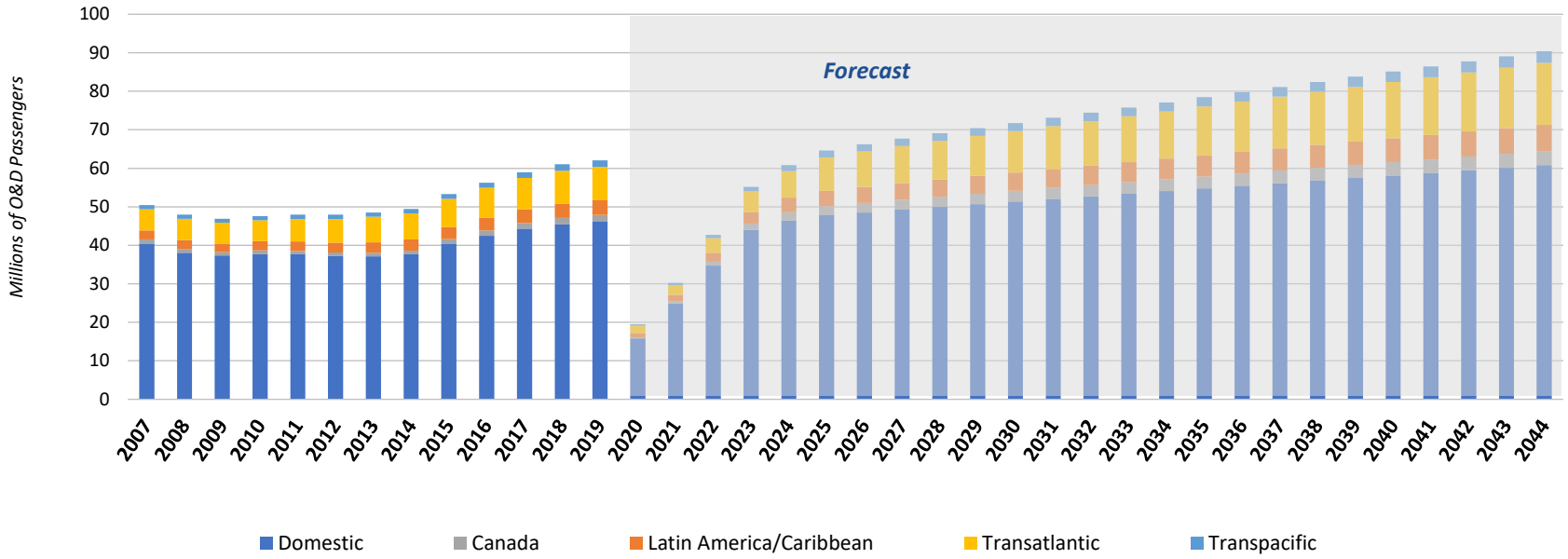
Table 5-6: The R^2 for the Selected Forecast Models Indicate the Strong Correlation between the Independent and Dependent Variables for the VATSP Forecast

Market Segment	Independent Variables	Model Fit (R^2)
Northern Virginia/Washington Metropolitan		
Domestic	US GDP DC Population	0.948
Canada	North America GDP	0.854
Latin America/Caribbean	US GDP	0.990
Transatlantic	US GDP	0.931
Transpacific	US GDP	0.975
Virginia Small and Non-hub		
Domestic	Virginia GDP Virginia Population	0.867
International	Virginia GDP Virginia Employment	0.989

Source: VATSP Forecast.

Source: Heather Ream.

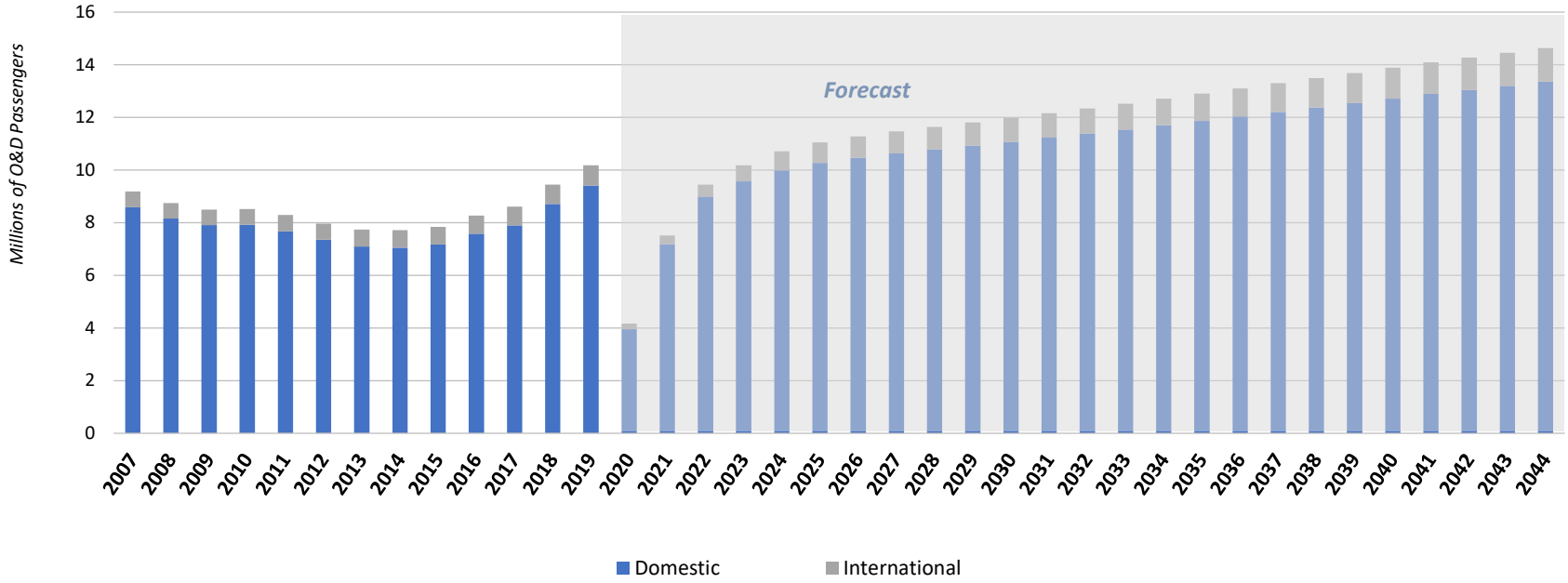
The Northern Virginia/Washington Metropolitan Market traffic is forecast to increase 1.5 percent from 2019 to 2044.



Note: Includes O&D passengers from Reagan National, Dulles International, Baltimore/Washington International.
Source: O&D Survey Data; VATSP Forecast.

Figure 5-11: Northern Virginia/Washington O&D Passengers; CY 2007-2044

Traffic at small and non-hub airports in Virginia is forecast to increase 1.5 percent from 2019 to 2044. Growth at Virginia's small and non-hub airports is primarily driven by domestic traffic.



Source: O&D Survey Data; VATSP Forecast.

Figure 5-12: Virginia Small and Non-hub O&D Passengers; CY 2007-2044

As previously mentioned, once O&D passenger demand for the Northern Virginia/Washington Metropolitan area and small- and non-hubs was projected, traffic was then allocated to the individual airports. The Northern Virginia/Washington Metropolitan Market was forecasted as one market because the three airports share overlapping service areas requiring the forecast for the region as a whole to be allocated to each airport. This is standard practice in multiple airport markets. The forecast reflects that the O&D passenger share at Dulles International and Reagan National will return to 2019 levels by 2023 for Domestic, Canadian, and Latin America/Caribbean traffic, while passenger share for the trans-oceanic regions will return to pre-pandemic levels by 2024. Transoceanic is expected to lag the Americas due to differing travel restrictions. The domestic U.S. market has almost returned to 2019 levels, while the Transatlantic market opened in November of 2021 and for vaccinated passengers only.

Table 5-7: Northern Virginia/Washington Metropolitan Market O&D Passenger Allocation

		Actual			Forecast				
		2015	2019	2020	2024	2029	2034	2039	2044
Domestic	Dulles International	20.0%	20.1%	19.9%	20.1%	20.1%	20.1%	20.1%	20.1%
	Reagan National	43.3%	41.4%	37.2%	41.4%	41.1%	40.8%	40.4%	40.1%
	Baltimore	36.7%	38.5%	42.9%	38.5%	38.8%	39.1%	39.5%	39.8%
	Total	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***
Canada	Dulles International	28.5%	41.2%	38.3%	41.2%	41.2%	41.2%	41.2%	41.2%
	Reagan National	52.7%	38.8%	44.3%	38.7%	38.6%	38.4%	38.2%	38.0%
	Baltimore	18.8%	20.0%	17.4%	20.1%	20.2%	20.4%	20.6%	20.8%
	Total	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***
Latin America/Caribbean	Dulles International	48.7%	49.3%	45.1%	49.3%	49.3%	49.3%	49.3%	49.3%
	Reagan National	23.6%	19.6%	18.9%	19.6%	19.3%	19.1%	18.8%	18.6%
	Baltimore	27.7%	31.1%	36.0%	31.1%	31.4%	31.6%	31.9%	32.1%
	Total	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***
Transatlantic	Dulles International	91.0%	92.8%	95.0%	92.0%	92.0%	92.0%	92.0%	92.0%
	Reagan National	2.5%	1.7%	1.6%	1.7%	1.6%	1.5%	1.4%	1.3%
	Baltimore	6.5%	5.5%	3.4%	6.3%	6.4%	6.5%	6.6%	6.7%
	Total	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***
Transpacific	Dulles International	85.0%	88.8%	89.7%	88.0%	88.0%	88.0%	88.0%	88.0%
	Reagan National	9.0%	5.8%	5.6%	5.8%	5.5%	5.2%	4.9%	4.6%
	Baltimore	6.0%	5.4%	4.7%	6.2%	6.5%	6.8%	7.1%	7.4%
	Total	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***

Source: O&D Survey Data, VATSP Forecast.

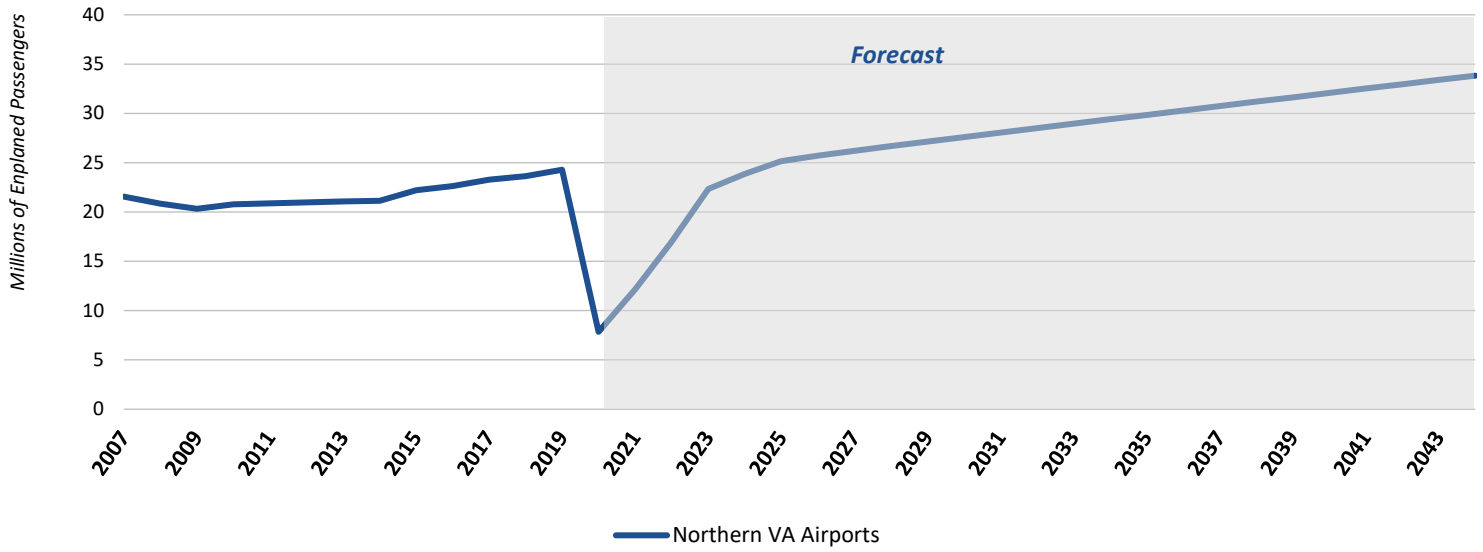
The forecast assumes that both domestic and international O&D passenger share at the seven small and non-hub airports will return to 2019 levels by 2022, reflecting the accelerated domestic return to 2019 levels.

Table 5-8: Virginia's Small and Non-Hub Airports O&D Passenger Allocation

	Actual			Forecast				
Domestic O&D Share	**2015**	**2019**	**2020**	**2024**	**2029**	**2034**	**2039**	**2044**
Charlottesville-Albemarle	6.8%	7.5%	6.3%	7.5%	7.8%	8.2%	8.6%	8.9%
Lynchburg Regional	2.0%	1.8%	2.3%	1.7%	1.6%	1.5%	1.4%	1.4%
Norfolk International	37.2%	37.9%	41.9%	37.1%	35.8%	35.3%	35.4%	35.5%
Newport News/Williamsburg	5.1%	4.2%	3.4%	3.7%	3.8%	3.8%	3.8%	3.8%
Richmond International	41.6%	41.5%	39.2%	43.2%	44.6%	45.2%	45.2%	45.2%
Roanoke-Blacksburg	7.2%	6.8%	6.8%	6.5%	6.1%	5.7%	5.3%	4.9%
Shenandoah Valley	0.1%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
International O&D Share	**2015**	**2019**	**2020**	**2024**	**2029**	**2034**	**2039**	**2044**
Charlottesville-Albemarle	4.8%	4.9%	4.4%	4.9%	4.9%	4.9%	4.9%	4.9%
Lynchburg Regional	1.2%	1.0%	1.3%	1.0%	1.0%	1.0%	1.0%	1.0%
Norfolk International	41.7%	39.5%	41.2%	39.5%	39.5%	39.5%	39.5%	39.5%
Newport News/Williamsburg	2.8%	1.7%	1.3%	1.7%	1.7%	1.7%	1.7%	1.7%
Richmond International	40.9%	45.1%	44.7%	45.1%	45.1%	45.1%	45.1%	45.1%
Roanoke-Blacksburg	8.5%	7.8%	6.9%	7.8%	7.8%	7.8%	7.8%	7.8%
Shenandoah Valley	0.1%	0.1%	0.2%	0.1%	0.1%	0.1%	0.1%	0.1%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

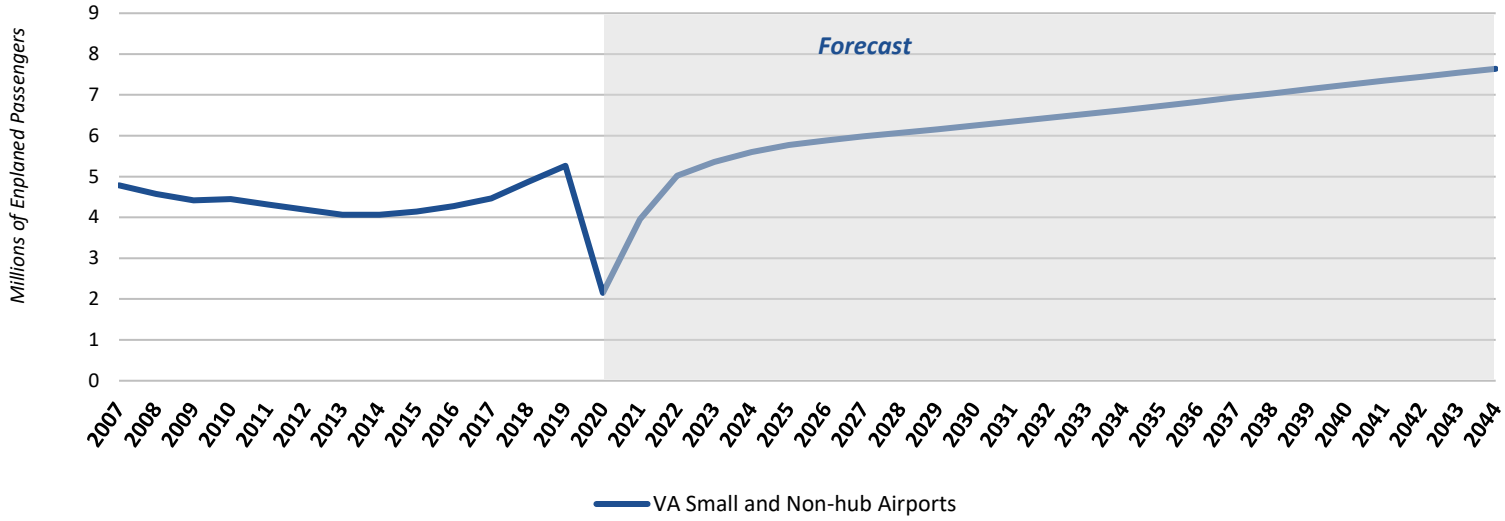
Note: Numbers might not add to 100% due to rounding.
Source: O&D Survey Data, VATSP Forecast.

Northern Virginia/Washington Metropolitan airports' enplaned passengers are forecast to increase 1.3 percent between 2019 and 2044. The enplaned passenger forecast at Dulles International, and Reagan National reflects not only the O&D passenger forecast, but also passengers that are using the two large hub airports as a connecting hub. Virginia's small and non-hub airports' enplanements are projected to increase by 1.5 percent per year.



Note: Enplaned Forecast graph excludes BWI; VATSP Forecast.
Source: VATSP Forecast.

Figure 5-13: Northern Virginia Airports Enplaned Passenger Forecast; CY 2007-2044



Source: VATSP Forecast.

Figure 5-14: Virginia Small and Non-hub Airports Enplaned Passenger Forecast; CY 2007-2044

Between 2007 and 2019, the range of performance when looking at enplanements at the Virginia commercial service airports varied between -7 percent per year at Newport News-Williamsburg to growth of 11.1 percent at Shenandoah Valley. In 2020, enplanements at all the Virginia airports fell due to COVID-19, with seven of the nine commercial service airport enplanements falling by more than 60 percent. Norfolk International and Lynchburg Regional fell by 55 percent and 49 percent, respectively. Throughout the forecast period, the compound annual growth rates range from 0.5 percent at Lynchburg Regional to 2.4 percent per year at Charlottesville-Albemarle.

Table 5-9: Historical and Forecast Enplanements at Virginia Commercial Service Airports

	Dulles International	Reagan National	Richmond International	Norfolk International	Charlottesville-Albemarle	Roanoke-Blacksburg	Newport News/ Williamsburg	Lynchburg Regional	Shenandoah Valley
Historical									
2007	12,273,506	9,294,077	1,805,992	1,867,307	187,078	348,634	513,381	55,785	4,907
2008	11,857,947	8,977,831	1,733,668	1,786,594	169,843	315,293	504,292	55,307	7,746
2009	11,546,771	8,767,243	1,649,284	1,701,246	180,462	297,588	498,205	86,366	8,364
2010	11,742,060	9,035,544	1,651,131	1,663,294	197,776	316,478	519,906	93,772	10,408
2011	11,517,956	9,362,812	1,571,155	1,606,695	216,957	320,961	516,789	73,821	12,033
2012	11,172,236	9,788,155	1,582,565	1,651,440	230,097	315,877	314,139	79,889	15,179
2013	10,860,616	10,197,696	1,597,913	1,560,754	230,699	310,295	263,964	77,795	19,730
2014	10,679,374	10,458,353	1,671,096	1,488,114	250,666	305,496	259,082	78,876	9,422
2015	10,713,852	11,495,977	1,759,449	1,515,200	274,767	300,181	209,474	75,824	5,536
2016	10,862,655	11,767,262	1,784,674	1,602,631	295,930	305,212	203,774	75,465	5,442
2017	11,323,660	11,946,400	1,835,337	1,694,329	334,347	309,044	204,391	82,489	6,605
2018	11,943,263	11,709,855	2,048,066	1,846,031	352,816	329,233	201,642	83,392	12,179
2019	12,326,926	11,949,040	2,201,777	1,990,570	386,344	359,999	215,822	92,214	17,278
2020	4,083,437	3,767,537	857,185	892,568	131,516	145,776	70,710	47,314	6,179
Forecast									
2024	11,546,858	12,319,012	2,422,340	2,064,515	417,129	383,018	206,027	91,804	18,495
2029	13,761,248	13,373,249	2,749,706	2,181,391	484,626	401,866	227,965	96,125	19,438
2034	15,221,770	14,175,898	3,004,753	2,300,701	549,173	410,297	246,438	99,175	20,156
2039	16,684,194	14,950,867	3,239,639	2,473,047	621,445	417,392	266,419	102,187	20,889
2044	18,131,792	15,693,225	3,469,421	2,640,330	697,315	419,986	286,067	104,382	21,477
Compound Annual Growth Rate (CAGR):									
2007-19	0.0%	2.1%	1.7%	0.5%	6.2%	0.3%	-7.0%	4.3%	11.1%
2014-19	2.9%	2.7%	5.7%	6.0%	9.0%	3.3%	-3.6%	3.2%	12.9%
2019-24	-1.3%	0.6%	1.9%	0.7%	1.5%	1.2%	-0.9%	-0.1%	1.4%
2019-29	1.1%	1.1%	2.2%	0.9%	2.3%	1.1%	0.5%	0.4%	1.2%
2019-34	1.4%	1.1%	2.1%	1.0%	2.4%	0.9%	0.9%	0.5%	1.0%
2019-39	1.5%	1.1%	1.9%	1.1%	2.4%	0.7%	1.1%	0.5%	1.0%
2019-44	1.6%	1.1%	1.8%	1.1%	2.4%	0.6%	1.1%	0.5%	0.9%

Source: Airport reported statistics, FAA Enplanement Database, VATSP Forecast.

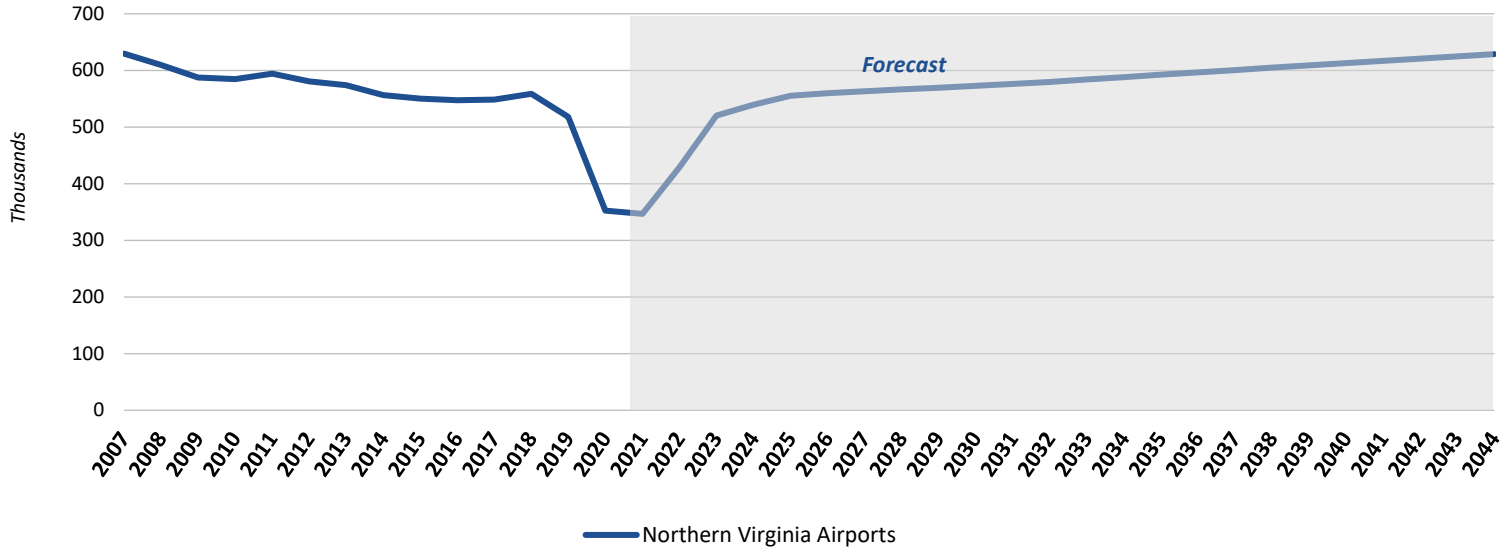
Commercial Passenger Aircraft Operations

Forecasts of annual commercial passenger aircraft operations are based on forecast passenger traffic demand. Passenger aircraft landings depend on the average aircraft size and average load factor (i.e., average passenger per flight), as represented by the formula below:

Passenger Aircraft Operations = (Passenger Forecasts) / (Avg. Aircraft Size x Avg. Load Factor)

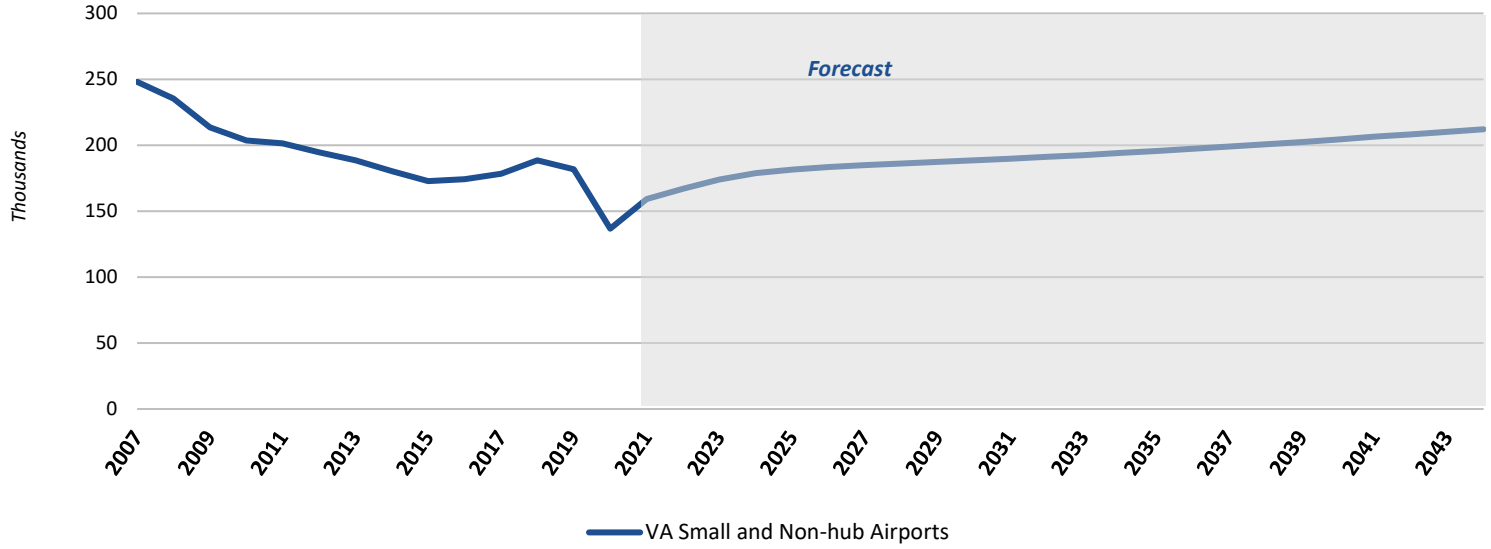
where Avg. Aircraft Size x Avg. Load Factor = Avg. Passengers per Aircraft Movement

Northern Virginia airports commercial operations are forecast to increase 0.8 percent between 2019 and 2044. Virginia's small and non-hub airports are projected to increase by 0.6 percent per year.



Note: Enplaned Forecast graph excludes BWI.
Source: VATSP Forecast.

Figure 5-15: Northern Virginia/Washington Metropolitan Airports Commercial Operations Forecast; CY 2007-2044



Source: VATSP Forecast.

Figure 5-16: Virginia Small and Non-hub Airports Commercial Operations Forecast; CY 2007-2044

Commercial operations growth at the small and non-hub airports is expected to lag enplanement growth. This is due to the retirement of the 50-seat jet and continued increase in average aircraft size. Similar to the commercial service airports' enplanements in 2020, operations also fell due to COVID-19.

Throughout the forecast period, the compound annual growth rates range from -1.6 percent at Roanoke-Blacksburg to 1.4 percent per year at Richmond International.

Table 5-10: Historical and Forecast of Commercial Operations at Virginia Commercial Service Airports

	Dulles International	Reagan National	Richmond International	Norfolk International	Charlottesville-Albemarle	Roanoke-Blacksburg	Newport News/ Williamsburg	Lynchburg	Shenandoah Valley
Historical									
2007	355,733	273,969	84,278	75,955	21,549	32,430	25,546	6,573	1,776
2008	337,479	271,805	78,925	71,650	23,354	30,499	23,006	6,072	2,003
2009	319,538	267,794	72,869	65,470	20,749	25,748	21,189	5,538	2,003
2010	317,642	267,077	68,437	65,014	19,659	23,289	19,560	5,500	2,116
2011	314,914	279,380	68,269	65,016	18,847	22,953	18,560	5,238	2,466
2012	298,532	282,147	66,838	62,226	18,282	22,217	16,706	6,075	2,427
2013	288,193	285,922	66,227	58,548	18,805	21,194	15,283	6,236	2,226
2014	274,170	282,377	65,071	52,974	20,200	19,754	14,031	6,155	2,095
2015	259,731	290,571	63,727	51,150	19,618	18,673	12,027	5,896	1,700
2016	254,765	292,610	62,161	53,848	21,223	18,197	11,305	5,882	1,549
2017	257,496	291,132	63,106	54,048	25,153	18,771	10,680	5,511	1,211
2018	267,078	291,635	66,562	56,185	29,895	18,446	10,738	5,259	1,458
2019	252,515	265,273	63,505	54,882	29,184	17,223	10,318	5,290	1,372
2020	179,666	172,636	46,377	40,182	23,396	13,239	7,663	4,520	1,372
Forecast									
2024	249,075	290,275	73,847	52,304	24,573	11,083	9,635	5,988	1,374
2029	273,988	295,426	78,852	53,564	26,168	11,222	9,984	6,168	1,405
2034	292,634	290,275	82,032	55,158	27,653	11,238	10,265	6,295	1,418
2039	313,101	295,846	85,071	58,378	29,252	11,358	10,612	6,426	1,432
2044	332,669	295,933	88,940	61,550	31,188	11,453	10,941	6,574	1,434
Compound Annual Growth Rate (CAGR):									
2007-19	-2.8%	-0.3%	-2.3%	-2.7%	2.6%	-5.1%	-7.3%	-1.8%	-2.1%
2014-19	-1.6%	-1.2%	-0.5%	0.7%	7.6%	-2.7%	-6.0%	-3.0%	-8.1%
2019-24	-0.3%	1.8%	3.1%	-1.0%	-3.4%	-8.4%	-1.4%	2.5%	0.0%
2019-29	0.8%	1.1%	2.1%	-0.2%	-1.1%	-4.2%	0.3%	1.5%	0.2%
2019-34	1.0%	0.7%	1.7%	0.0%	-0.4%	-2.8%	0.0%	1.2%	0.2%
2019-39	1.1%	0.5%	1.5%	0.3%	0.0%	-2.1%	0.1%	1.0%	0.2%
2019-44	1.1%	0.4%	1.4%	0.5%	0.3%	-1.6%	0.2%	0.9%	0.2%

Source: US DOT T-100 Data, FAA Terminal Area Forecast, VATSP Forecast.

The following sections examine the forecast for the nine commercial service airports in Virginia. For purposes of illustration of the dramatic impact of COVID-19, both the 2019 TAF and the 2020 TAF are included. However, for the purposes of the FAA's review and approval of the Aviation Forecasts, the VATSP was only compared to the 2020 TAF. This is presented in **Tables 5-24 to 5-26**.

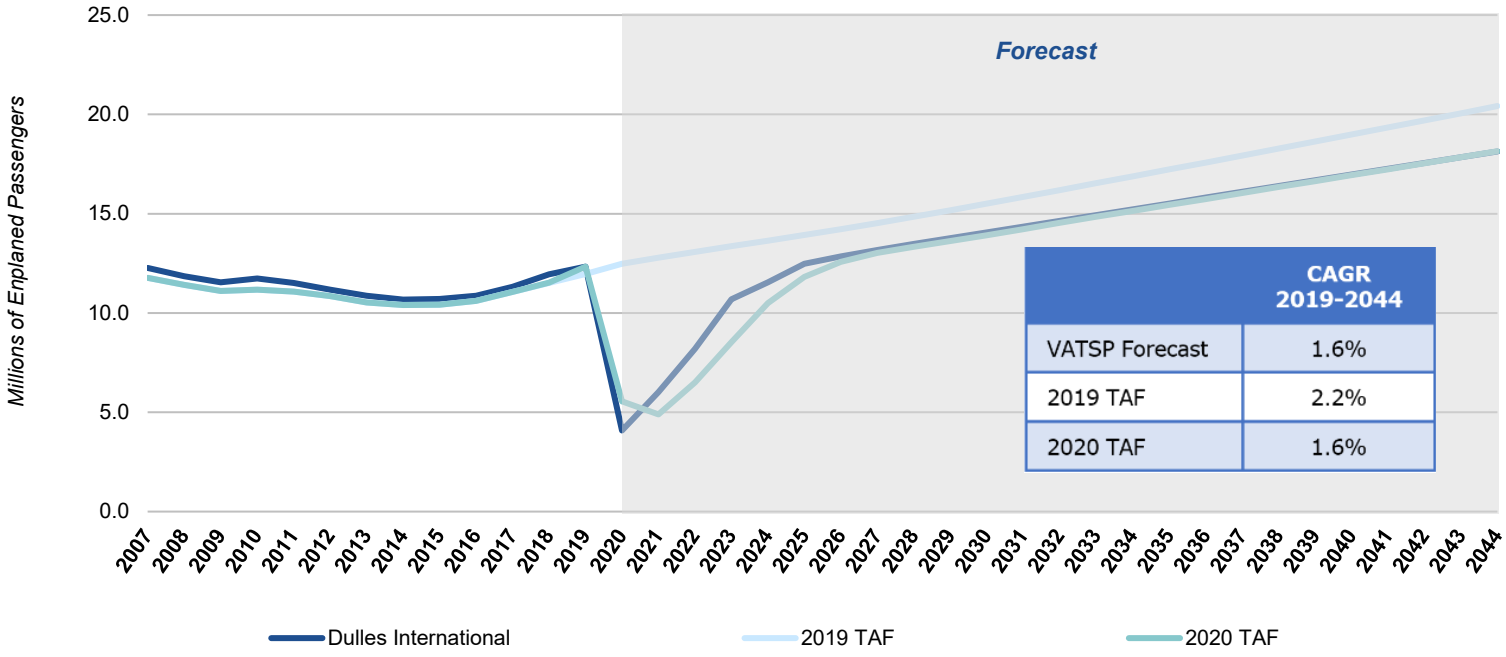
Dulles International

Dulles International is one of United Airlines' seven hubs. United Airlines' hub at Dulles International is paramount in importance not only in employment but also in bringing domestic and international passengers to Virginia.

Historically, Dulles International's enplanement growth was flat from the period of 2007-2019. From 2010 through 2015, United Airlines contracted at Dulles International due to a number of factors that include the cost to operate at Dulles International and the change in United's strategy. Starting in 2016 United Airlines returned to growth and grew the hub's capacity for four consecutive years. From 2014-2019, Dulles International's passenger traffic grew 2.9 percent per year. Only United Airlines' hubs at Denver and Houston have seen more capacity restored following COVID-19, illustrating the importance of Dulles International to United Airlines' system.

As shown below, Dulles International's enplanements are expected to increase from 12.3 million in 2019 to 18.1 million in 2044. The VATSP forecast has a compound annual growth rate of 1.6 percent per year, lower than the 2019 TAF growth rate of 2.2 percent, but in line with the 2020 TAF growth rate of 1.6 percent (**Figure 5.17**).

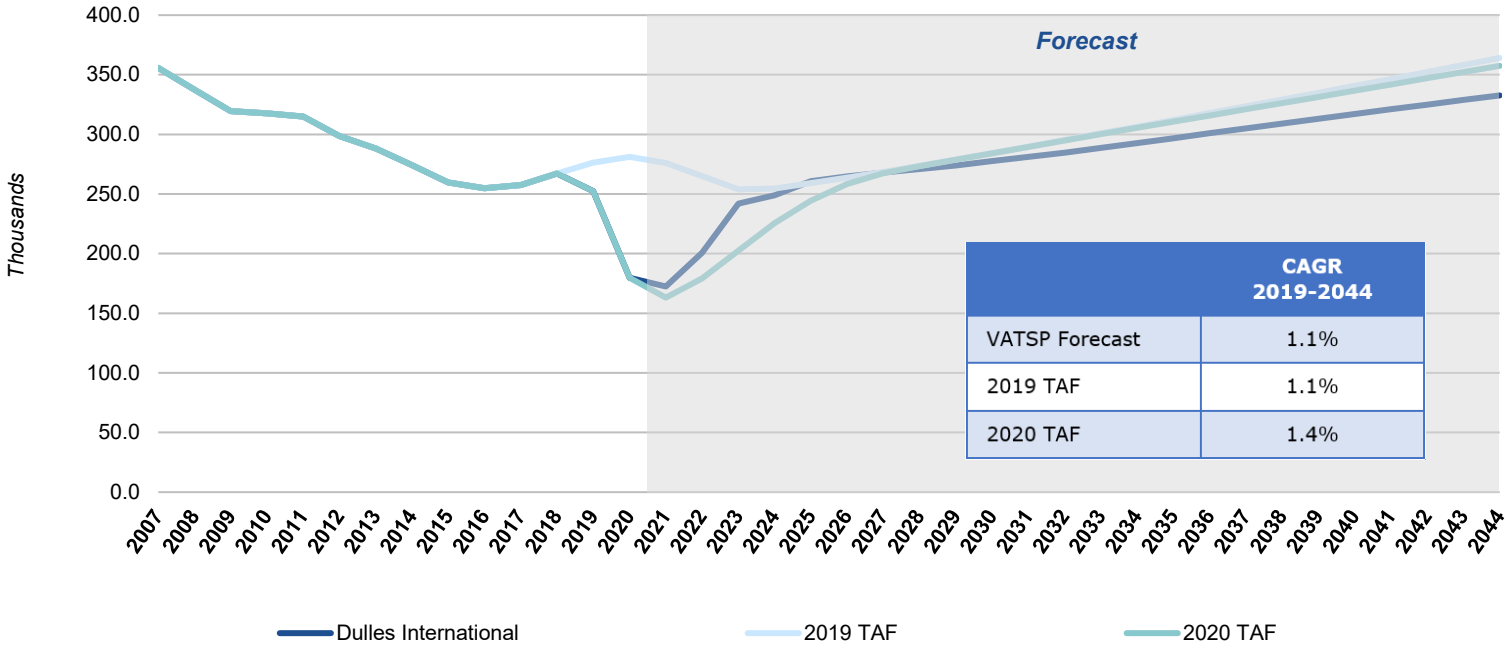
The short-term growth rate from 2019-2024 is expected to be down 1.3 percent with Dulles International recovering to 2019 levels in 2025.



Source: VATSP Forecast; FAA TAF.

Figure 5-17: Dulles International Enplanement Forecast, CY 2007-CY 2044

Dulles International's commercial operations are expected to increase from 253,000 in 2019 to 333,000 in 2044. This is an annual growth rate of 1.1 percent (**Figure 5.18**). The VATSP operations forecast assumes an increase in gauge over the forecast period and a load factor that is capped at 85 percent.[6]



Source: VATSP Forecast; FAA TAF.

Figure 5-18: Dulles International Commercial Operations Forecast, CY 2007-CY 2044

[6] This reflects the assumption that carriers make given the seasonality of demand that on average they will not achieve more than an 85 percent load factor.

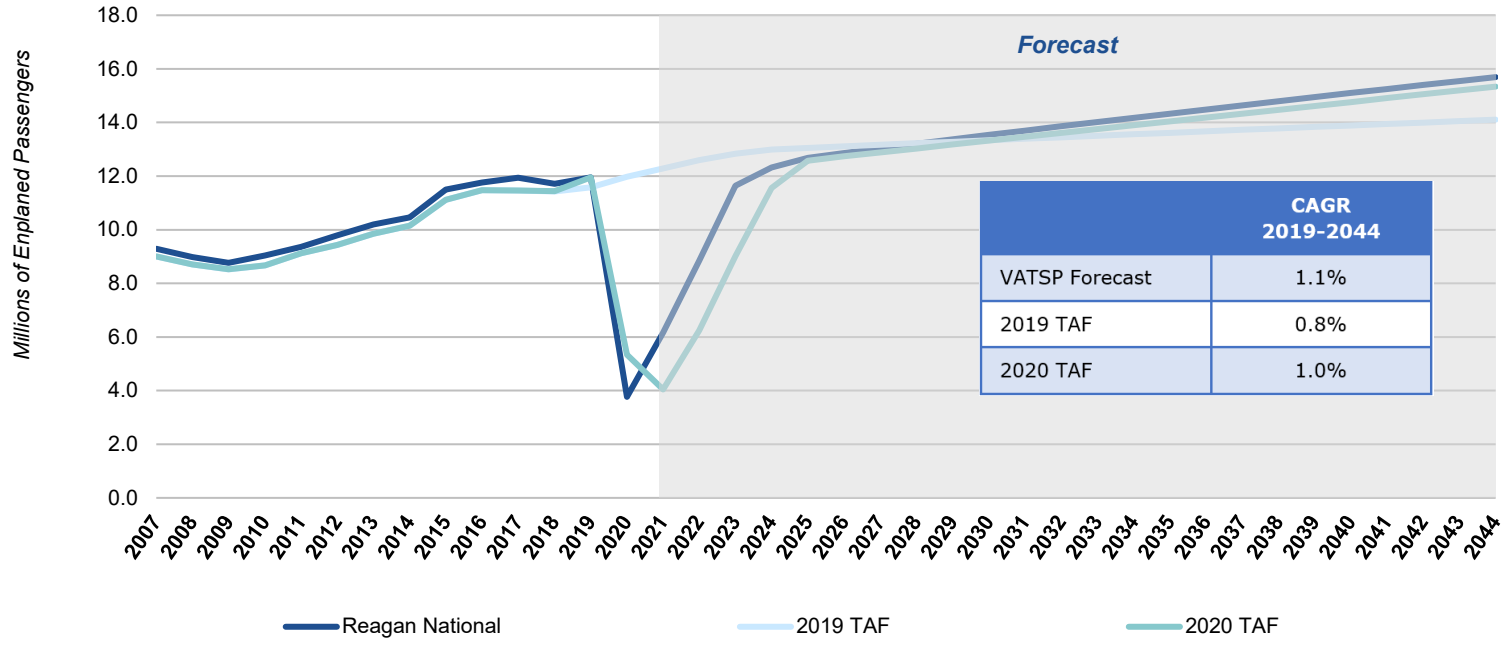
Reagan National

Reagan National is the other large hub airport in Virginia and is home to a small hub and spoke operation flown by American Airlines. Like the rest of American Airlines' northeast U.S. operations in New York, Philadelphia, and Boston, Reagan National has been slow to rebound from the impacts of COVID-19. This is largely due to a dearth of business travel along with the lockdowns throughout the region.

Historically, Reagan National's enplanement growth was 2.1 percent per year from 2007-2019 with stronger growth in the shorter-term (2014-2019) of 2.7 percent per year. Reagan National is a slot-controlled airport, which limits the number of operations allowed at the airport. However, it is no longer served by just the network carriers and has seen an increase in passengers due to low fare carriers that now serve Reagan National.

Reagan National's enplanements are expected to increase from 12.0 million in 2019 to 15.7 million in 2044. The VATSP forecast has a compound annual growth rate of 1.1 percent per year, which is higher than the 2019 TAF growth rate of 0.8 percent and the 2020 TAF has a growth rate of 1.0 percent (**Figure 5-19**).

Reagan National is forecasted to recover to 2019 enplanement levels in 2024 with a short-term growth rate of 0.6 percent per year (2019-2024).

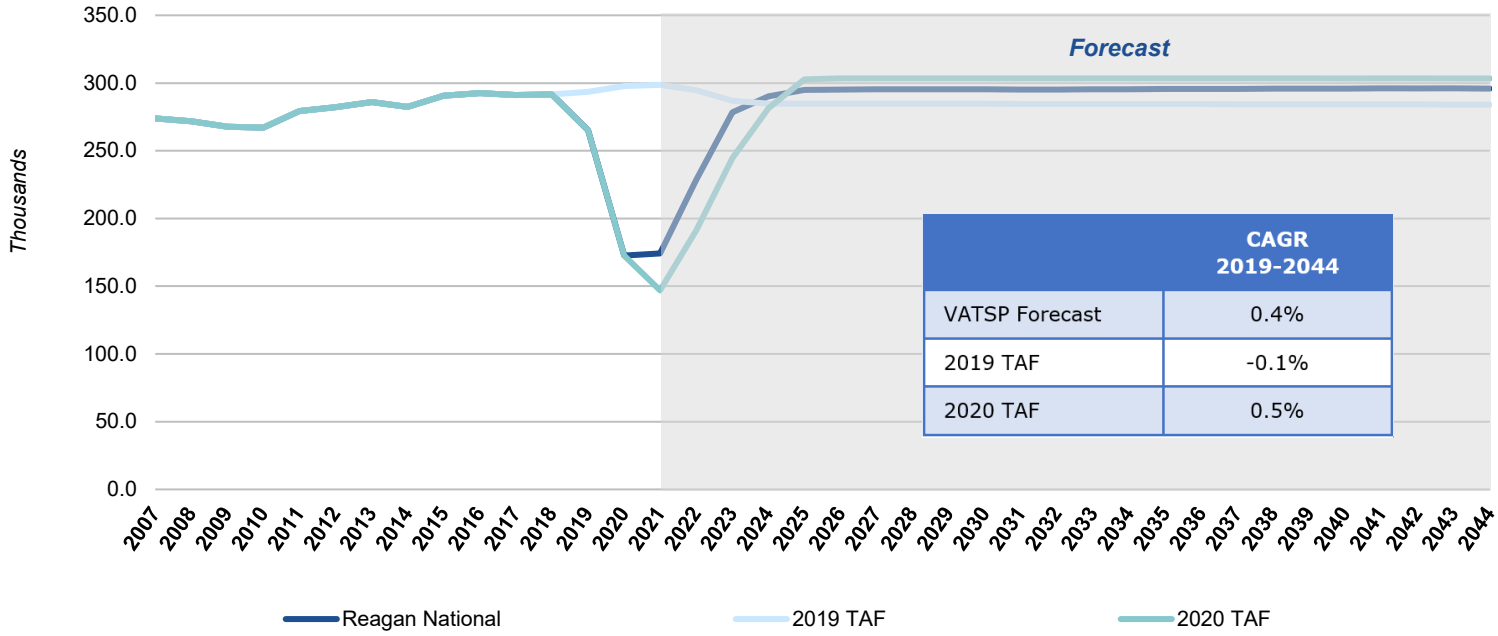


	CAGR 2019-2044
VATSP Forecast	1.1%
2019 TAF	0.8%
2020 TAF	1.0%

Source: VATSP Forecast; FAA TAF.

Figure 5-19: Reagan National Enplanement Forecast, CY 2007-CY 2044

Reagan National's commercial operations are expected to increase from 265,000 in 2019 to 296,000 in 2044. This is an annual growth rate of 0.4 percent (**Figure 5-20**). This relatively low growth in operations for Reagan National reflects that it is a slot-controlled airport constrained to 60 operations per hour.



	CAGR 2019-2044
VATSP Forecast	0.4%
2019 TAF	-0.1%
2020 TAF	0.5%

Source: VATSP Forecast; FAA TAF.

Figure 5-20: Reagan National Commercial Operations Forecast, CY 2007-CY 2044

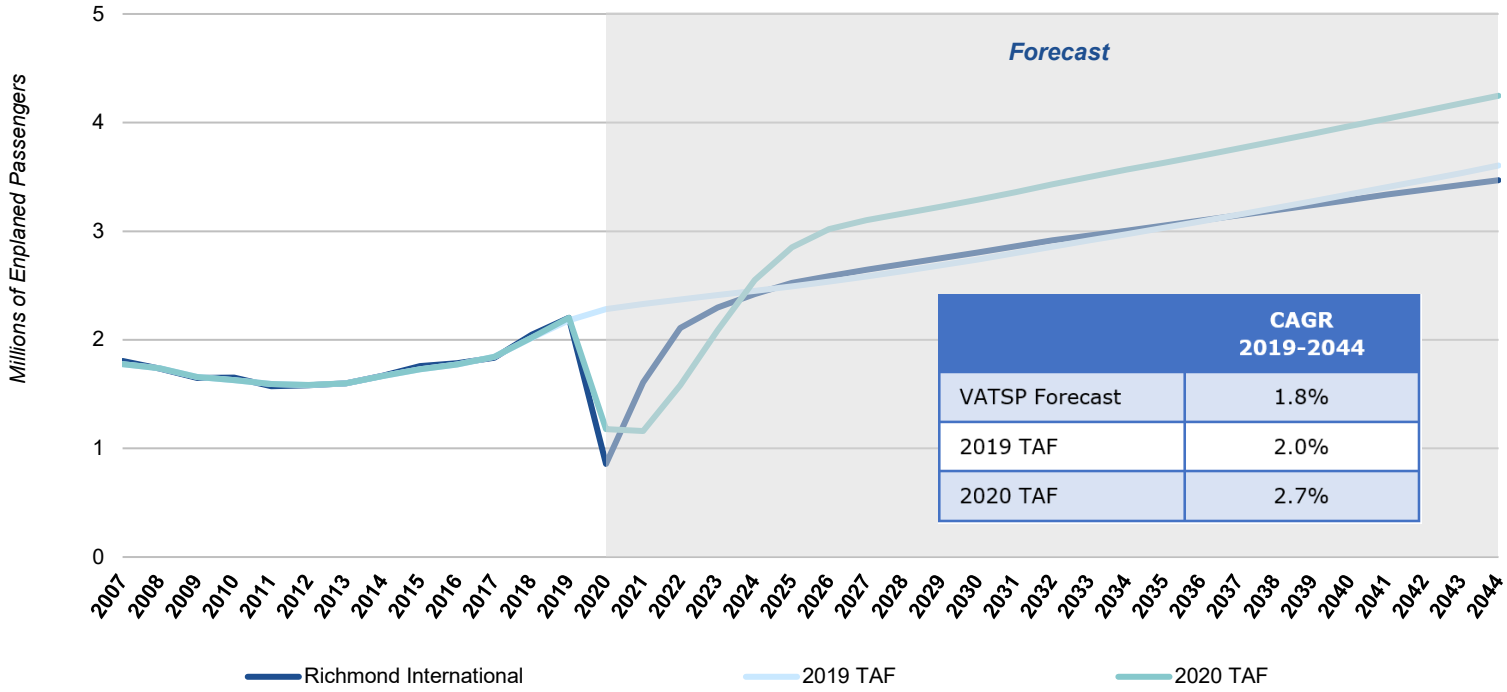
Richmond International

Richmond has transformed over the past decade. Once considered a financial center in the South, Richmond is now considered an emerging city for technology-related companies with a growing population.

Historically, Richmond International has been a high airfare market and the sole domain of the network carriers that serviced it to various hubs. Richmond International's enplanement growth was 1.7 percent per year from 2007-2019 with stronger growth in the shorter-term (2014-2019) of 5.2 percent per year. The strong growth in the past five years was due in part to the entrance of ULCC, Allegiant Air and Spirit Airlines. Richmond International has been one of the fastest growing airports in the region. This trend is expected to continue into the forecast period.

Richmond International's enplanements are expected to increase from 2.2 million in 2019 to 3.5 million in 2044 (**Figure 5-21**). The VATSP forecast has a compound annual growth rate of 1.8 percent per year, in line with the 2019 TAF growth rate of 2.0 percent and lower than the 2020 TAF growth rate of 2.7 percent.

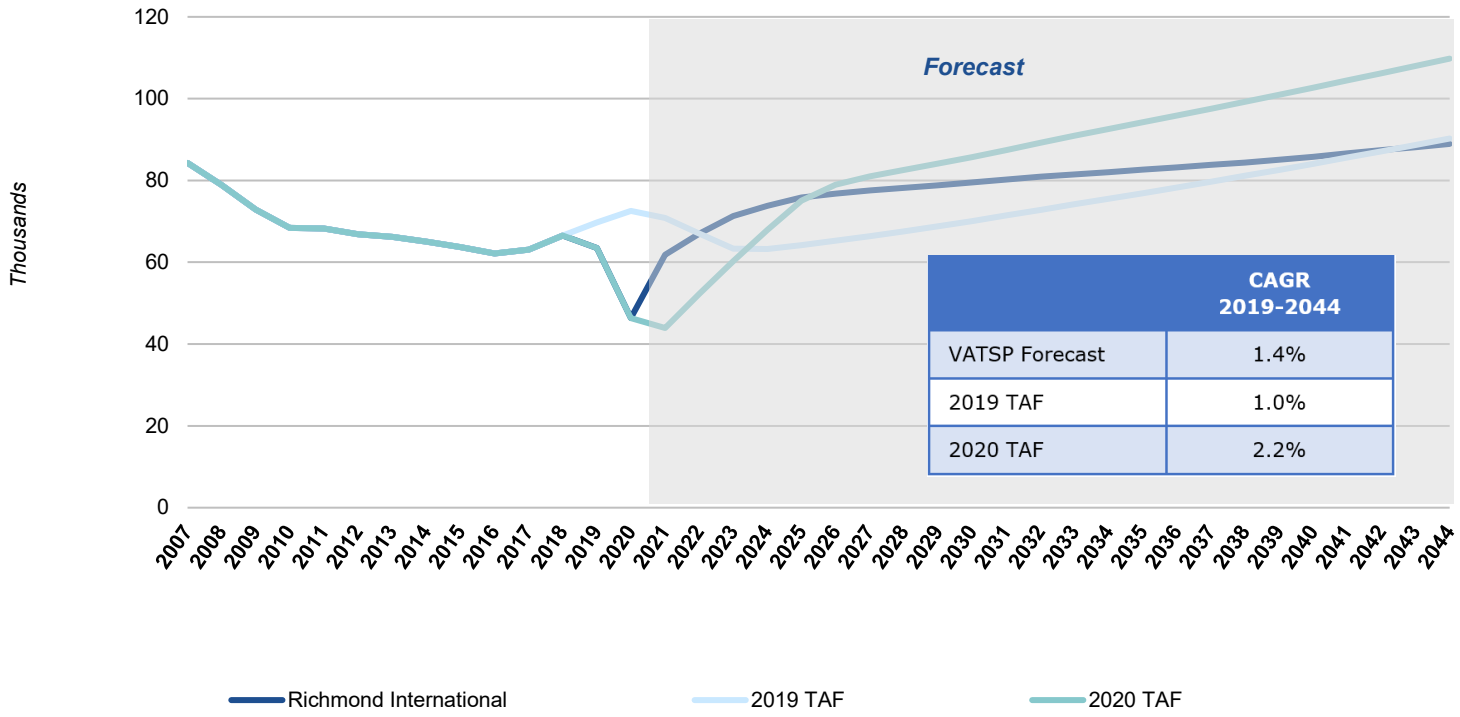
The short-term growth rate from 2019-2024 is expected to be 1.9 percent per year with Richmond International recovering to 2019 levels in 2023.



Source: VATSP Forecast; FAA TAF.

Figure 5-21: Richmond International Enplanement Forecast, CY 2007-CY 2044

Richmond International's commercial operations are expected to increase from 64,000 in 2019 to 89,000 in 2044 (**Figure 5-22**). This is an annual growth rate of 1.4 percent.



Source: VATSP Forecast; FAA TAF.

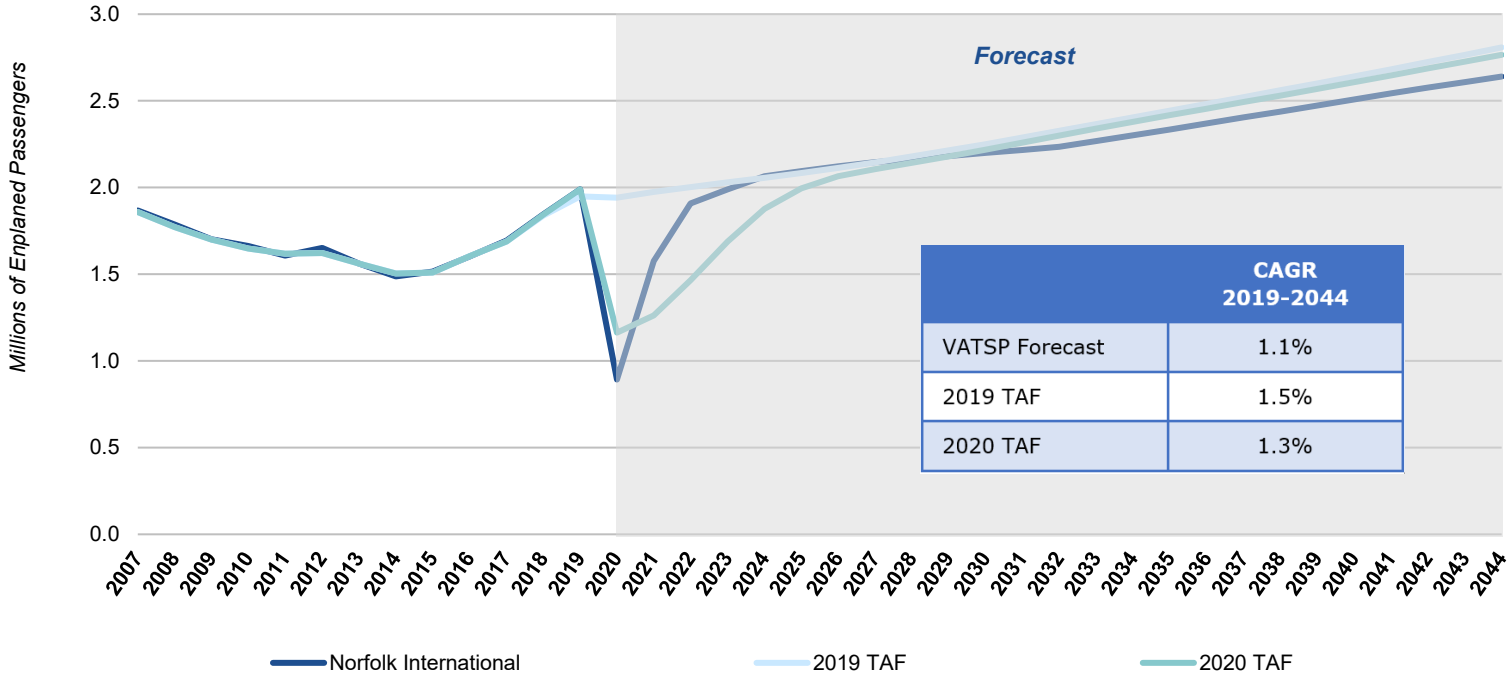
Figure 5-22: Richmond International Commercial Operations Forecast, CY 2007-CY 2044

Norfolk International

Norfolk International is one of two small hub[7] airports in Virginia and acts as a gateway to Virginia Beach, a popular leisure destination. Norfolk is diversifying its economy away from heavy government/military dependence. The combination of these two factors will benefit Norfolk International over the longer term. Historically, Norfolk International's enplanement growth was 0.5 percent from 2007-2019 with stronger growth in the shorter-term (2014-2019) of 6.0 percent per year. This strong growth was due to new service being provided by Frontier Airlines and Allegiant Air.

Norfolk International's enplanements are expected to increase from 2.0 million in 2019 to 2.6 million in 2044. The VATSP forecast has a compound annual growth rate of 1.1 percent per year (**Figure 5-23**), slightly lower than 2019 TAF growth rate of 1.5 percent, but slightly higher than the 2020 TAF growth rate of 1.3 percent.

The short-term growth rate from 2019-2024 is expected to be 0.7 percent per year with Norfolk International recovering to 2019 levels in 2023.



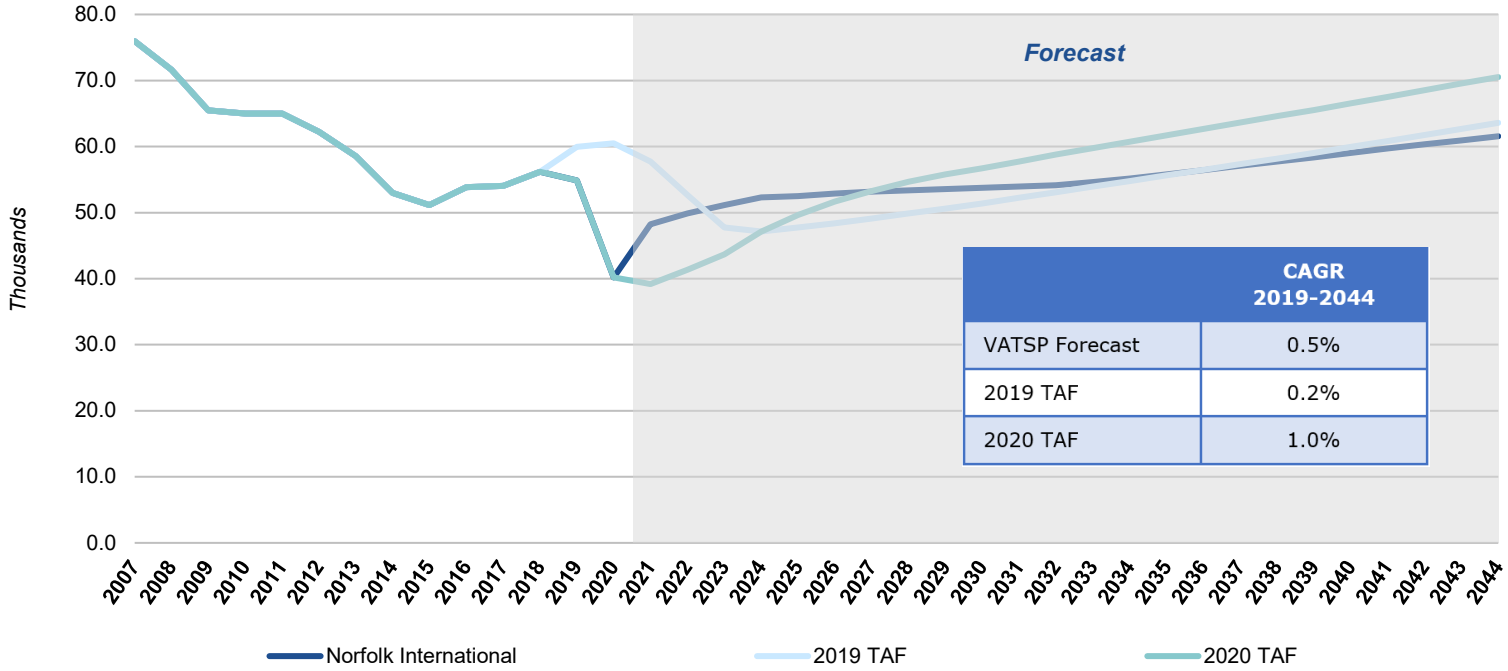
	CAGR 2019-2044
VATSP Forecast	1.1%
2019 TAF	1.5%
2020 TAF	1.3%

Source: VATSP Forecast; FAA TAF.

Figure 5-23: Norfolk International Enplanement Forecast, CY 2007-CY 2044

[7] Norfolk International was classified as a small hub airport at the time the forecast was conducted.

Norfolk International's commercial operations are expected to increase from 55,000 in 2019 to 62,000 in 2044 with a compound annual growth rate of 0.5 percent (**Figure 5-24**).



	CAGR 2019-2044
VATSP Forecast	0.5%
2019 TAF	0.2%
2020 TAF	1.0%

Source: VATSP Forecast; FAA TAF.

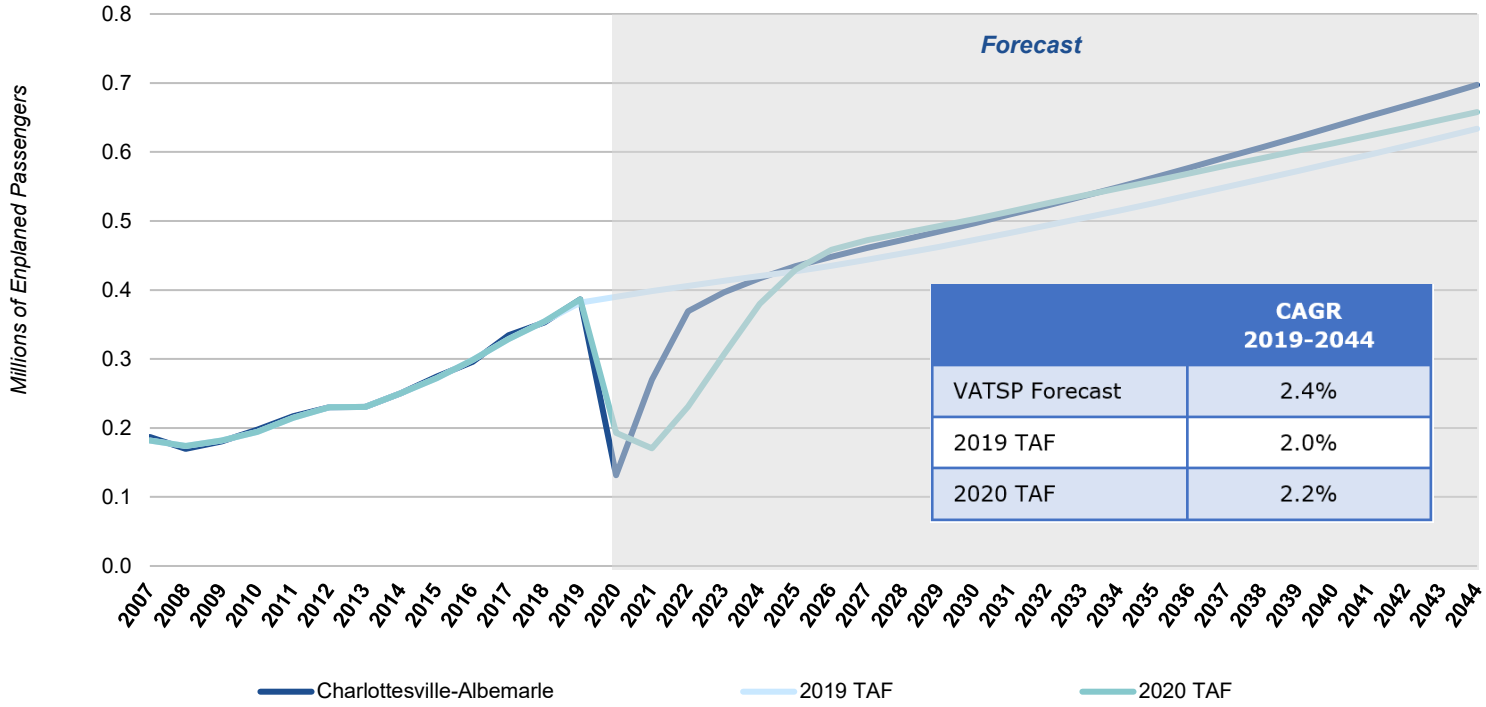
Figure 5-24: Norfolk International Commercial Operations Forecast, CY 2007-CY 2044

Charlottesville-Albemarle

Charlottesville-Albemarle is a strong market in Virginia. The air service market benefits from a population with disposable income that have relocated from Northern Virginia and the major presence of the University of Virginia. Historically, Charlottesville-Albemarle's enplanement growth was strong at 6.2 percent per year from 2007-2019. Charlottesville-Albemarle experienced even stronger growth in the shorter-term (2014-2019) of 9.0 percent per year. Charlottesville-Albemarle has been one of the fastest growing commercial service airports in Virginia.

Charlottesville-Albemarle's enplanements are expected to increase from 386,000 in 2019 to 697,000 in 2044. The VATSP forecast has a compound annual growth rate of 2.4 percent per year (**Figure 5-25**); this is faster growth than both the 2019 and 2020 TAF.

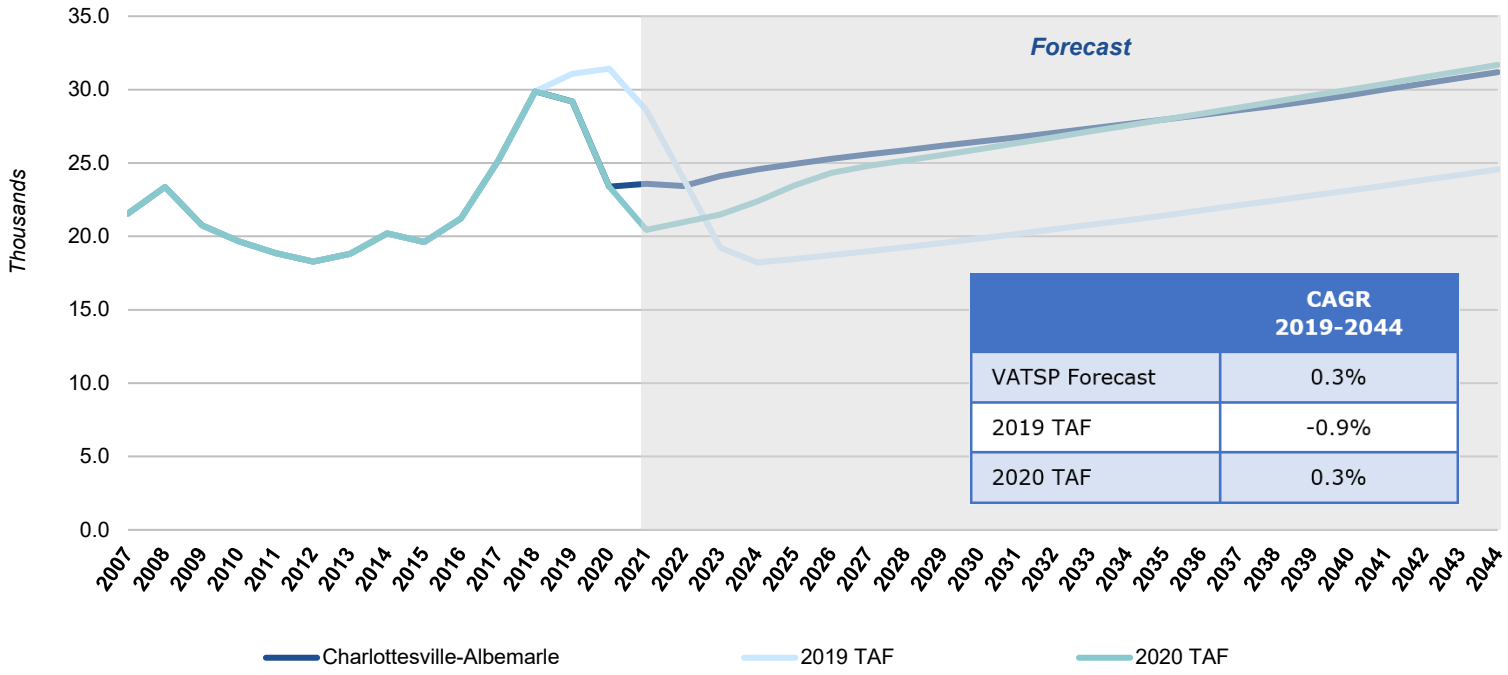
The forecasted short-term growth rate from 2019-2024 is expected to be 1.5 percent per year with Charlottesville-Albemarle recovering to 2019 levels in 2023.



Source: VATSP Forecast; FAA TAF.

Figure 5-25: Charlottesville-Albemarle Enplanement Forecast, CY 2007-CY 2044

Charlottesville-Albemarle's commercial operations are expected to increase from 29,000 in 2019 to 31,000 in 2044 (**Figure 5-26**). This is an annual growth rate of 0.3 percent.



	CAGR 2019-2044
VATSP Forecast	0.3%
2019 TAF	-0.9%
2020 TAF	0.3%

Source: VATSP Forecast; FAA TAF.

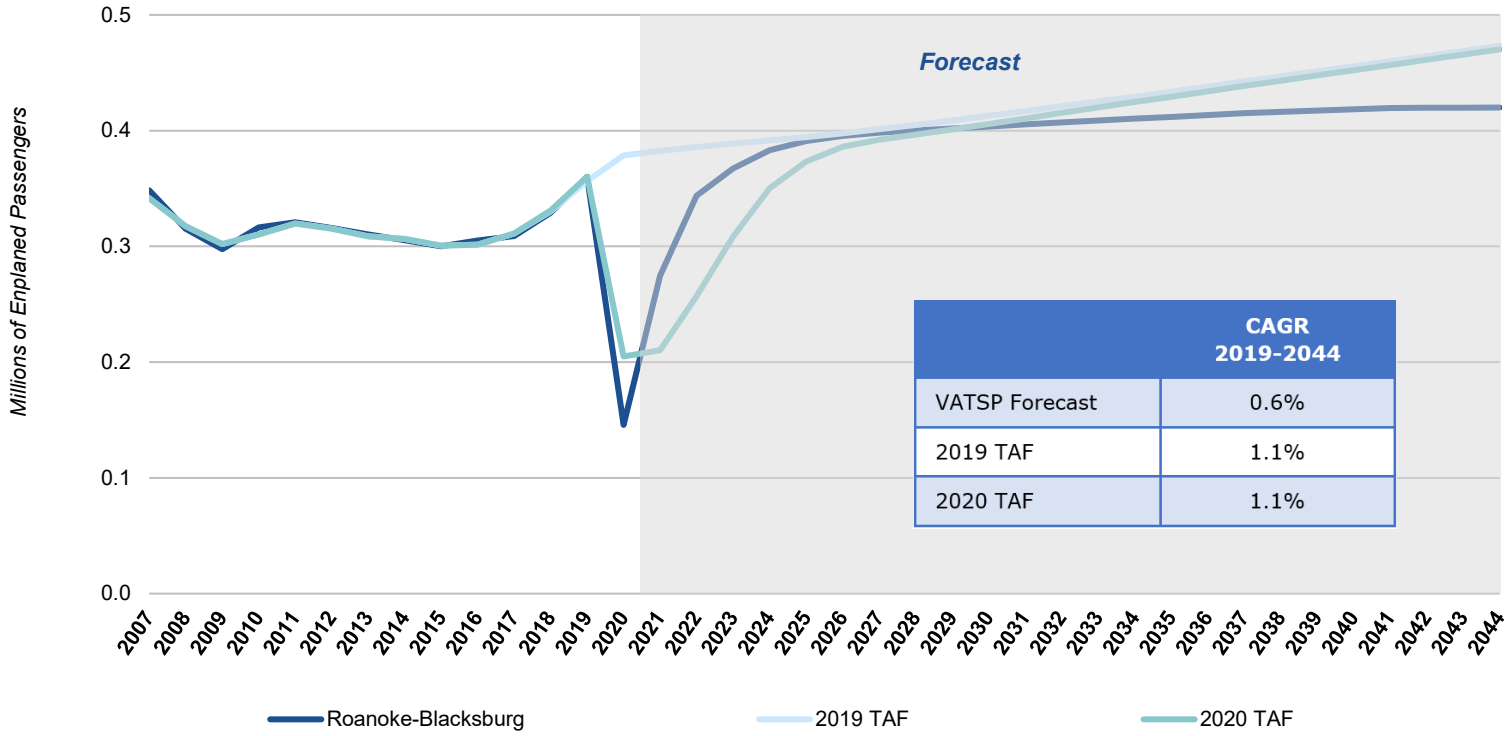
Figure 5-26: Charlottesville-Albemarle Commercial Operations Forecast, CY 2007-CY 2044

Roanoke-Blacksburg

Roanoke-Blacksburg is a non-hub airport in Virginia. It receives service from all three network carriers, American Airlines, Delta Air Lines and United Airlines, as well as service from Allegiant Air. Historically, Roanoke-Blacksburg's enplanement growth was relatively flat at 0.3 percent per year from 2007-2019. In the past five years, Roanoke-Blacksburg's enplanement growth has strengthened at 3.3 percent per year (2014-2019).

Roanoke-Blacksburg enplanements are expected to increase from 360,000 in 2019 to 420,000 in 2044 (**Figure 5-27**). The VATSP forecast has a compound annual growth rate of 0.6 percent per year, while the 2019 TAF has a growth rate of 1.1 percent, and the 2020 TAF has a growth rate of 1.1 percent.

The forecasted short-term growth rate from 2019-2024 is expected to be 1.2 percent per year with Roanoke-Blacksburg recovering to 2019 levels in 2023.

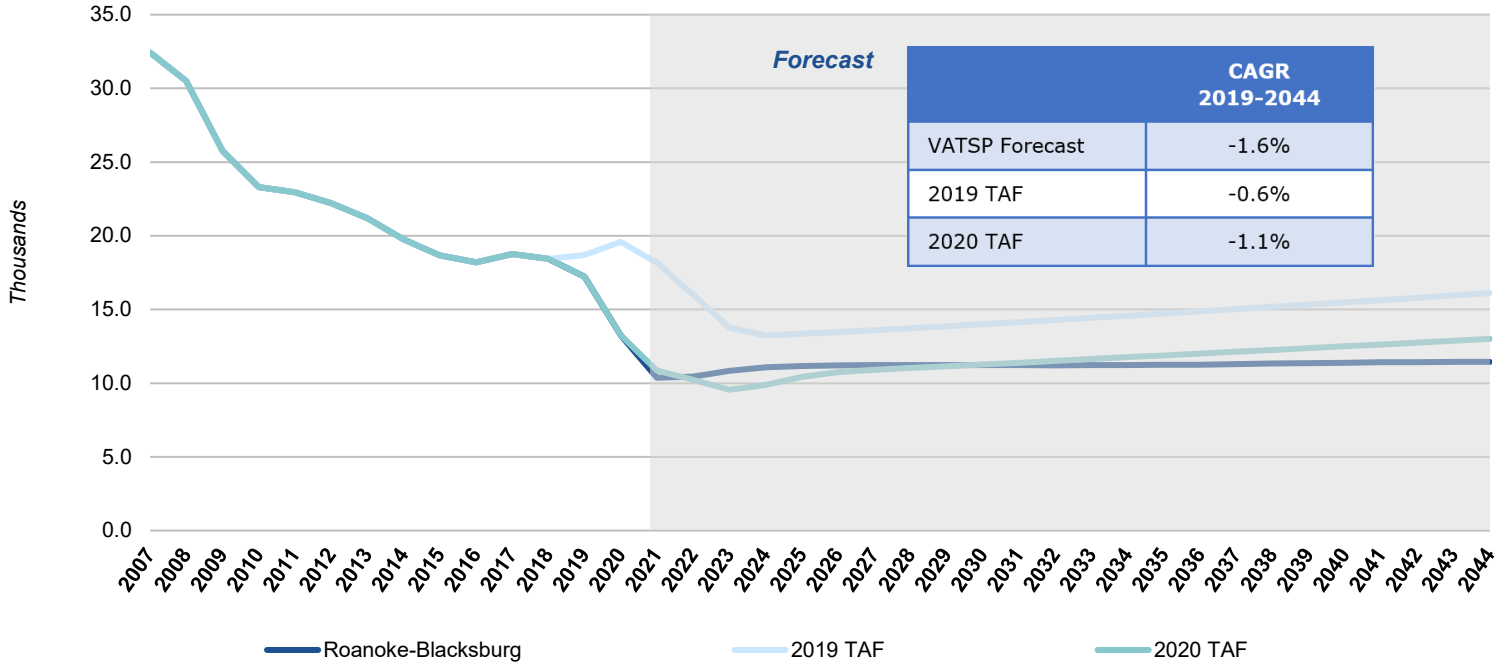


	CAGR 2019-2044
VATSP Forecast	0.6%
2019 TAF	1.1%
2020 TAF	1.1%

Source: VATSP Forecast; FAA TAF.

Figure 5-27: Roanoke-Blacksburg Enplanement Forecast, CY 2007-CY 2044

In a continuation of long-term trends, Roanoke-Blacksburg's commercial service operations are expected to decrease from 17,000 in 2019 to 11,500 in 2044. Roanoke-Blacksburg's commercial service operations are forecast to decline at 1.6 percent per year (**Figure 5-28**). Both the 2019 and 2020 TAF also forecasted a decline in Roanoke-Blacksburg's commercial service operations.



Source: VATSP Forecast; FAA TAF.

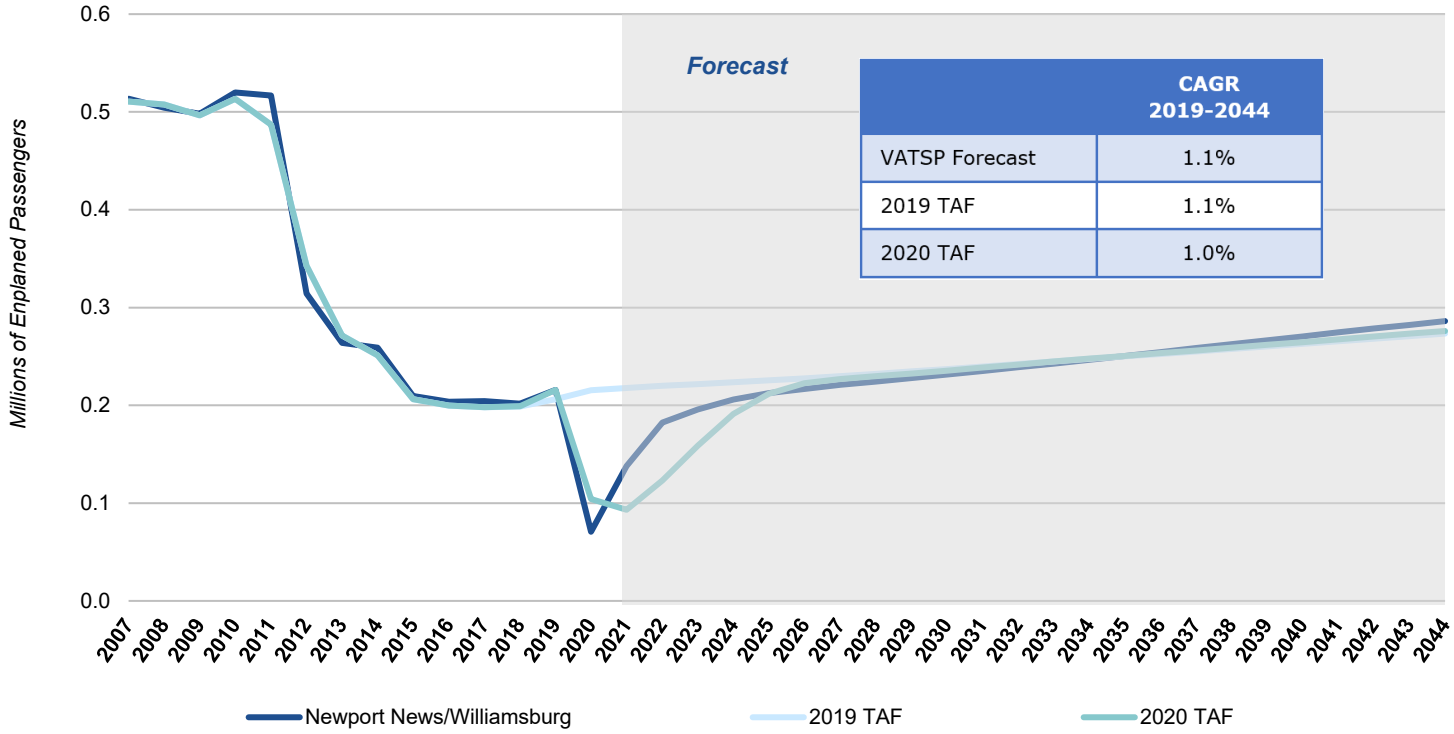
Figure 5-28: Roanoke-Blacksburg Commercial Operations Forecast, CY 2007-CY 2044

Newport News-Williamsburg

Newport News-Williamsburg is a non-hub airport in Virginia located about one hour away from Richmond International and less than an hour from Norfolk International. Historically, Newport News-Williamsburg has seen a decline in enplanements at about 7 percent per year from 2007-2019. This trend has lessened since 2014, with a decline of 3.6 percent per year (2014-2019). The contraction of service at Newport News-Williamsburg is in part due to the discontinuation of service in 2012 by Southwest Airlines as part of the merger with AirTran Airways. When the market had service from AirTran it responded well. However, Newport News-Williamsburg has yet to recover from Southwest Airlines leaving the market. Fortunately, Newport News-Williamsburg has a strong economy, and the airport recently received a Small Community Air Service Development (SCASD) Grant to use for new service to Dulles International.

Newport News-Williamsburg enplanements are expected to increase from 216,000 in 2019 to 286,000 in 2044. The VATSP forecast has a compound annual growth rate of 1.1 percent per year, in line with the 2019 TAF growth rate of 1.1 percent and higher than the 2020 TAF growth rate of 1.0 percent (**Figure 5-29**).

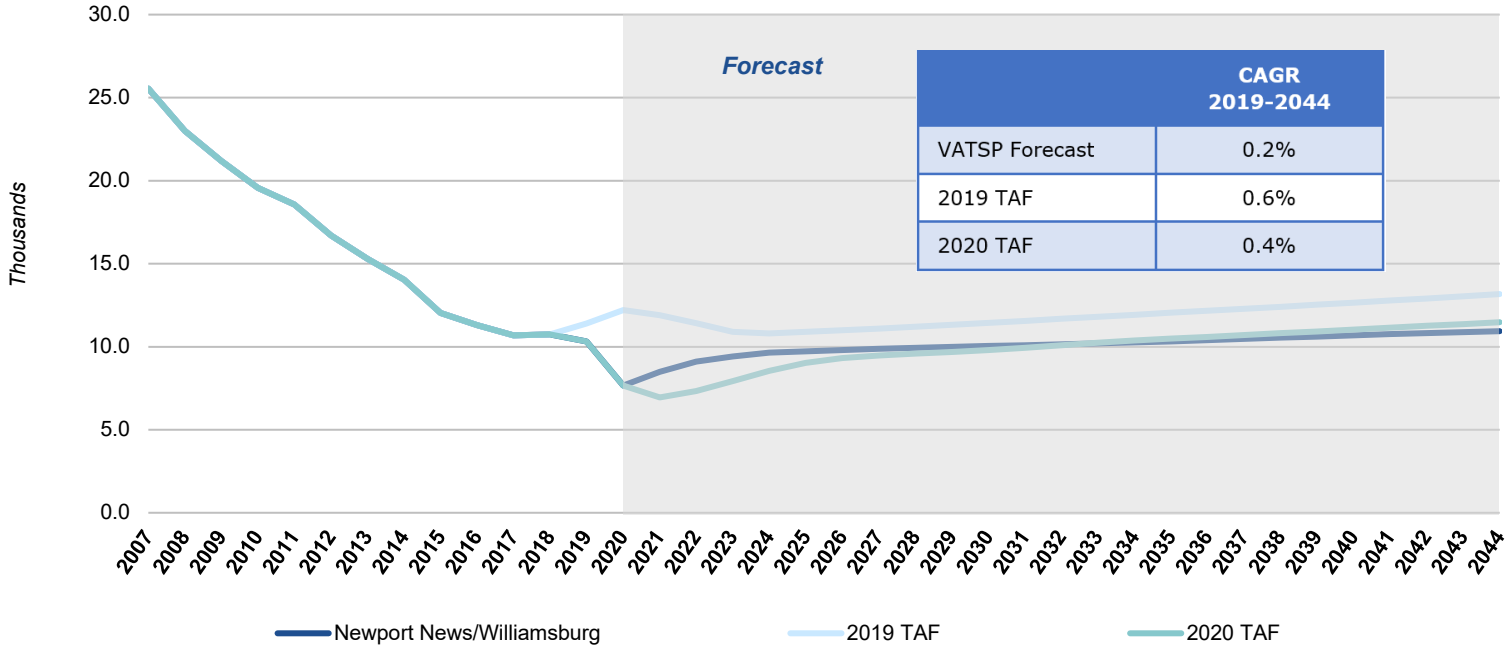
The forecasted short-term growth rate from 2019-2024 is expected to be down 0.9 percent with Newport News-Williamsburg recovering to 2019 levels in 2026.



Source: VATSP Forecast; FAA TAF.

Figure 5-29: Newport News-Williamsburg Enplanement Forecast, CY 2007-CY 2044

Newport News-Williamsburg's commercial service operations are expected to increase from 10,000 in 2019 to 11,000 in 2044. Newport News-Williamsburg's commercial service operations are forecast to grow at 0.2 percent per year (**Figure 5-30**).



Source: VATSP Forecast; FAA TAF.

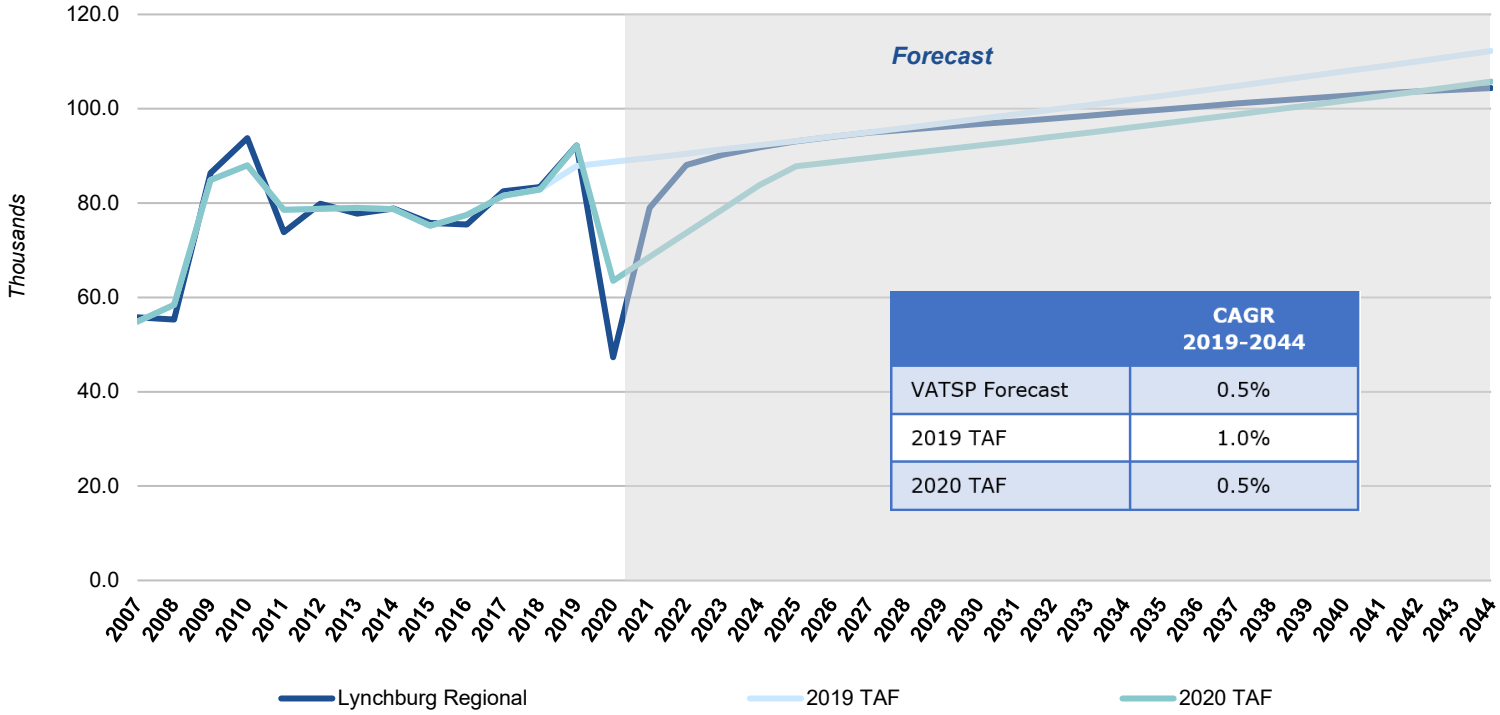
Figure 5-30: Newport News-Williamsburg Commercial Operations Forecast, CY 2007-CY 2044

Lynchburg Regional

Lynchburg Regional is a non-hub airport in Virginia. For years, American Airlines has been the sole provider of scheduled commercial service with service to Charlotte Douglas International Airport. The flight to Charlotte has provided the community with a high level of connectivity throughout the day to points domestic and international on a one-stop basis. From 2007-2019, Lynchburg Regional's enplanements grew at 4.3 percent per year with the past five-years' (2014-2019) enplanement growth at 3.2 percent per year.

Lynchburg Regional's enplanements are expected to increase from 92,000 in 2019 to 104,000 in 2044. The VATSP forecast has a compound annual growth rate of 0.5 percent per year, lower than the 2019 TAF growth rate of 1.0 percent but in line with the 2020 TAF growth rate of 0.5 percent (**Figure 5-31**).

The forecasted short-term growth rate from 2019-2024 is expected to be down 0.1 percent per year with Lynchburg Regional recovering to 2019 levels in 2025.

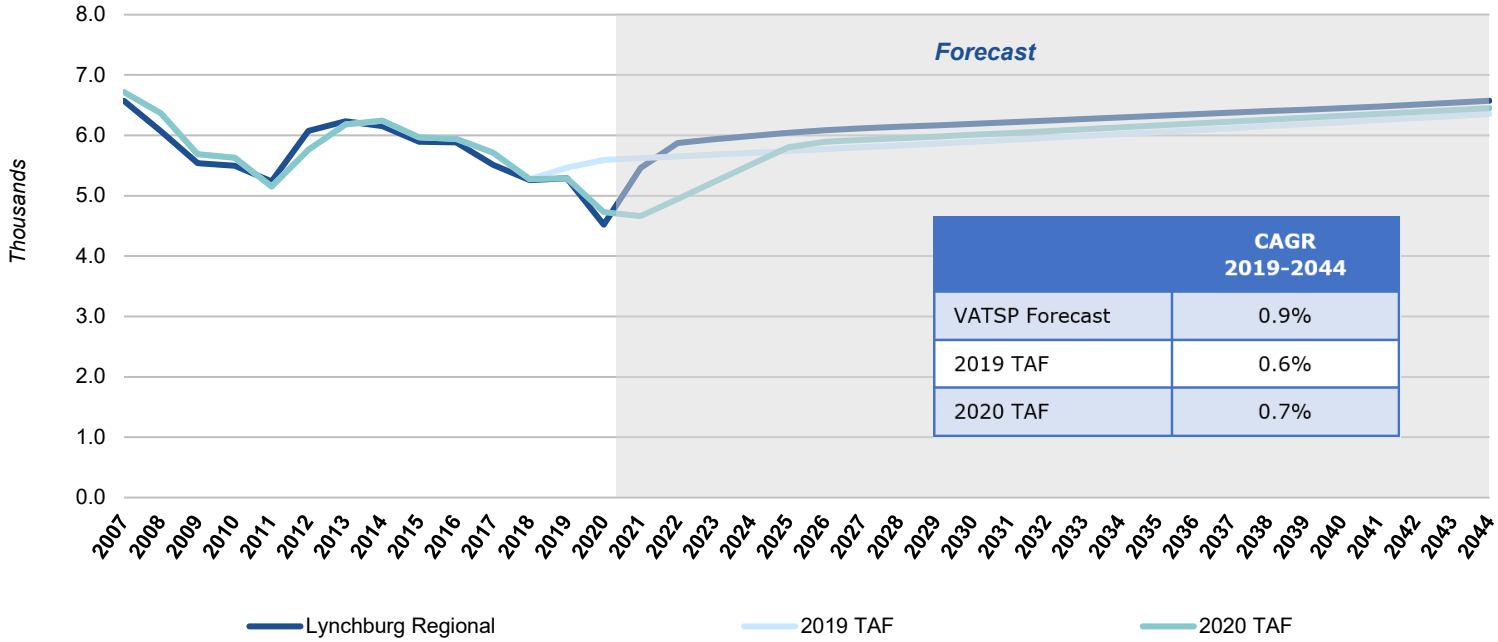


	CAGR 2019-2044
VATSP Forecast	0.5%
2019 TAF	1.0%
2020 TAF	0.5%

Source: VATSP Forecast; FAA TAF.

Figure 5-31: Lynchburg Regional Enplanement Forecast, CY 2007-CY 2044

Lynchburg Regional's commercial service operations are expected to increase from 5,000 in 2019 to 6,600 in 2044. Lynchburg Regional's commercial service operations are forecast to grow at 0.9 percent per year (**Figure 5-32**).



	CAGR 2019-2044
VATSP Forecast	0.9%
2019 TAF	0.6%
2020 TAF	0.7%

Source: VATSP Forecast; FAA TAF.

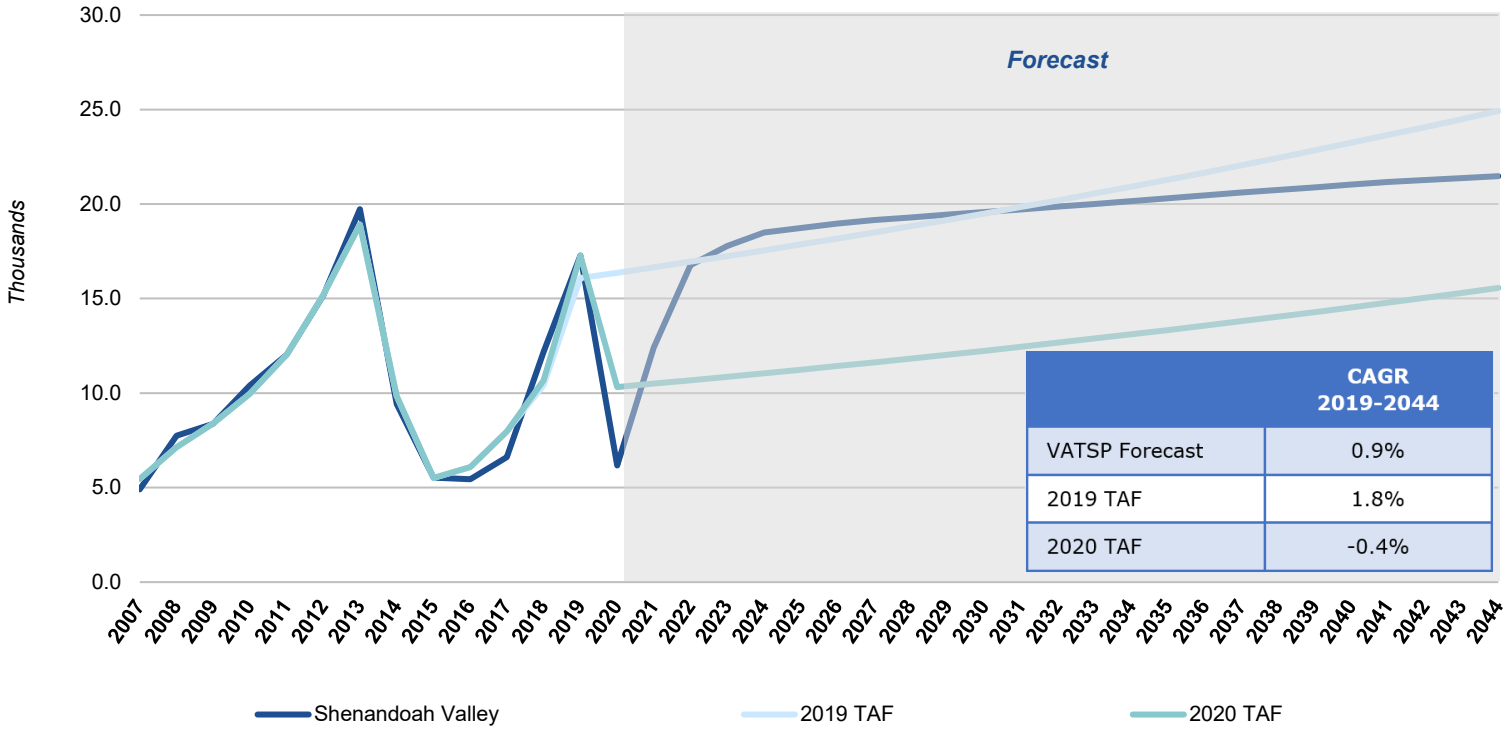
Figure 5-32: Lynchburg Regional Commercial Operations Forecast, CY 2007-CY 2044

Shenandoah Valley

Shenandoah Valley is an Essential Air Service (EAS) market with service to Dulles International and Chicago O'Hare International. The service is operated by Skywest on a codeshare with United Airlines. Since Skywest became the operator of the EAS operation, the service has been successful for Shenandoah Valley. From 2007-2019, Shenandoah Valley experienced strong enplanement growth at 11.1 percent per year with the past five-years' (2014-2019) enplanement growth at 12.9 percent per year. As a result of the service from a reliable carrier, Shenandoah Valley was the fastest growing commercial service airport in Virginia.

Shenandoah Valley's enplanements are expected to increase from 17,000 in 2019 to 21,500 in 2044. The VATSP forecast has a compound annual growth rate of 0.9 percent per year, while the 2019 TAF has a growth rate of 1.8 percent, and the 2020 TAF has a growth rate of negative 0.4 percent (**Figure 5-33**).

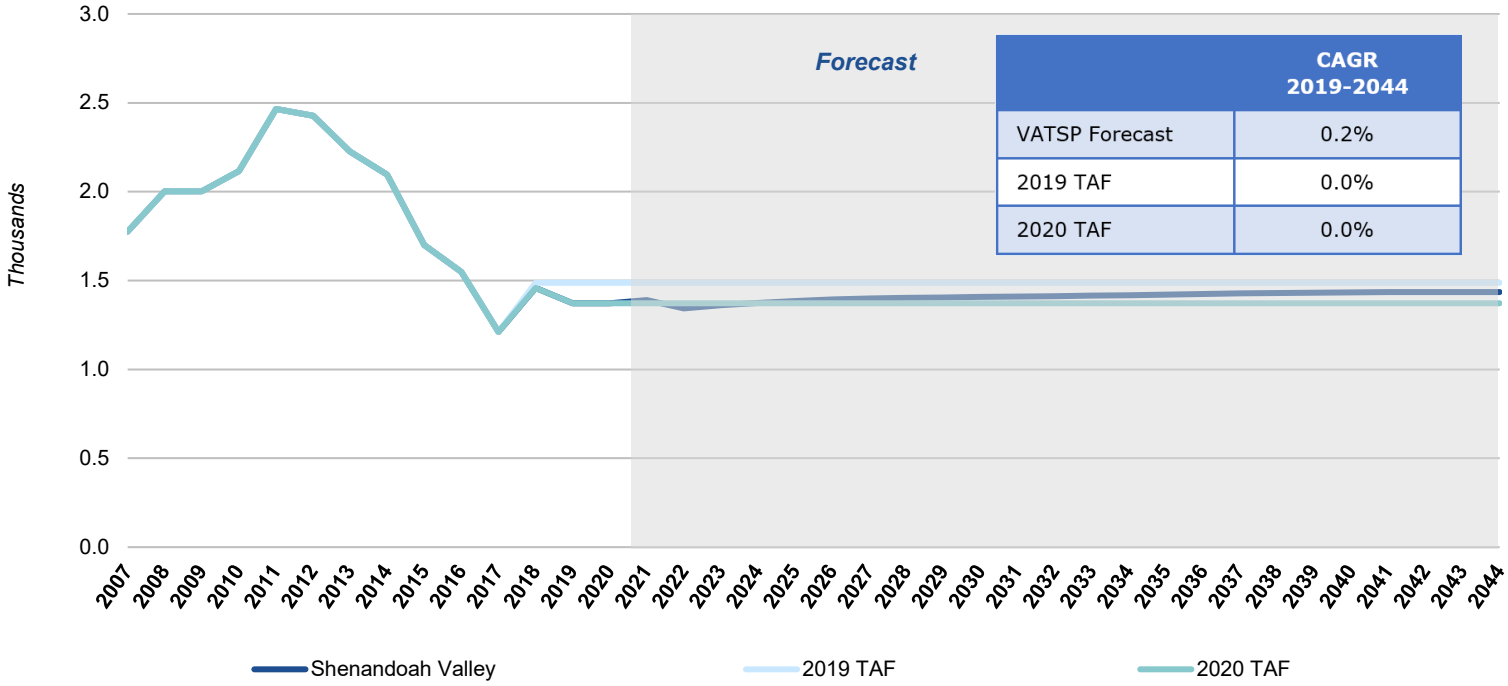
The forecasted short-term growth rate from 2019-2024 is expected to be 1.4 percent per year with Shenandoah Valley recovering to 2019 levels in 2023.



Source: VATSP Forecast; FAA TAF.

Figure 5-33: Shenandoah Valley Enplanement Forecast, CY 2007-CY 2044

Shenandoah Valley's commercial service operations are forecasted to remain relatively flat. Shenandoah Valley's commercial service operations are expected to grow at 0.2 percent per year (**Figure 5-34**).



Source: VATSP Forecast; FAA TAF.

Figure 5-34: Shenandoah Valley Commercial Operations Forecast, CY 2007-CY 2044

Commercial Service Activity Forecast Conclusion

Virginia's nine commercial service airports entered 2020 having grown for five years at 3.2 percent, slightly slower than the nation. The fundamentals in Virginia were solid. The state's large hub airports were prospering, relying on rapidly growing business and international travel. The economies of the small hubs were transforming, and most of the non-hubs had found a service pattern that provided a foundation for growth. The FAA TAF anticipated that Virginia would continue on its growth path.

The COVID-19 pandemic quickly reversed this growth, and the losses to the entire commercial aviation industry are unprecedented. For the large hub airports, their dependence on business and/or international hindered their recovery. Even Charlottesville, historically one of the fastest growing airports in Virginia, would be slow to recover due to the University of Virginia's remote only learning. The availability of vaccines in early 2021 stimulated a resurgence of leisure travel. By the summer of 2021, Richmond International, Norfolk International, Lynchburg Regional, Roanoke-Blacksburg, and Shenandoah Valley had almost reached 2019 levels. The fall and winter of 2021 saw a slowdown in the air travel recovery due to a resurgence in COVID-19 cases and staffing shortages. Despite having strong fundamentals, the continued labor shortage of mechanics and pilots could prolong the recovery of the Virginia airports. In the case of pilots, the pandemic caused airlines to offer pilots early retirement packages to reduce payroll expenses. However, now that demand is returning, airlines cannot find enough pilots to fill their growing schedules. The supply of pilots is unable to keep up with demand, in part, because Congress increased minimum pilot flight hours from 250 to 1,500 following the 2009 Colgan Air crash in Buffalo. In 2022, Republic Airways attempted to increase the pilot supply by requesting an exemption from the higher flight hour requirement based on their focused training standards, but the FAA rejected their proposal. With no long-term solutions to the pilot shortage in place, the pace of future airline growth is likely to remain constrained.

For the small and non-hub airports, full recovery is expected to be reached in 2023, followed by a return to growth driven by increasing GDP. Newport News-Williamsburg and Lynchburg Regional are expected to recover in 2026 and 2025, respectively. The large hubs in Northern Virginia will return to 2019 levels in 2024 and 2025. The outlook for commercial aviation in Virginia is good because its fundamentals remain strong.

Source: Heather Ream.

General Aviation Airport Forecasts

Like commercial service, as the GA industry entered 2020, the outlook for GA had been strong coming off a solid year in 2019. The active GA fleet was forecast to continue to have a modest decline; however, steady growth in the economy was likely to result in continued growth of business/turbine aircraft. Greater utilization of business jets was expected to more than offset the decline in fixed-wing piston hours. In addition, the GA industry recorded a modest increase of 1.4 percent in deliveries of U.S. manufactured aircraft in 2019. GA activity at FAA contract tower airports had a 3.3 percent increase in operations in 2019.

Consistent with the commercial service experience, beginning in March of 2020, GA activity declined due to COVID-19-related travel restrictions. Virtually every measure of GA activity experienced decline. Unfortunately, much of the GA activity takes place at non-towered airports and is not able to be accurately measured. However, analysis of GA operations at FAA towered and contract towered airports indicates that in 2020 operations declined by 8.9 percent (**Table 5-11**). Over half of the nation's GA operations are itinerant.[8] These operations were hit the hardest, declining 11.6 percent in 2020 compared to local[9] declining 5.9 percent. This compares to the U.S. commercial service operations that were down almost 40 percent during the same period.

Table 5-11: FAA Towered and Contract Tower GA Operations (FFY 2015-FFY 2020)

	U.S. GA Operations			Percent Change		
Year	**Itinerant**	**Local**	**Total**	**Itinerant**	**Local**	**Total**
2015	14,025,670	11,769,503	25,795,173	-0.7%	0.1%	-0.3%
2016	13,996,259	11,702,770	25,699,029	-0.2%	-0.6%	-0.4%
2017	13,929,713	11,802,288	25,732,001	-0.5%	0.9%	0.1%
2018	14,175,401	12,409,306	26,584,707	1.8%	5.1%	3.3%
2019	14,261,328	13,109,829	27,371,157	0.6%	5.6%	3.0%
2020	12,608,003	12,332,877	24,940,880	-11.6%	-5.9%	-8.9%

Source: FAA TAF.

An additional metric is aircraft shipments, which is published annually by General Aviation Manufacturers Association (GAMA). Because it reflects transactions that may have been negotiated in the previous year, this metric will tend to understate the decline caused by the pandemic. But it does allow for some indication of how widespread the pandemic-related losses are and provides guidance on the near-term outlook. Using the information supplied by GAMA indicates that in 2020, when compared to 2019 (**Table 5-12**), piston airplane deliveries declined 0.9 percent, turboprop airplane deliveries declined 15.6 percent, and business jet deliveries declined 20.4 percent. The value of airplane deliveries for 2020 was $20 billion, down from $23.5 billion, a decline of approximately 14.8 percent.

[8] Itinerant operations are operations that land at an airport, arriving from outside the airport area, or departs an airport and leaves the airport area.

[9] Local operations are operations that depart and land from the same airport.

Table 5-12: Aircraft Shipments for 2019 and 2020

Aircraft Shipments			
Aircraft Type	**2019**	**2020**	**Percent Change**
Pistons	1,324	1,312	-0.9%
Turboprops	525	443	-15.6%
Business Jets	809	644	-20.4%
Total	**2,658**	**2,399**	**-9.7%**

Source: GAMA 2020 Report.

General Aviation in Virginia

Virginia has 57 GA airports and nine commercial service airports. Virginia's 11 FAA towered airports (nine commercial service and Manassas and Leesburg) account for 39 percent of the based aircraft in Virginia and had a combined total of 491,000 operations in 2019. The commercial/towered airports accommodate approximately 40 percent of Virginia's GA activity.

As with the commercial service airports, the FAA TAF is the guiding document. Because of the pandemic's dramatic effects on activity in 2020, the base year for the VATSP forecast is 2019 with operations data for towered airports for 2020 and 2021 being actual (**Table 5-13**). While more than half of the nation's GA operations were itinerant, more than half of Virginia's operations were local. Comparing Virginia's 2020 GA operations to 2019 GA operations indicates a reduction of 12 percent. This decline is slightly greater than the nation, which was down 8.9 percent. Virginia's itinerant operations grew faster in 2019 than the nation but contracted more in 2020, down 16.7 percent compared to 11.6 percent for the nation.

Table 5-13: GA Operations at Virginia's Commercial Service Airports and Two Towered GA Airports

	Virginia GA Operations – Towered Airports Only			Percent Change		
Year	**Itinerant**	**Local**	**Total**	**Itinerant**	**Local**	**Total**
2015	239,836	252,680	492,516	-3.6%	-2.9%	-3.2%
2016	241,795	259,776	501,571	0.8%	2.8%	1.8%
2017	241,458	253,517	494,975	-0.1%	-2.4%	-1.3%
2018	225,457	244,296	469,753	-6.6%	-3.6%	-5.1%
2019	234,841	256,598	491,439	4.2%	5.0%	4.6%
2020	195,685	234,449	430,134	-16.7%	-8.6%	-12.5%

Note: only includes the 11 towered airports in Virginia; includes Manassas and Leesburg.
Source: FAA TAF.

From 2015 to 2019, Virginia airports' based aircraft went from 3,700 to 3,600 for a decline of 0.9 percent per year. This decline in based aircraft came largely from the GA airports, which declined at 1 percent per year. The decline in based aircraft in Virginia continued into 2020 but by less than one percent (**Table 5-14**).

Table 5-14: Virginia's Airports' Based Aircraft 2015-2020

Virginia's Based Aircraft		
Year	**Based Aircraft**	**Percent Change**
2015	3,740	N/A
2016	3,105	-17.0%
2017	3,691	18.9%
2018	3,839	4.0%
2019	3,614	-5.9%
2020	3,588	-0.7%

Source: DOAV.

Source: DOAV.

Overview of the GA Forecast

The GA activity in Virginia consists of a diverse range of activities including pilot training, recreational flying, law enforcement, medical/patient transport, aerial spraying, and business aviation.

Forecasts of GA activity include forecasts of:

- Based GA aircraft,
- GA fleet mix, and
- Aircraft operations.

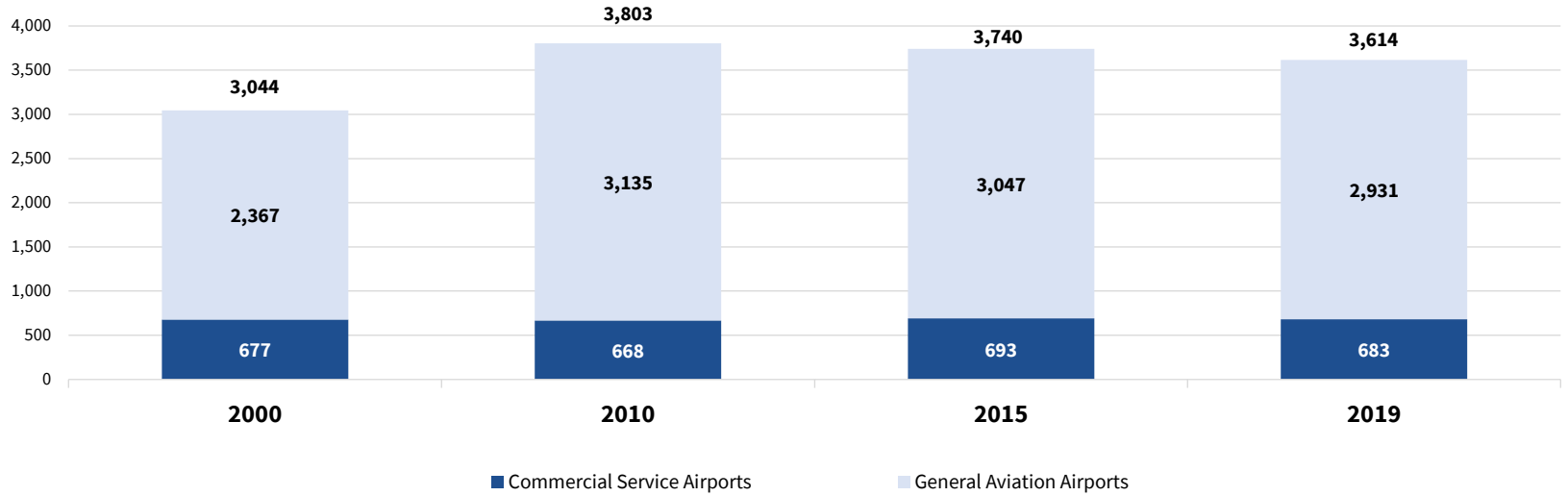
The following data sources were used in preparation of the forecasts:

- Historical based aircraft data provided by DOAV
- Data including based aircraft and operations from the FAA TAF
- FAA Form 5010
- 2016 Virginia Air Transportation System Plan

There is much uncertainty associated with forecasting in general, which has been magnified by COVID-19 due to the potential shift in demand from commercial to business jet.

Based Aircraft

To develop projections of based GA aircraft for study airports, historical growth in based aircraft in Virginia was reviewed. Historical data maintained by DOAV was used to analyze the historical trends in the number of based GA aircraft in Virginia. Virginia's total based GA aircraft increased from 3,044 in 2000 to 3,614 in 2019. For the most recent period from 2015 to 2019, the total number of based aircraft in Virginia fell by 3.3 percent from 3,740 to 3,614. This loss was largely from the GA airports and is a continuation of a trend that was also seen in 2015.



Source: DOAV.

Figure 5-35: Historic Based Aircraft at Virginia Commercial Service and GA Airports, 2000 – 2019

Table 5-15: Historic Average Annual Growth Rates for Based GA Aircraft in Virginia

CAGR of Based Aircraft			
	2000-19	2010-19	2015-19
Commercial Service Airports	0.0%	0.2%	-0.4%
GA Airports	1.1%	-0.7%	-1.0%
Total Virginia	0.9%	-0.6%	-0.9%
Total United States	-0.2%	-0.6%	0.1%

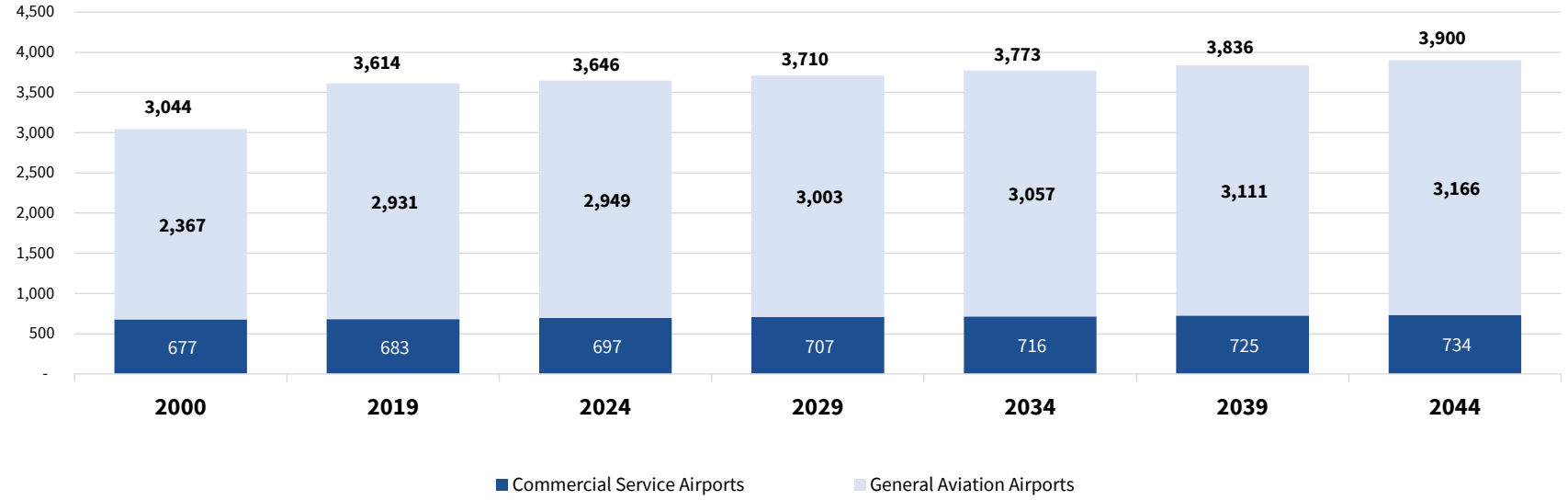
Note: Reagan National does not have based aircraft because of the GA restrictions in place.
Source: DOAV and 2020 FAA Aerospace Forecast.

Overall, based aircraft in Virginia has grown 0.9 percent per year since 2000, compared to the U.S. which declined 0.2 percent. The growth has largely been at the GA airports, which increased 1.1 percent per year over the same period, while the commercial service airport's based aircraft growth remained flat. Since 2010, Virginia and the U.S. fleet have both declined 0.6 percent per year.

To develop Virginia's based GA aircraft forecast, the historical growth and trends in based aircraft throughout Virginia were analyzed. This is shown in **Figure 5-35** and **Table 5-15** on the previous page. The historical data was provided by DOAV.

A linear trend methodology was used in forecasting based GA aircraft. The linear trend methodology analyzes the historical growth in based aircraft, the number of aircraft added per year. The forecast of based GA aircraft at each airport is derived from the average of the historical long-term growth (2000-2019) and the short-term growth (2014-2019), giving equal importance to both the long-term and short-term growth. Once this average rate of growth was established for individual airports, based aircraft at each airport were projected to grow at this average rate through 2044. Subsequent adjustments were made on an individual airport basis in cases where historical data was inconsistent or did not represent sustainable long-term growth rates. This methodology is consistent with the 2016 VATSP forecast. The VATSP base year for the forecast is 2019, yet there is actual based aircraft data for 2020 and 2021. Therefore, the first forecast year is 2022. Due to the pandemic, there are shifts in the number of based aircraft compared to 2019 with some growing during 2020 and 2021 and others facing a decline.

Throughout the 25-year forecast period, based aircraft are projected to grow from 3,614 in 2019 to 3,900 in 2044, an increase of 286 aircraft (**Figure 5-36**). This growth is being driven by GA airports, where based aircraft are forecast to increase by 235 between 2019 and 2044, while commercial service airports are projected to grow by 51 aircraft. It should be noted that Reagan National does not have based aircraft due to the GA restrictions in place at the airport.



Source: DOAV and VATSP Forecast.

Figure 5-36: Forecast of Based Aircraft at Virginia Airports

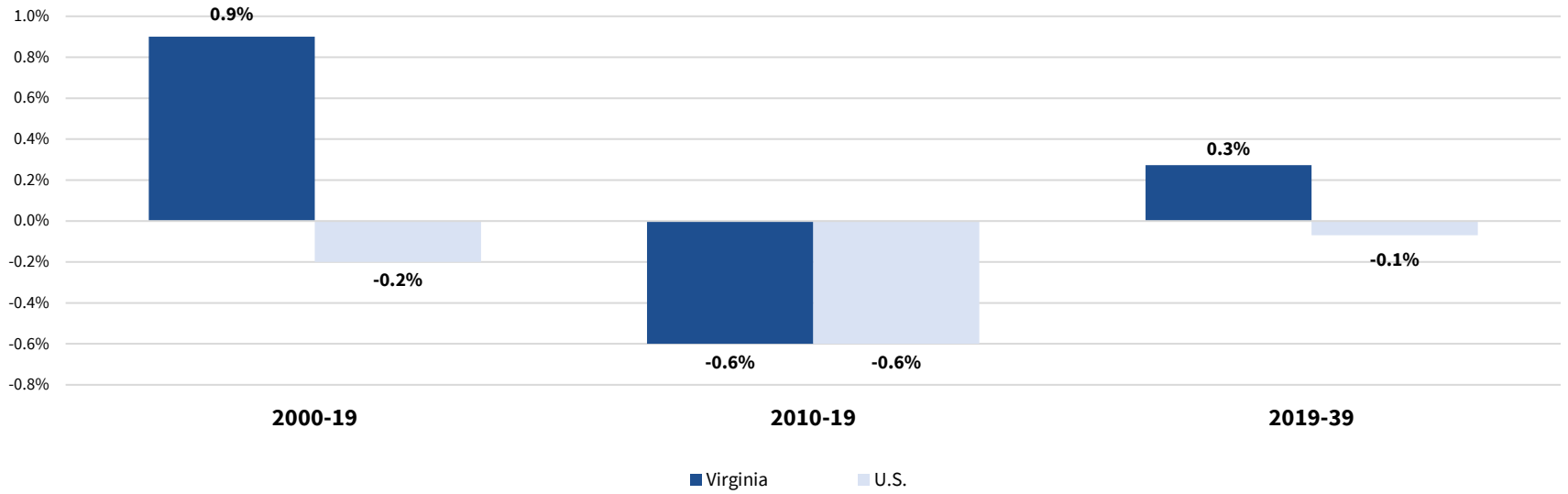
Virginia's based aircraft are forecast to grow 0.3 percent per year from 2019 to 2044, with both the GA airports and the commercial service airports growing at the same rate.

Table 5-16: Compound Annual Growth Rates for the Forecast of Based Aircraft at Virginia Airports

CAGR of Based Aircraft						
	2000-19	2019-24	2019-29	2019-34	2019-39	2019-44
Commercial Service Airports	0.0%	0.4%	0.3%	0.3%	0.3%	0.3%
GA Airports	1.1%	0.1%	0.2%	0.3%	0.3%	0.3%
Total Virginia	**0.9%**	**0.2%**	**0.3%**	**0.3%**	**0.3%**	**0.3%**

Source: DOAV.

Historically, growth of based aircraft in Virginia has outpaced the U.S. by 1.1 percentage points. This trend is expected to continue during the forecast period with Virginia's based aircraft projected to increase by 0.3 percent per year, outpacing the U.S. growth, which is projected to decline 0.1 percent (**Figure 5-37**).



Note: FAA Aerospace Forecast only through 2041.
Source: DOAV and FAA Aerospace Forecast.

Figure 5-37: Forecast Growth Rates of Based Aircraft at Virginia Airports and U.S.

Based aircraft at Virginia's commercial service and GA airports are projected to grow throughout the forecast period. **Table 5-17** on the following pages shows the actual historical based aircraft at five-year increments from 2000 to 2015, and 2019-2021 as provided by DOAV. The historical data provides context for each airport's individual projection of based GA aircraft.

Table 5-17: Based Aircraft by Airport

		Actual							Forecast					CAGR
Airport Role	**Airport**	**2000**	**2005**	**2010**	**2015**	**2019**	**2020**	**2021**	**2024**	**2029**	**2034**	**2039**	**2044**	**2019-44**
CS	Charlottesville-Albemarle	69	93	76	65	74	63	49	69	70	71	72	73	-0.1%
CS	Dulles International	52	54	33	58	63	67	59	60	62	64	66	68	0.3%
CS	Lynchburg Regional	48	62	73	93	87	87	93	96	101	106	111	116	1.2%
CS	Newport News-Williamsburg	110	121	106	139	141	140	127	130	136	141	147	153	0.3%
CS	Norfolk International	66	94	105	94	87	84	88	89	91	93	95	98	0.5%
CS	Reagan National	22	10	8	0	0	1	1	0	0	0	0	0	N/A
CS	Richmond International	109	95	72	61	64	62	61	61	62	62	63	63	-0.1%
CS	Roanoke-Blacksburg	118	125	123	105	90	100	101	98	92	87	82	77	-0.6%
CS	Shenandoah Valley Regional	83	187	72	78	77	85	94	93	92	91	89	88	0.5%
Total Commercial Service Airports		**677**	**841**	**668**	**693**	**683**	**689**	**673**	**697**	**707**	**716**	**725**	**734**	**0.3%**
GA	Accomack	22	24	25	25	23	22	20	20	20	21	21	21	-0.4%
GA	Blackstone	8		11	10	7	5	8	8	7	6	6	5	-1.3%
GA	Blue Ridge	41	57	50	39	32	39	45	43	41	38	36	33	0.1%
GA	Bridgewater	22	7	72	100	43	42	45	43	41	38	35	33	-1.1%
GA	Brookneal	2	0	0	0	2	3	3	3	3	4	4	4	2.8%
GA	Chase City	5	5	4	5	2	4	4	4	3	2	2	1	-2.7%
GA	Chesapeake	71	110	144	111	140	120	121	127	138	148	158	169	0.8%
GA	Chesterfield	111	135	142	131	115	119	115	115	115	115	115	116	0.0%
GA	Crewe	9	13	11	14	14	15	15	16	16	17	18	19	1.2%
GA	Culpeper	104	128	126	127	162	174	153	159	169	179	189	199	0.8%
GA	Danville	44	44	40	42	46	45	45	46	46	47	48	49	0.3%
GA	Dinwiddie	81	80	54	74	60	55	57	55	52	50	47	44	-1.2%
GA	Eagle's Nest	26		49	44	40	38	35	36	36	37	38	39	-0.1%
GA	Emporia	3	5	5	7	8	8	12	12	13	14	15	16	2.8%
GA	Falwell	17	17	11	10	16	14	18	18	19	20	20	21	1.1%

Table 5-17: Based Aircraft by Airport (continued)

		Actual							Forecast					CAGR
Airport Role	Airport	2000	2005	2010	2015	2019	2020	2021	2024	2029	2034	2039	2044	2019-44
GA	Farmville	24	23	27	25	19	15	11	11	11	11	11	11	-2.2%
GA	Franklin	12	29	25	22	17	16	16	16	16	16	16	16	-0.2%
GA	Front Royal	25	37	51	68	55	54	51	52	54	56	58	60	0.3%
GA	Gordonsville	13		20	20	18	18	15	15	15	15	15	15	-0.7%
GA	Grundy	14		11	7	0	0	0	0	0	0	0	0	N/A
GA	Hampton Roads	147	203	207	178	155	157	165	164	161	159	157	155	0.0%
GA	Hanover	69	85	138	106	116	100	109	112	118	123	128	134	0.6%
GA	Hummel Field	27	45	35	35	32	26	29	29	29	29	29	29	-0.4%
GA	Ingalls Field	7	4	5	3	7	3	3	3	4	4	4	5	-1.3%
GA	Lake Anna		3	1	5	2	2	2	2	2	2	2	3	1.6%
GA	Lake Country	4	6	5	6	6	5	6	6	6	7	7	7	0.6%
GA	Lawrenceville	5	4	5	2	3	8	5	5	5	4	4	4	1.2%
GA	Lee County	0	9	9	11	8	8	7	7	8	9	9	10	0.9%
GA	Leesburg	231	231	226	239	238	238	245	246	248	250	251	253	0.2%
GA	Lonesome Pine	20	23	25	22	17	55	20	20	19	19	18	18	0.2%
GA	Louisa	34	47	55	55	52	52	55	56	58	60	61	63	0.8%
GA	Lunenburg	5		2	2	2	2	1	1	1	1	1	1	-2.7%
GA	Luray	10	15	24	29	25	25	29	30	32	34	36	38	1.7%
GA	Manassas	286	402	404	418	388	388	404	409	417	424	432	440	0.5%
GA	Mecklenburg-Brunswick	13	14	26	30	34	32	32	34	37	40	43	46	1.2%
GA	Middle Peninsula	26		30	34	42	37	35	36	39	41	44	46	0.4%
GA	Mountain Empire	22	21	28	20	17	22	15	14	13	12	11	9	-2.5%
GA	New Kent	40	38	51	44	46	46	43	43	44	44	45	46	0.0%
GA	New London	58		57	53	35	33	34	32	28	24	20	16	-3.1%
GA	New Market	24	26	22	16	25	26	25	25	26	26	27	28	0.5%
GA	New River Valley	18	25	43	48	43	35	34	35	37	39	41	43	0.0%

Table 5-17: Based Aircraft by Airport (continued)

		Actual							Forecast					CAGR
Airport Role	**Airport**	**2000**	**2005**	**2010**	**2015**	**2019**	**2020**	**2021**	**2024**	**2029**	**2034**	**2039**	**2044**	**2019-44**
GA	Orange	22	24	27	38	44	44	41	43	46	49	52	55	0.9%
GA	Shannon	144	146	104	94	92	100	98	95	91	86	82	77	-0.7%
GA	Smith Mountain Lake	14	12	13	9	25	24	30	32	34	37	40	43	2.2%
GA	Stafford	0	10	59	69	63	64	61	65	70	76	82	88	1.3%
GA	Suffolk	81	105	82	66	68	64	71	70	68	67	65	64	-0.2%
GA	Tangier Island	0	0	0	0	0	0	0	0	0	0	0	0	N/A
GA	Tappahannock Essex	0	0	26	27	30	28	31	33	36	40	43	46	1.7%
GA	Tazewell	12	8	10	11	13	13	15	15	16	16	17	18	1.3%
GA	Twin County	13	9	12	22	19	21	22	22	23	23	24	24	0.9%
GA	Virginia Highlands	62	66	73	69	74	66	61	62	63	65	66	68	-0.3%
GA	Virginia Tech	39	30	42	37	42	50	45	45	46	47	48	49	0.6%
GA	Wakefield	28	21	26	24	23	19	20	20	19	19	18	18	-1.0%
GA	Warrenton-Fauquier	98	125	162	162	137	135	145	146	149	151	153	156	0.5%
GA	William Tuck	18	20	22	18	21	19	23	24	24	25	26	27	1.0%
GA	Williamsburg	56	61	68	59	61	52	54	54	55	55	56	57	-0.3%
GA	Winchester	80	120	133	105	107	94	112	113	115	117	119	122	0.5%
Total GA Airports		**2,367**	**2,672**	**3,135**	**3,047**	**2,931**	**2,899**	**2,916**	**2,949**	**3,003**	**3,057**	**3,111**	**3,166**	**0.3%**
Grand Total		**3,044**	**3,513**	**3,803**	**3,740**	**3,614**	**3,588**	**3,589**	**3,646**	**3,710**	**3,773**	**3,836**	**3,900**	**0.3%**

Note: Totals may not add due to rounding; CS = Commercial Service.
Source: DOAV.

Fleet Mix

In addition to projecting total based GA aircraft, the forecast also projects the future fleet mix of based GA aircraft at airports in Virginia. The aircraft are categorized into the following aircraft types:

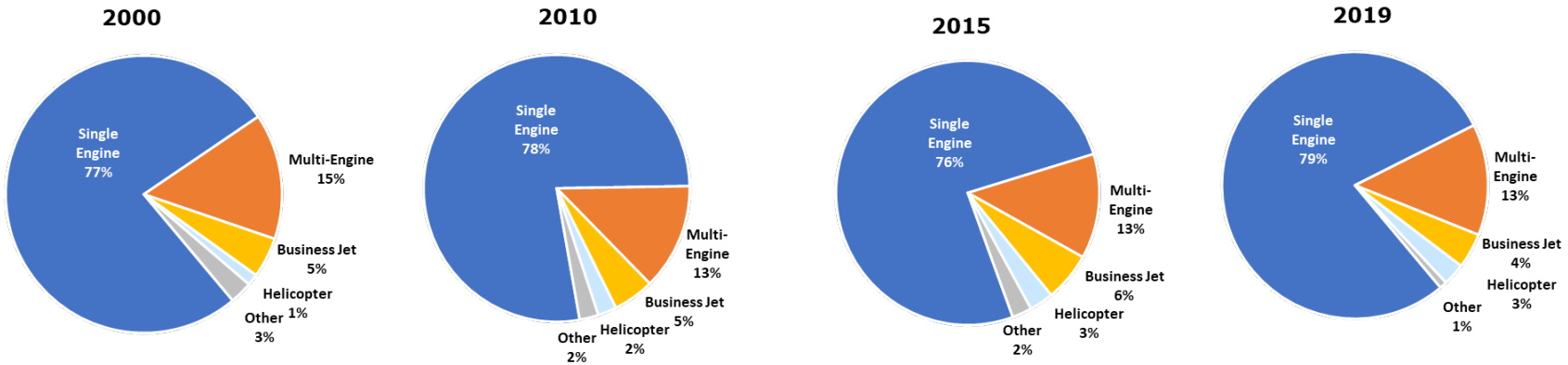
- Single Engine
- Multi-Engine
- Business Jet
- Helicopter
- Other, which includes Experimental and Light Sport Aircraft

The GA fleet mix forecast was developed using the based aircraft forecast developed for the VATSP and the Active General Aviation and Air Taxi Aircraft growth rates outlined in the FAA's Aerospace Forecast 2021–2041. The annual growth rates were applied to the based aircraft by aircraft type on an airport basis that reflects the individual airport's fleet mix and trends. The two factors in the fleet mix forecast are:

- The fleet mix each Virginia airport had in 2019; and
- The FAA Aerospace Forecast expected growth rates by aircraft type.

Similar to the based aircraft forecast, the base year for the fleet mix forecast is 2019; however, the forecast utilizes the actual fleet data for 2020 and 2021 with the first forecast year being 2022.

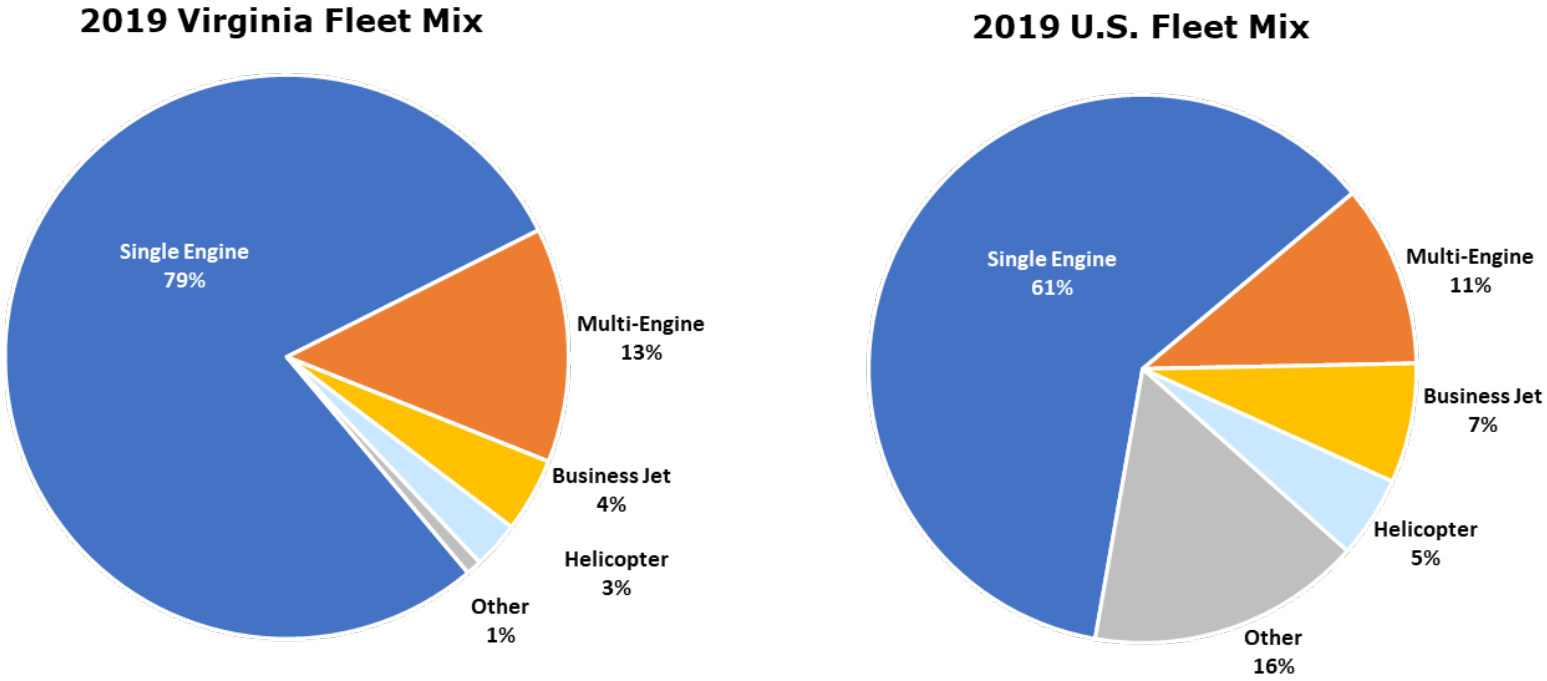
In 2019, over three quarters of Virginia's fleet mix was single engine piston aircraft (**Figure 5-38**). The components of Virginia's fleet mix have been consistent since 2000 with single engine piston aircraft accounting for 79 percent of the fleet in 2019 or 2,842 aircraft.



Source: DOAV

Figure 5-38: Virginia's Historical Fleet Mix

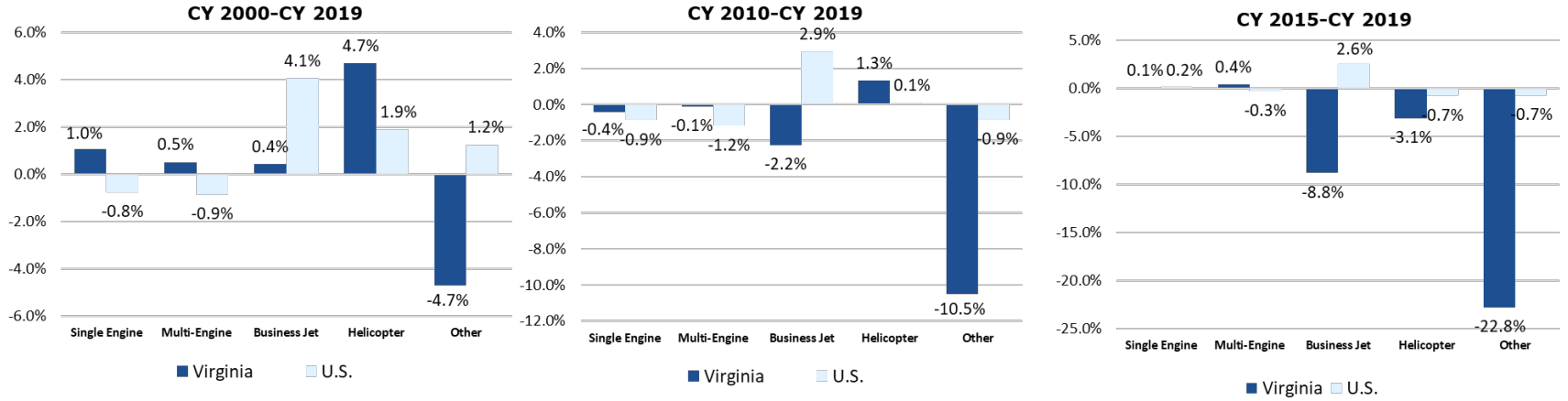
Single engine piston aircraft account for most of both Virginia's and the nation's GA fleet mix. Virginia has a higher concentration with single engine piston representing 79 percent of the fleet, 18 percentage points higher than the nation (**Figure 5-39**). While Virginia's fleet mix is more focused on single engine aircraft, the U.S. fleet mix has a higher percentage in business jet. The national trend is moving towards business jet aircraft, which could result in Virginia experiencing an increase in business jet aircraft.



Note: The two largest aircraft categories in Other are Experimental and Light Sport Aircraft, which have not grown as quickly in Virginia as they have in the U.S. as a whole.
Source: DOAV and FAA Aerospace Forecast.

Figure 5-39: Virginia's Historical Fleet Mix Compared to the Nation

While Virginia's business jets increased slightly over the last two decades (**Figure 5-40**), the most recent 10-year period indicated that Virginia's business jet fleet contracted. The more recent decline in business jets in Virginia comes from the commercial service airports where the commercial service segment of the airports enjoyed rapid growth. Dulles International, Richmond International, and Charlottesville-Albemarle lost the most business jet aircraft over the period. During this same time, the nation's business jet fleet grew by 3 percent per year. The declining trend in Virginia has reversed as the pandemic led to some business travel moving away from commercial service and towards business jets. In 2020 and 2021, Virginia saw increases in business jet fleet.



Source: DOAV and FAA Aerospace Forecast.

Figure 5-40: Historical Compound Annual Growth Rates of Fleet Mix at Virginia Airports and in the U.S.

Table 5-18 shows the absolute numbers by fleet type for the last five years (2015-2019).

Table 5-18: Fleet Mix at Virginia Airports and in the U.S. for CY 2015 and CY 2019

FAA Historical Fleet Mix

	Single Engine	Multi-Engine	Business Jet	Helicopter	Other	Total
2015	127,887	22,966	13,440	10,506	35,232	210,031
2019	128,926	22,712	14,888	10,198	34,257	210,981
CAGR	**0.2%**	**-0.3%**	**2.6%**	**-0.7%**	**-0.7%**	**0.1%**

Virginia Fleet Mix

	Single Engine	Multi-Engine	Business Jet	Helicopter	Other	Total
2015	2,835	480	224	111	90	3,740
2019	2,842	487	155	98	32	3,614
CAGR	**0.1%**	**0.4%**	**-8.8%**	**-3.1%**	**-22.8%**	**-0.9%**

Source: FAA Aerospace Forecast and DOAV.

Table 5-19 shows Virginia's fleet mix by airport for the period of 2000 and 2019. Over the 19-year time-period, the overall fleet grew by 0.9 percent per year with single engine piston growing at 1 percent per year and helicopters growing at 4 percent per year. Both multi-engine and business jet aircraft were essentially flat throughout the period. From 2000 to 2019, business jet aircraft declined at the commercial service airports by 1.8 percent, while it grew at 7 percent per year at the GA airports. However, despite that growth in the GA airports, the nine commercial service airports still account for 48 percent of the business jet aircraft in Virginia in 2019.

Table 5-19: Virginia's Fleet Mix by Airport 2000 and 2019

		2000						2019						2000-2019 CAGR					
Airport Role	Airport	Single Engine	Multi-Engine	Business Jet	Helicopter	Other	Total	Single Engine	Multi-Engine	Business Jet	Helicopter	Other	Total	Single Engine	Multi-Engine	Business Jet	Helicopter	Other	Total
CS	Charlottesville-Albemarle	43	15	6	1	4	69	60	12	0	2	0	74	1.8%	-1.2%	-100%	3.7%	-100%	0.4%
CS	Dulles International	3	13	36	0	0	52	8	44	10	1	0	63	5.3%	6.6%	-6.5%	N/A	N/A	1.0%
CS	Lynchburg Regional	37	10	1	0	0	48	64	14	7	2	0	87	2.9%	1.8%	10.8%	N/A	N/A	3.2%
CS	Newport News-Williamsburg	80	10	19	1	0	110	81	25	35	0	0	141	0.1%	4.9%	3.3%	-100.0%	N/A	1.3%
CS	Norfolk International	38	21	5	2	0	66	50	21	15	1	0	87	1.5%	0.0%	6.0%	-3.6%	N/A	1.5%
CS	Reagan National	4	9	6	3	0	22	0	0	0	0	0	0	-100%	-100%	-100%	-100%	N/A	-100%
CS	Richmond International	37	32	29	10	1	109	22	27	7	8	0	64	-2.7%	-0.9%	-7.2%	-1.2%	-100%	-2.8%
CS	Roanoke-Blacksburg	90	25	2	1	0	118	66	24	0	0	0	90	-1.6%	-0.2%	-100%	-100.0%	N/A	-1.4%
CS	Shenandoah Valley Regional	53	28	1	0	1	83	55	20	1	1	0	77	0.2%	-1.8%	0.0%	N/A	-100%	-0.4%
Total Commercial Service Airports		**385**	**163**	**105**	**18**	**6**	**677**	**406**	**187**	**75**	**15**	**0**	**683**	**0.3%**	**0.7%**	**-1.8%**	**-1.0%**	**-100%**	**0.0%**
GA	Accomack	20	2	0	0	0	22	23	0	0	0	0	23	0.7%	-100%	N/A	N/A	N/A	0.2%
GA	Blackstone	5	0	0	0	3	8	5	0	0	0	2	7	0.0%	N/A	N/A	N/A	-2.1%	-0.7%
GA	Blue Ridge	34	4	1	2	0	41	26	4	1	1	0	32	-1.4%	0.0%	0.0%	-3.6%	N/A	-1.3%
GA	Bridgewater	0	22	0	0	0	22	3	40	0	0	0	43	N/A	3.2%	N/A	N/A	N/A	3.6%
GA	Brookneal	2	0	0	0	0	2	2	0	0	0	0	2	0.0%	N/A	N/A	N/A	N/A	0.0%
GA	Chase City	5	0	0	0	0	5	2	0	0	0	0	2	-4.7%	N/A	N/A	N/A	N/A	-4.7%
GA	Chesapeake	55	13	0	0	3	71	130	10	0	0	0	140	4.6%	-1.4%	N/A	N/A	-100%	3.6%
GA	Chesterfield	86	17	5	2	1	111	79	18	9	9	0	115	-0.4%	0.3%	3.1%	8.2%	-100.0%	0.2%
GA	Crewe	8	1	0	0	0	9	13	1	0	0	0	14	2.6%	0.0%	N/A	N/A	N/A	2.4%
GA	Culpeper	98	4	1	0	1	104	150	10	0	2	0	162	2.3%	4.9%	-100%	N/A	-100%	2.4%
GA	Danville	38	3	3	0	0	44	41	3	1	0	1	46	0.4%	0.0%	-5.6%	N/A	N/A	0.2%
GA	Dinwiddie	61	11	0	0	9	81	51	6	2	1	0	60	-0.9%	-3.1%	N/A	N/A	-100%	-1.6%
GA	Eagle's Nest	22	1	0	0	3	26	38	2	0	0	0	40	4.0%	-2.7%	N/A	N/A	-100%	2.6%

Table 5-19: Virginia's Fleet Mix by Airport 2000 and 2019 (continued)

		2000						2019						2000-2019 CAGR					
Airport Role	Airport	Single Engine	Multi-Engine	Business Jet	Helicopter	Other	Total	Single Engine	Multi-Engine	Business Jet	Helicopter	Other	Total	Single Engine	Multi-Engine	Business Jet	Helicopter	Other	Total
GA	Emporia	2	1	0	0	0	3	7	1	0	0	0	8	6.8%	0.0%	N/A	N/A	N/A	5.3%
GA	Falwell	14	3	0	0	0	17	16	0	0	0	0	16	0.7%	-100%	N/A	N/A	N/A	-0.3%
GA	Farmville	19	5	0	0	0	24	17	1	1	0	0	19	-0.6%	-8.1%	N/A	N/A	N/A	-1.2%
GA	Franklin	9	3	0	0	0	12	16	0	0	1	0	17	3.1%	-100%	N/A	N/A	N/A	1.9%
GA	Front Royal	14	1	0	0	10	25	34	2	0	1	18	55	4.8%	3.7%	N/A	N/A	3.1%	4.2%
GA	Gordonsville	11	1	0	0	1	13	18	0	0	0	0	18	2.6%	-100%	N/A	N/A	-100%	1.7%
GA	Grundy	10	2	0	0	2	14	0	0	0	0	0	0	-100%	-100%	N/A	N/A	-100%	-100%
GA	Hampton Roads	129	15	1	2	0	147	120	21	3	11	0	155	-0.4%	1.8%	6.0%	9.4%	N/A	0.3%
GA	Hanover	61	5	1	0	2	69	104	4	4	4	0	116	2.8%	-1.2%	7.6%	N/A	-100%	2.8%
GA	Hummel Field	25	1	0	1	0	27	31	1	0	0	0	32	1.1%	0.0%	N/A	-100.0%	N/A	0.9%
GA	Ingalls Field	5	0	1	1	0	7	4	2	1	0	0	7	-1.2%	N/A	0.0%	-100.0%	N/A	0.0%
GA	Lake Anna	0	0	0	0	0	0	2	0	0	0	0	2	N/A	N/A	N/A	N/A	N/A	N/A
GA	Lake Country	4	0	0	0	0	4	6	0	0	0	0	6	2.2%	N/A	N/A	N/A	N/A	2.2%
GA	Lawrenceville	4	0	0	0	1	5	3	0	0	0	0	3	-1.5%	N/A	N/A	N/A	-100%	-2.7%
GA	Lee County	0	0	0	0	0	0	5	1	0	2	0	8	N/A	N/A	N/A	N/A	N/A	N/A
GA	Leesburg	192	32	6	1	0	231	190	29	12	7	0	238	-0.1%	-0.5%	3.7%	10.8%	N/A	0.2%
GA	Lonesome Pine	12	4	1	1	2	20	13	3	1	0	0	17	0.4%	-1.5%	0.0%	-100.0%	-100%	-0.9%
GA	Louisa	29	4	1	0	0	34	46	4	1	0	1	52	2.5%	0.0%	0.0%	N/A	N/A	2.3%
GA	Lunenburg	5	0	0	0	0	5	2	0	0	0	0	2	-4.7%	N/A	N/A	N/A	N/A	-4.7%
GA	Luray	10	0	0	0	0	10	20	5	0	0	0	25	3.7%	N/A	N/A	N/A	N/A	5.8%
GA	Manassas	218	46	13	5	4	286	291	47	28	19	3	388	1.5%	0.1%	4.1%	7.3%	-1.5%	1.6%
GA	Mecklenburg-Brunswick	11	1	1	0	0	13	33	1	0	0	0	34	6.0%	0.0%	-100%	N/A	N/A	5.2%
GA	Middle Peninsula	18	5	0	0	3	26	38	3	0	1	0	42	4.0%	-2.7%	N/A	N/A	-100%	2.6%
GA	Mountain Empire	18	3	0	0	1	22	16	1	0	0	0	17	-0.6%	-5.6%	N/A	N/A	-100%	-1.3%
GA	New Kent	38	0	0	0	2	40	46	0	0	0	0	46	1.0%	N/A	N/A	N/A	-100%	0.7%
GA	New London	55	1	0	0	2	58	34	1	0	0	0	35	-2.5%	0.0%	N/A	N/A	-100%	-2.6%
GA	New Market	23	1	0	0	0	24	23	1	0	0	1	25	0.0%	0.0%	N/A	N/A	N/A	0.2%
GA	New River Valley	13	5	0	0	0	18	32	9	1	1	0	43	4.9%	3.1%	N/A	N/A	N/A	4.7%
GA	Orange	22	0	0	0	0	22	39	4	0	1	0	44	3.1%	N/A	N/A	N/A	N/A	3.7%

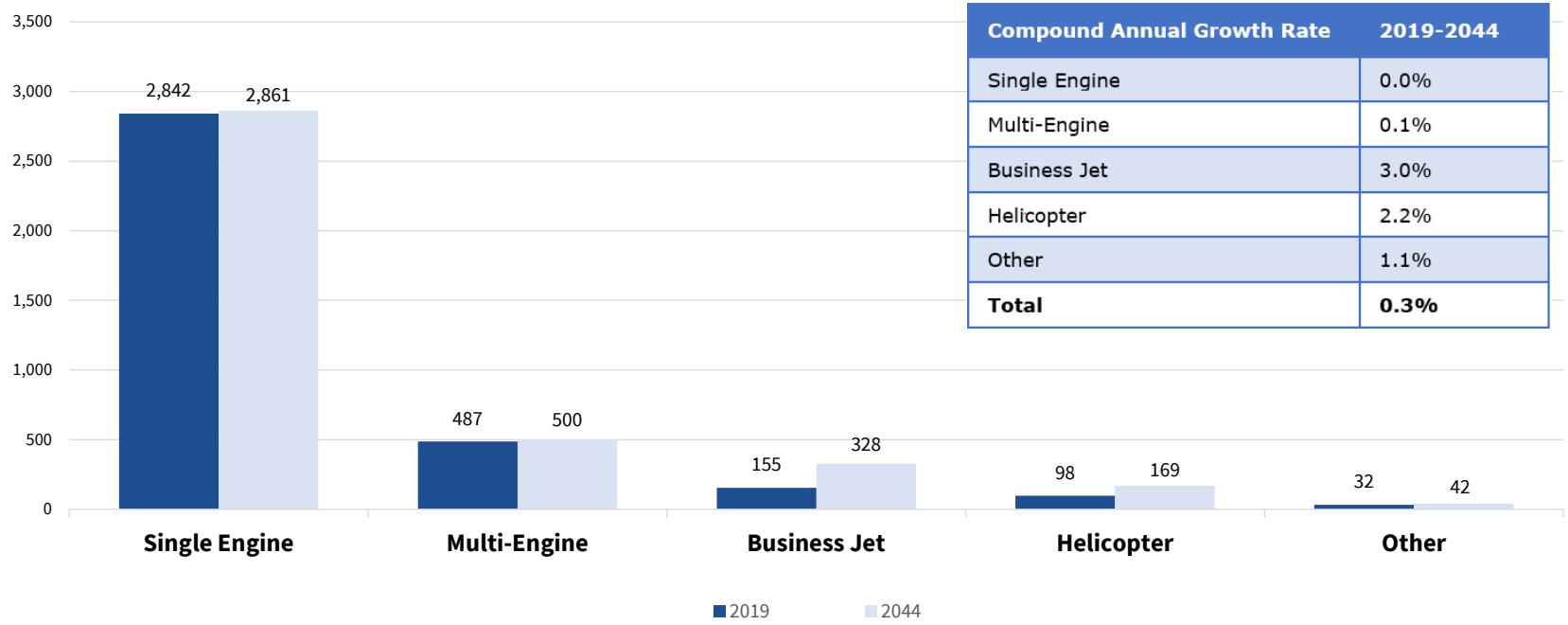
Table 5-19: Virginia's Fleet Mix by Airport 2000 and 2019 (continued)

		2000						2019						2000-2019 CAGR					
Airport Role	Airport	Single Engine	Multi-Engine	Business Jet	Helicopter	Other	Total	Single Engine	Multi-Engine	Business Jet	Helicopter	Other	Total	Single Engine	Multi-Engine	Business Jet	Helicopter	Other	Total
GA	Shannon	124	18	0	1	1	144	82	5	0	4	1	92	-2.2%	-6.5%	N/A	7.6%	0.0%	-2.3%
GA	Smith Mountain Lake	11	3	0	0	0	14	24	1	0	0	0	25	4.2%	-5.6%	N/A	N/A	N/A	3.1%
GA	Stafford	0	0	0	0	0	0	49	2	1	11	0	63	N/A	N/A	N/A	N/A	N/A	N/A
GA	Suffolk	72	6	0	1	2	81	56	9	0	0	3	68	-1.3%	2.2%	N/A	-100.0%	2.2%	-0.9%
GA	Tangier Island	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
GA	Tappahannock Essex	0	0	0	0	0	0	28	2	0	0	0	30	N/A	N/A	N/A	N/A	N/A	N/A
GA	Tazewell	7	2	0	0	3	12	9	4	0	0	0	13	1.3%	3.7%	N/A	N/A	-100%	0.4%
GA	Twin County	9	1	0	0	3	13	16	2	0	1	0	19	3.1%	3.7%	N/A	N/A	-100%	2.0%
GA	Virginia Highlands	42	6	2	4	8	62	55	8	8	3	0	74	1.4%	1.5%	7.6%	-1.5%	-100%	0.9%
GA	Virginia Tech	36	2	0	1	0	39	38	0	3	1	0	42	0.3%	-100%	N/A	0.0%	N/A	0.4%
GA	Wakefield	27	1	0	0	0	28	22	0	0	0	1	23	-1.1%	-100%	N/A	N/A	N/A	-1.0%
GA	Warrenton-Fauquier	81	11	0	0	6	98	122	14	1	0	0	137	2.2%	1.3%	N/A	N/A	-100%	1.8%
GA	William Tuck	18	0	0	0	0	18	19	1	0	1	0	21	0.3%	N/A	N/A	N/A	N/A	0.8%
GA	Williamsburg	50	5	0	1	0	56	57	3	0	0	1	61	0.7%	-2.7%	N/A	-100.0%	N/A	0.5%
GA	Winchester	66	12	1	0	1	80	90	14	2	1	0	107	1.6%	0.8%	3.7%	N/A	-100%	1.5%
Total GA Airports		**1,948**	**284**	**38**	**23**	**74**	**2,367**	**2,436**	**300**	**80**	**83**	**32**	**2,931**	**1.2%**	**0.3%**	**4.0%**	**7.0%**	**-4.3%**	**1.1%**
Total Virginia		**2,333**	**447**	**143**	**41**	**80**	**3,044**	**2,842**	**487**	**155**	**98**	**32**	**3,614**	**1.0%**	**0.5%**	**0.4%**	**4.7%**	**-4.7%**	**0.9%**

Note: Totals may not add due to rounding.
Source: DOAV.

The Virginia fleet is expected to grow 0.3 percent per year over the forecast period. Business jets are forecast to grow the fastest at 3 percent per year (**Figure 5-41**) consistent with national trends and reflective of the recent growth in Virginia in 2020 and 2021. Minimal growth is expected to be in single engine and multi-engine aircraft.

The fleet mix forecast is consistent with national trends.

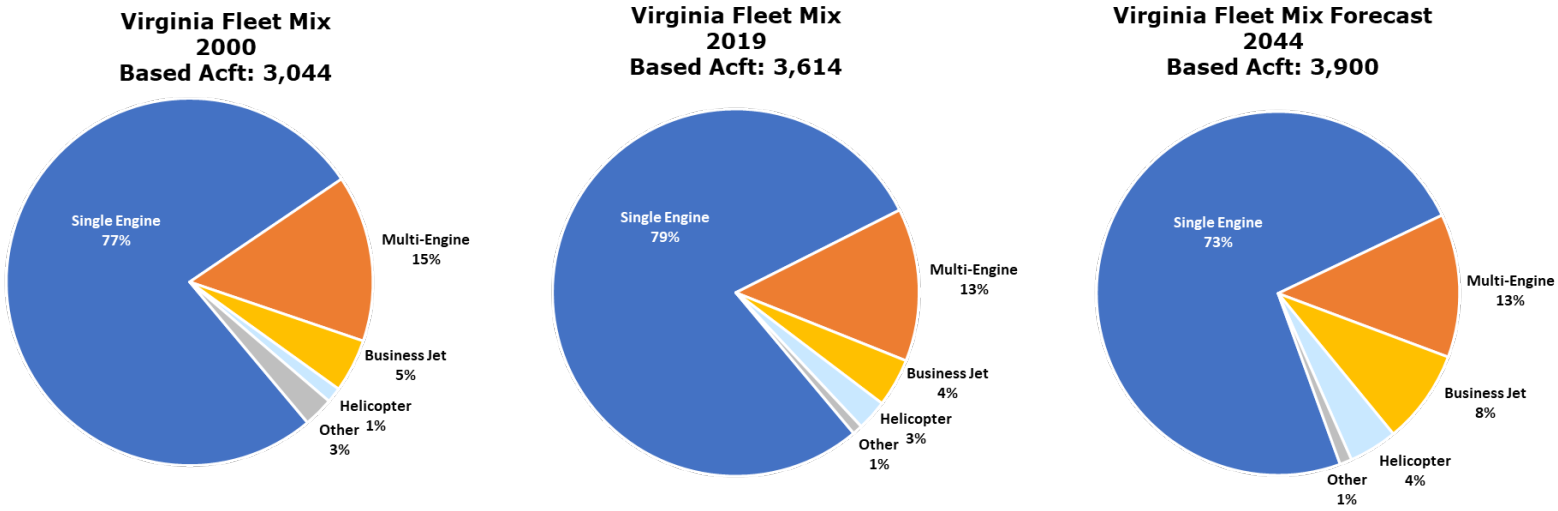


Compound Annual Growth Rate	2019-2044
Single Engine	0.0%
Multi-Engine	0.1%
Business Jet	3.0%
Helicopter	2.2%
Other	1.1%
Total	**0.3%**

Source: DOAV and VATSP Forecast.

Figure 5-41: Forecast of Virginia's Fleet Mix 2019 and 2044

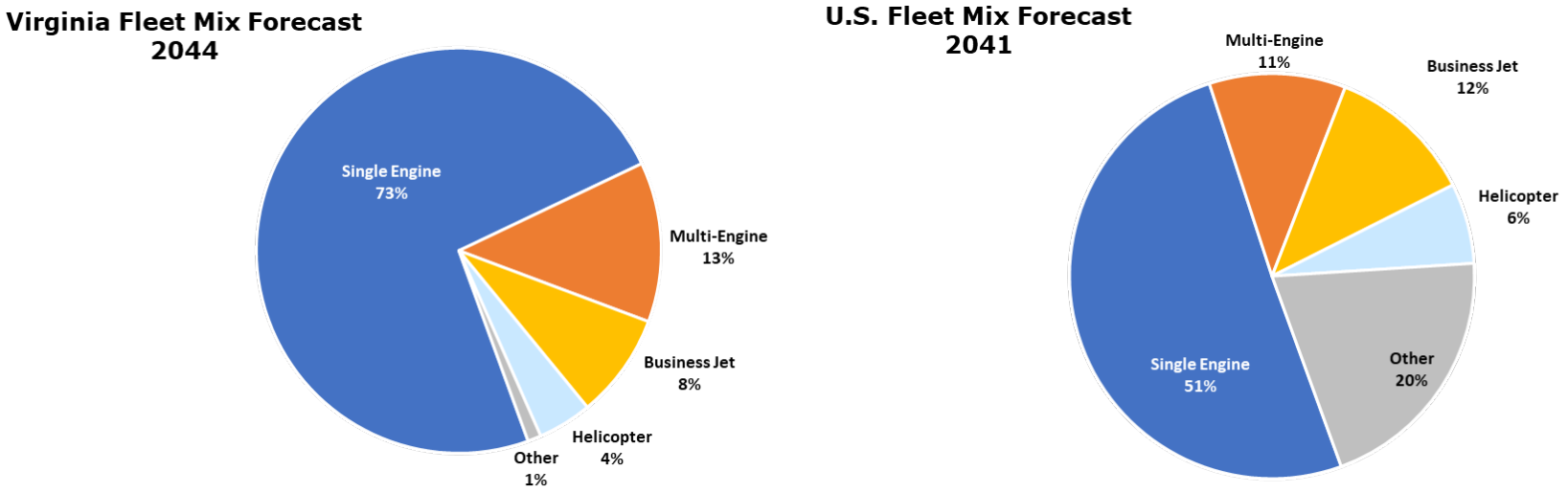
In 2044, single engine aircraft are still expected to account for the largest share of Virginia's fleet mix. However, the forecast share is expected to decline from 79 percent in 2019 to 73 percent in 2044. Business jet aircraft share of the Virginia fleet mix is forecasted to increase from 4 percent in 2019 to 8 percent in 2044 (**Figure 5-42**). This is an increase of 173 business jet aircraft.



Source: DOAV and VATSP Forecast.

Figure 5-42: Aircraft Type Share of Virginia's Based Aircraft 2000, 2019, 2044

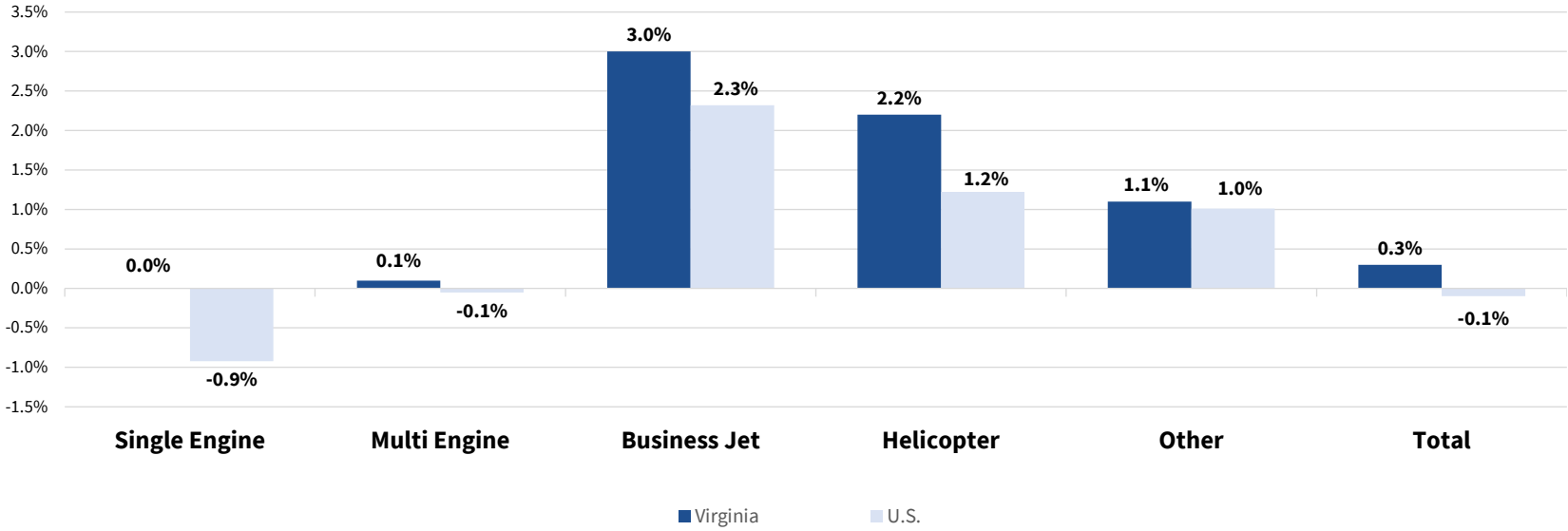
Consistent with the historical data, the Virginia fleet mix is still more concentrated in single engine aircraft than the nation. The U.S. fleet mix is forecasted to be 51 percent single engine, while Virginia's fleet is forecast to be 73 percent (**Figure 5-43**). Virginia and the U.S. are forecasted to have similar share for multi-engine, business jet and helicopter fleet. The U.S. is expected to continue to have a higher proportion of light sport aircraft and experimental (examples of Other) aircraft than Virginia.



Source: VATSP forecast and FAA Aerospace Forecast.

Figure 5-43: Forecast Shares of Virginia and the U.S. Fleet Mix

Fleet mix growth in Virginia is in line with the FAA Aerospace Forecast for the nation (**Figure 5-44**), while maintaining the specific fleet that serves Virginia. The nation has the single engine piston and the multi-engine fleet slightly declining, while the VATSP forecast has two aircraft types flat over the forecast period. Both the nation and the VATSP fleet forecast have business jet and helicopters growing over the forecast period.



Source: VATSP Forecast and FAA Aerospace Forecast.

Figure 5-44: The Forecast Compound Annual Growth Rates for Virginia and the U.S.

Table 5-20 shows the fleet mix by airport for 2019, 2020, 2021 and 2044. Business jet aircraft grew at both the commercial service airports and the GA airports in 2020 and 2021. This is due to the movement back to flying privately that COVID-19 caused. Even with the impacts of COVID-19 starting to fade, the VATSP forecast anticipates that business jets will continue to be the leader in fleet growth. The table is displayed across six pages to improve readability.

Table 5-20: Fleet Mix Forecast by Virginia Airport

		2019						2020					
Airport Role	**Airport**	**Single Engine**	**Multi-Engine**	**Business Jet**	**Helo**	**Other**	**Total**	**Single Engine**	**Multi-Engine**	**Business Jet**	**Helo**	**Other**	**Total**
CS	Charlottesville-Albemarle	60	12	0	2	0	74	48	13	0	2	0	63
CS	Dulles International	8	44	10	1	0	63	9	0	57	1	0	67
CS	Lynchburg Regional	64	14	7	2	0	87	64	14	7	2	0	87
CS	Newport News-Williamsburg	81	25	35	0	0	141	89	29	22	0	0	140
CS	Norfolk International	50	21	15	1	0	87	47	18	18	1	0	84
CS	Reagan National	0	0	0	0	0	0	0	0	1	0	0	1
CS	Richmond International	22	27	7	8	0	64	24	25	4	8	1	62
CS	Roanoke-Blacksburg	66	24	0	0	0	90	76	24	0	0	0	100
CS	Shenandoah Valley Regional	55	20	1	1	0	77	63	19	2	1	0	85
Total Commercial Service Airports		**406**	**187**	**75**	**15**	**0**	**683**	**420**	**142**	**111**	**15**	**1**	**689**
GA	Accomack	23	0	0	0	0	23	22	0	0	0	0	22
GA	Blackstone	5	0	0	0	2	7	5	0	0	0	0	5
GA	Blue Ridge	26	4	1	1	0	32	32	4	1	2	0	39
GA	Bridgewater	3	40	0	0	0	43	4	38	0	0	0	42
GA	Brookneal	2	0	0	0	0	2	3	0	0	0	0	3
GA	Chase City	2	0	0	0	0	2	4	0	0	0	0	4
GA	Chesapeake	130	10	0	0	0	140	111	7	0	2	0	120
GA	Chesterfield	79	18	9	9	0	115	80	19	10	9	1	119
GA	Crewe	13	1	0	0	0	14	14	1	0	0	0	15
GA	Culpeper	150	10	0	2	0	162	159	10	0	3	2	174
GA	Danville	41	3	1	0	1	46	42	2	1	0	0	45
GA	Dinwiddie	51	6	2	1	0	60	41	6	7	1	0	55
GA	Eagle's Nest	38	2	0	0	0	40	36	2	0	0	0	38
GA	Emporia	7	1	0	0	0	8	7	1	0	0	0	8
GA	Falwell	16	0	0	0	0	16	14	0	0	0	0	14
GA	Farmville	17	1	1	0	0	19	13	1	1	0	0	15
GA	Franklin	16	0	0	1	0	17	15	0	0	1	0	16
GA	Front Royal	34	2	0	1	18	55	32	2	0	1	19	54
GA	Gordonsville	18	0	0	0	0	18	18	0	0	0	0	18
GA	Grundy	0	0	0	0	0	0	0	0	0	0	0	0
GA	Hampton Roads	120	21	3	11	0	155	108	28	6	15	0	157
GA	Hanover	104	4	4	4	0	116	91	5	2	2	0	100
GA	Hummel Field	31	1	0	0	0	32	25	1	0	0	0	26
GA	Ingalls Field	4	2	1	0	0	7	3	0	0	0	0	3

Table 5-20 Fleet Mix Forecast by Virginia Airport (continued)

		2019						2020					
Airport Role	**Airport**	**Single Engine**	**Multi-Engine**	**Business Jet**	**Helo**	**Other**	**Total**	**Single Engine**	**Multi-Engine**	**Business Jet**	**Helo**	**Other**	**Total**
GA	Lake Anna	2	0	0	0	0	2	2	0	0	0	0	2
GA	Lake Country	6	0	0	0	0	6	5	0	0	0	0	5
GA	Lawrenceville	3	0	0	0	0	3	5	1	0	2	0	8
GA	Lee County	5	1	0	2	0	8	5	1	0	2	0	8
GA	Leesburg	190	29	12	7	0	238	190	29	12	7	0	238
GA	Lonesome Pine	13	3	1	0	0	17	50	4	1	0	0	55
GA	Louisa	46	4	1	0	1	52	46	4	1	0	1	52
GA	Lunenburg	2	0	0	0	0	2	2	0	0	0	0	2
GA	Luray	20	5	0	0	0	25	20	5	0	0	0	25
GA	Manassas	291	47	28	19	3	388	291	47	28	19	3	388
GA	Mecklenburg-Brunswick	33	1	0	0	0	34	30	2	0	0	0	32
GA	Middle Peninsula	38	3	0	1	0	42	32	3	0	2	0	37
GA	Mountain Empire	16	1	0	0	0	17	21	1	0	0	0	22
GA	New Kent	46	0	0	0	0	46	46	0	0	0	0	46
GA	New London	34	1	0	0	0	35	32	1	0	0	0	33
GA	New Market	23	1	0	0	1	25	25	1	0	0	0	26
GA	New River Valley	32	9	1	1	0	43	27	6	1	1	0	35
GA	Orange	39	4	0	1	0	44	39	4	0	1	0	44
GA	Shannon	82	5	0	4	1	92	93	4	0	3	0	100
GA	Smith Mountain Lake	24	1	0	0	0	25	22	1	0	1	0	24
GA	Stafford	49	2	1	11	0	63	47	6	0	11	0	64
GA	Suffolk	56	9	0	0	3	68	55	9	0	0	0	64
GA	Tangier Island	0	0	0	0	0	0	0	0	0	0	0	0
GA	Tappahannock Essex	28	2	0	0	0	30	26	2	0	0	0	28
GA	Tazewell	9	4	0	0	0	13	8	5	0	0	0	13
GA	Twin County	16	2	0	1	0	19	18	2	0	1	0	21
GA	Virginia Highlands	55	8	8	3	0	74	47	7	8	4	0	66
GA	Virginia Tech	38	0	3	1	0	42	44	2	2	1	1	50
GA	Wakefield	22	0	0	0	1	23	18	0	0	0	1	19
GA	Warrenton-Fauquier	122	14	1	0	0	137	118	14	2	0	1	135
GA	William Tuck	19	1	0	1	0	21	18	0	0	1	0	19
GA	Williamsburg	57	3	0	0	1	61	49	3	0	0	0	52
GA	Winchester	90	14	2	1	0	107	81	9	3	1	0	94
Total GA Airports		**2,436**	**300**	**80**	**83**	**32**	**2,931**	**2,391**	**300**	**86**	**93**	**29**	**2,899**
Total Virginia		**2,842**	**487**	**155**	**98**	**32**	**3,614**	**2,811**	**442**	**197**	**108**	**30**	**3,588**

Table 5-20 Fleet Mix Forecast by Virginia Airport (continued)

		2021						2044					
Airport Role	Airport	Single Engine	Multi-Engine	Business Jet	Helo	Other	Total	Single Engine	Multi-Engine	Business Jet	Helo	Other	Total
CS	Charlottesville-Albemarle	36	11	0	2	0	49	50	19	0	4	0	73
CS	Dulles International	6	0	53	0	0	59	4	0	64	0	0	68
CS	Lynchburg Regional	63	19	9	2	0	93	69	25	18	3	0	116
CS	Newport News-Williamsburg	76	26	25	0	0	127	75	31	46	0	0	153
CS	Norfolk International	48	18	19	3	0	88	42	19	32	4	0	98
CS	Reagan National	0	0	1	0	0	1	0	0	0	0	0	0
CS	Richmond International	23	24	4	10	0	61	19	24	6	13	0	63
CS	Roanoke-Blacksburg	75	25	0	1	0	101	54	22	0	1	0	77
CS	Shenandoah Valley Regional	69	19	5	1	0	94	59	20	8	1	0	88
Total Commercial Service Airports		**396**	**142**	**116**	**19**	**0**	**673**	**372**	**160**	**175**	**28**	**0**	**734**
GA	Accomack	20	0	0	0	0	20	21	0	0	0	0	21
GA	Blackstone	5	0	0	0	3	8	3	0	0	0	2	5
GA	Blue Ridge	37	5	1	2	0	45	25	4	1	2	0	33
GA	Bridgewater	4	41	0	0	0	45	2	30	0	0	0	33
GA	Brookneal	3	0	0	0	0	3	4	0	0	0	0	4
GA	Chase City	4	0	0	0	0	4	1	0	0	0	0	1
GA	Chesapeake	110	9	0	2	0	121	149	15	0	4	0	169
GA	Chesterfield	76	19	9	11	0	115	66	20	15	15	0	116
GA	Crewe	14	1	0	0	0	15	17	2	0	0	0	19
GA	Culpeper	144	7	0	2	0	153	184	11	0	4	0	199
GA	Danville	42	1	1	0	1	45	44	1	2	0	2	49
GA	Dinwiddie	40	8	8	1	0	57	27	6	10	1	0	44
GA	Eagle's Nest	32	2	0	1	0	35	35	3	0	2	0	39
GA	Emporia	11	1	0	0	0	12	14	2	0	0	0	16
GA	Falwell	18	0	0	0	0	18	21	0	0	0	0	21
GA	Farmville	10	0	1	0	0	11	9	0	2	0	0	11
GA	Franklin	15	0	0	1	0	16	14	0	0	1	0	16
GA	Front Royal	32	2	0	1	16	51	31	2	0	2	25	60
GA	Gordonsville	15	0	0	0	0	15	15	0	0	0	0	15
GA	Grundy	0	0	0	0	0	0	0	0	0	0	0	0
GA	Hampton Roads	115	29	8	13	0	165	96	29	12	17	0	155
GA	Hanover	97	6	3	3	0	109	113	8	7	5	0	134
GA	Hummel Field	28	1	0	0	0	29	28	1	0	0	0	29
GA	Ingalls Field	3	0	0	0	0	3	5	0	0	0	0	5
GA	Lake Anna	2	0	0	0	0	2	3	0	0	0	0	3
GA	Lake Country	6	0	0	0	0	6	7	0	0	0	0	7
GA	Lawrenceville	5	0	0	0	0	5	4	0	0	0	0	4
GA	Lee County	4	1	0	2	0	7	5	1	0	4	0	10
GA	Leesburg	207	22	11	5	0	245	200	26	20	8	0	253
GA	Lonesome Pine	15	4	1	0	0	20	12	4	2	0	0	18

Table 5-20 Fleet Mix Forecast by Virginia Airport (continued)

		2021						2044					
Airport Role	**Airport**	**Single Engine**	**Multi-Engine**	**Business Jet**	**Helo**	**Other**	**Total**	**Single Engine**	**Multi-Engine**	**Business Jet**	**Helo**	**Other**	**Total**
GA	Louisa	47	6	1	0	1	55	51	8	2	0	2	63
GA	Lunenburg	1	0	0	0	0	1	1	0	0	0	0	1
GA	Luray	24	5	0	0	0	29	30	8	0	0	0	38
GA	Manassas	307	50	27	18	2	404	300	59	50	28	3	440
GA	Mecklenburg-Brunswick	30	2	0	0	0	32	43	3	0	0	0	46
GA	Middle Peninsula	30	4	0	1	0	35	38	6	0	2	0	46
GA	Mountain Empire	14	1	0	0	0	15	9	1	0	0	0	9
GA	New Kent	43	0	0	0	0	43	46	0	0	0	0	46
GA	New London	33	1	0	0	0	34	15	1	0	0	0	16
GA	New Market	23	1	0	0	1	25	25	1	0	0	2	28
GA	New River Valley	27	5	1	1	0	34	31	7	2	2	0	43
GA	Orange	37	3	0	1	0	41	48	5	0	2	0	55
GA	Shannon	91	4	1	2	0	98	69	4	1	2	0	77
GA	Smith Mountain Lake	28	1	0	1	0	30	39	2	0	2	0	43
GA	Stafford	46	4	0	11	0	61	59	6	0	22	0	88
GA	Suffolk	55	12	0	0	4	71	46	12	0	0	5	64
GA	Tangier Island	0	0	0	0	0	0	0	0	0	0	0	0
GA	Tappahannock Essex	28	3	0	0	0	31	41	5	0	0	0	46
GA	Tazewell	11	4	0	0	0	15	12	5	0	0	0	18
GA	Twin County	21	0	0	1	0	22	22	0	0	2	0	24
GA	Virginia Highlands	43	7	7	4	0	61	41	8	12	6	0	68
GA	Virginia Tech	41	1	2	1	0	45	42	1	4	2	0	49
GA	Wakefield	19	0	0	0	1	20	16	0	0	0	1	18
GA	Warrenton-Fauquier	128	14	3	0	0	145	132	18	6	0	0	156
GA	William Tuck	20	0	0	3	0	23	22	0	0	5	0	27
GA	Williamsburg	52	2	0	0	0	54	54	3	0	0	0	57
GA	Winchester	99	9	3	1	0	112	103	11	6	2	0	122
Total GA Airports		**2,412**	**298**	**88**	**89**	**29**	**2,916**	**2,489**	**340**	**153**	**142**	**42**	**3,166**
Total Virginia		**2,808**	**440**	**204**	**108**	**29**	**3,589**	**2,861**	**500**	**328**	**169**	**42**	**3,900**

Table 5-20 Fleet Mix Forecast by Virginia Airport (continued)

		2019-2044 CAGR					
Airport Role	**Airport**	**Single Engine**	**Multi-Engine**	**Business Jet**	**Helo**	**Other**	**Total**
CS	Charlottesville-Albemarle	-0.7%	1.8%	N/A	3.2%	N/A	0.0%
CS	Dulles International	-2.9%	-100.0%	7.7%	-100.0%	N/A	0.3%
CS	Lynchburg Regional	0.3%	2.4%	3.9%	2.2%	N/A	1.1%
CS	Newport News-Williamsburg	-0.3%	0.9%	1.1%	N/A	N/A	0.3%
CS	Norfolk International	-0.7%	-0.3%	3.0%	5.9%	N/A	0.5%
CS	Reagan National	N/A	N/A	N/A	N/A	N/A	N/A
CS	Richmond International	-0.5%	-0.4%	-0.4%	2.0%	N/A	-0.1%
CS	Roanoke-Blacksburg	-0.8%	-0.4%	N/A	N/A	N/A	-0.6%
CS	Shenandoah Valley Regional	0.3%	-0.1%	8.7%	1.2%	N/A	0.5%
Total Commercial Service Airports		**-0.3%**	**-0.6%**	**3.4%**	**2.5%**	N/A	**0.3%**
GA	Accomack	-0.4%	N/A	N/A	N/A	N/A	-0.4%
GA	Blackstone	-2.6%	N/A	N/A	N/A	0.8%	-1.3%
GA	Blue Ridge	-0.1%	0.2%	1.0%	3.1%	N/A	0.1%
GA	Bridgewater	-0.9%	-1.1%	N/A	N/A	N/A	-1.1%
GA	Brookneal	2.8%	N/A	N/A	N/A	N/A	2.8%
GA	Chase City	-2.7%	N/A	N/A	N/A	N/A	-2.7%
GA	Chesapeake	0.6%	1.6%	N/A	N/A	N/A	0.7%
GA	Chesterfield	-0.7%	0.4%	2.0%	2.1%	N/A	0.0%
GA	Crewe	1.2%	1.7%	N/A	N/A	N/A	1.2%
GA	Culpeper	0.8%	0.3%	N/A	2.8%	N/A	0.8%
GA	Danville	0.3%	-3.4%	2.7%	N/A	2.0%	0.3%
GA	Dinwiddie	-2.6%	0.3%	6.6%	0.2%	N/A	-1.2%
GA	Eagle's Nest	-0.4%	1.1%	N/A	N/A	N/A	-0.1%
GA	Emporia	2.8%	1.7%	N/A	N/A	N/A	2.7%
GA	Falwell	1.1%	N/A	N/A	N/A	N/A	1.1%
GA	Farmville	-2.4%	-100.0%	2.2%	N/A	N/A	-2.2%
GA	Franklin	-0.5%	N/A	N/A	1.6%	N/A	-0.4%
GA	Front Royal	-0.4%	0.7%	N/A	1.7%	1.2%	0.3%
GA	Gordonsville	-0.7%	N/A	N/A	N/A	N/A	-0.7%
GA	Grundy		N/A	N/A	N/A	N/A	N/A
GA	Hampton Roads	-0.9%	1.3%	5.9%	1.8%	N/A	0.0%
GA	Hanover	0.3%	3.1%	2.0%	1.3%	N/A	0.6%
GA	Hummel Field	-0.4%	0.8%	N/A	N/A	N/A	-0.4%
GA	Ingalls Field	0.5%	-100.0%	-100.0%	N/A	N/A	-1.8%
GA	Lake Anna	0.9%	N/A	N/A	N/A	N/A	0.9%
GA	Lake Country	0.6%	N/A	N/A	N/A	N/A	0.6%
GA	Lawrenceville	1.2%	N/A	N/A	N/A	N/A	1.2%
GA	Lee County	-0.2%	1.5%	N/A	2.6%	N/A	0.9%
GA	Leesburg	0.2%	-0.5%	2.0%	0.3%	N/A	0.2%
GA	Lonesome Pine	-0.3%	1.1%	1.7%	N/A	N/A	0.1%

Table 5-20 Fleet Mix Forecast by Virginia Airport (continued)

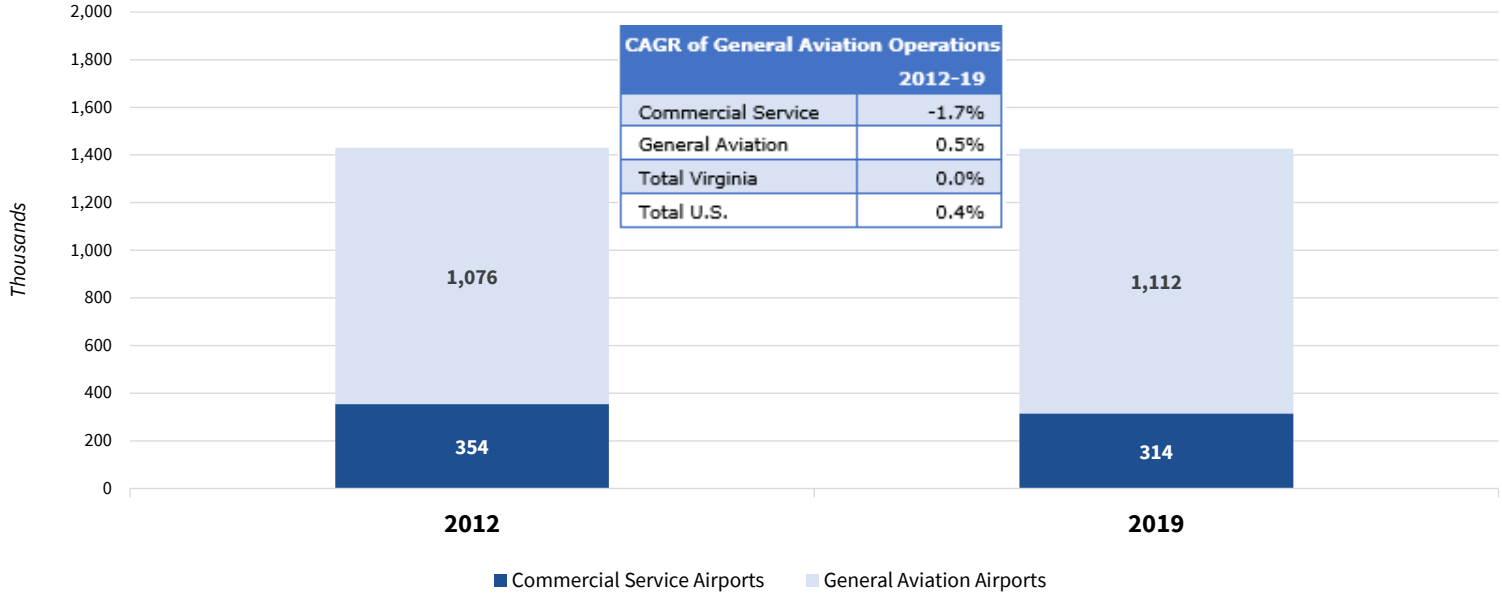
		2019-2044 CAGR					
Airport Role	**Airport**	**Single Engine**	**Multi-Engine**	**Business Jet**	**Helo**	**Other**	**Total**
GA	Louisa	0.4%	2.8%	2.9%	N/A	2.2%	0.8%
GA	Lunenburg	-2.7%	N/A	N/A	N/A	N/A	-2.7%
GA	Luray	1.6%	1.7%	N/A	N/A	N/A	1.6%
GA	Manassas	0.1%	0.9%	2.3%	1.5%	0.1%	0.5%
GA	Mecklenburg-Brunswick	1.0%	5.1%	N/A	N/A	N/A	1.2%
GA	Middle Peninsula	0.0%	2.9%	N/A	2.8%	N/A	0.4%
GA	Mountain Empire	-2.4%	-1.1%	N/A	N/A	N/A	-2.3%
GA	New Kent	0.0%	N/A	N/A	N/A	N/A	0.0%
GA	New London	-3.1%	-2.2%	N/A	N/A	N/A	-3.1%
GA	New Market	0.3%	1.0%	N/A	N/A	2.1%	0.4%
GA	New River Valley	-0.1%	-1.0%	3.2%	2.5%	N/A	0.0%
GA	Orange	0.9%	0.7%	N/A	2.9%	N/A	0.9%
GA	Shannon	-0.7%	-1.2%	N/A	-2.0%	-100%	-0.7%
GA	Smith Mountain Lake	1.9%	2.1%	N/A	N/A	N/A	2.1%
GA	Stafford	0.8%	4.7%	-100.0%	2.9%	N/A	1.3%
GA	Suffolk	-0.8%	1.2%	N/A	N/A	2.3%	-0.3%
GA	Tangier Island	N/A	N/A	N/A	N/A	N/A	N/A
GA	Tappahannock Essex	1.6%	4.0%	N/A	N/A	N/A	1.8%
GA	Tazewell	1.2%	1.2%	N/A	N/A	N/A	1.2%
GA	Twin County	1.3%	-100.0%	N/A	2.1%	N/A	0.9%
GA	Virginia Highlands	-1.2%	0.0%	1.8%	2.8%	N/A	-0.4%
GA	Virginia Tech	0.4%	N/A	1.0%	1.9%	N/A	0.6%
GA	Wakefield	-1.2%	N/A	N/A	N/A	1.2%	1.0%
GA	Warrenton-Fauquier	0.3%	0.9%	7.3%	N/A	N/A	0.5%
GA	William Tuck	0.6%	-100.0%	N/A	6.8%	N/A	1.0%
GA	Williamsburg	-0.2%	-0.7%	N/A	N/A	-100.0%	-0.3%
GA	Winchester	0.5%	-0.8%	4.4%	2.0%	N/A	0.5%
Total GA Airports		**0.1%**	**0.5%**	**2.6%**	**2.2%**	**1.1%**	**0.3%**
Total Virginia		**0.0%**	**0.1%**	**3.0%**	**2.2%**	**1.1%**	**0.3%**

Note: Totals may not add due to rounding
Source: VATSP Forecast, DOAV.

GA Operations

The forecast of GA operations, which consists of takeoffs and landings conducted by GA aircraft at Virginia airports, utilized an operations per based aircraft methodology. This industry standard methodology divides the total annual GA operations at an airport by the total based aircraft to create an operations per based aircraft ratio. This ratio is then applied to the based aircraft forecast that was developed for the VATSP. To capture each airports distinct activity levels, an operations per based aircraft ratio was developed for each airport in Virginia. Operations per based aircraft acts as a proxy that reflects operations by not only based aircraft but also transient aircraft.

For the past seven years, Virginia's GA operations (**Figure 5-45**) have remained flat, lagging the nation, which grew at 0.4 percent per year during that same time. Virginia GA airports have experienced slight growth since 2012, while the commercial service airports have experienced a decline.



CAGR of General Aviation Operations	2012-19
Commercial Service	-1.7%
General Aviation	0.5%
Total Virginia	0.0%
Total U.S.	0.4%

Source: DOAV; FAA Terminal Area Forecast.

Figure 5-45: GA Operations in Virginia

Utilizing the historic GA operations and the based aircraft in Virginia, the ratio of operations per based aircraft was calculated (**Table 5-21**). From 2012 to 2019, Virginia's operations per based aircraft grew 0.8 percent per year increasing from 373 operations per based aircraft to 395. The growth in operations per based aircraft comes from the GA airports, which grew at 1.5 percent per year during that same period. The commercial service airports experienced a decline in operations per based aircraft of 1.9 percent per year.

Based on historic trends, operations per based aircraft were forecast through 2044 (**Table 5-22**). From 2019 to 2044, GA operations per based aircraft are expected to increase by 0.5 percent per year going from 395 operations per based aircraft to 443 operations per based aircraft in 2044.

Table 5-21: GA Operations Per Based Aircraft

Virginia's GA Operations per Based Aircraft			
	2012	**2019**	**CAGR**
Commercial Service Airports	527	460	-1.9%
GA Airports	341	379	1.5%
Total Virginia	**373**	**395**	**0.8%**

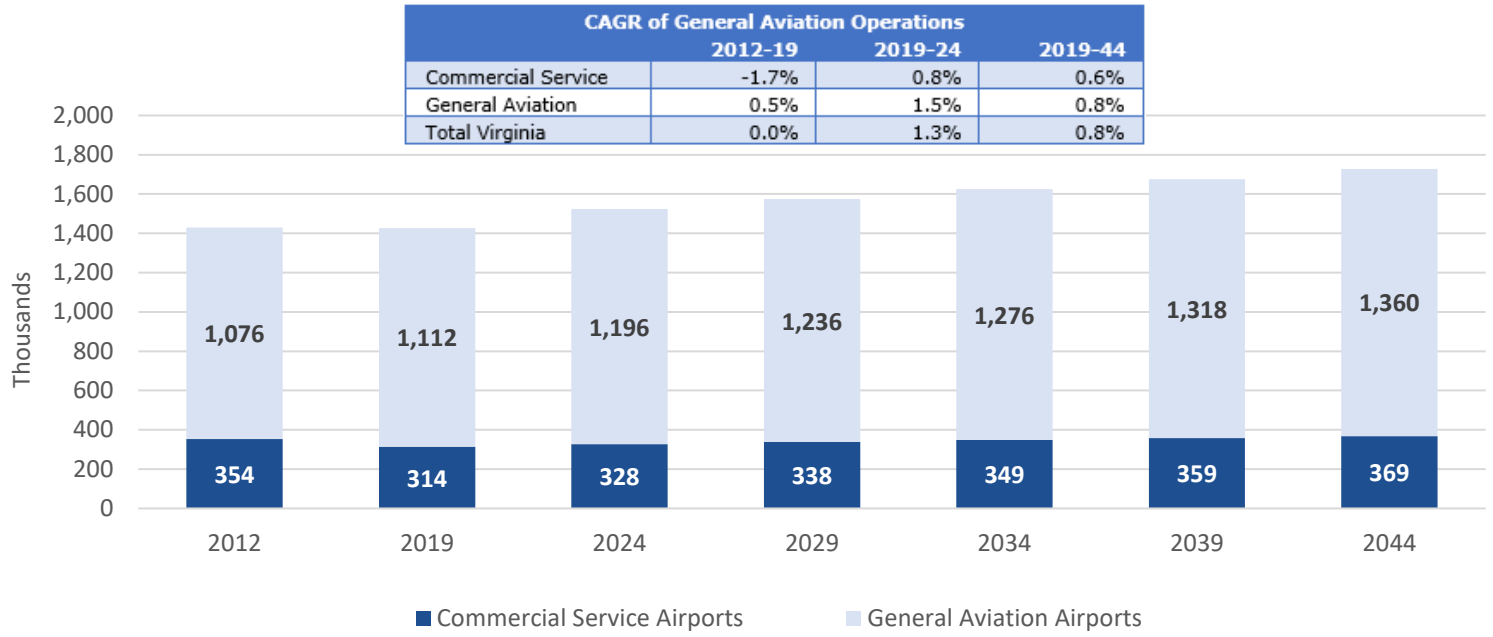
Source: DOAV; FAA Terminal Area Forecast.

Table 5-22: Forecast of GA Operations Per Based Aircraft

GA Operations per Based Aircraft								
	2012	**2019**	**2024**	**2029**	**2034**	**2039**	**2044**	**CAGR 2019-44**
Commercial Service	527	460	470	479	487	495	502	0.3%
GA	341	379	406	412	417	423	430	0.5%
Total Virginia	**373**	**395**	**418**	**424**	**431**	**437**	**443**	**0.5%**

Source: DOAV; VATSP Forecast.

Utilizing the GA operations per based aircraft forecast, a forecast of GA operations was developed (**Table 5-23**). Virginia's GA operations are expected to grow at 0.8 percent per year through 2044 (**Figure 5-46**). Both the commercial service airports and the GA airports are growing with the GA airports growing slightly faster at 0.8 percent per year compared to 0.6 percent per year at the commercial service airports.



Source: DOAV; VATSP Forecast.

Figure 5-46: Forecast of GA Operations

Table 5-23: Forecast of GA Operations by Virginia Airport

		Actual			Forecast					
Airport Role	**Airport**	**2012**	**2019**	**2020**	**2021**	**2024**	**2029**	**2034**	**2039**	**2044**
CS	Charlottesville-Albemarle	55,495	58,853	63,347	78,393	72,718	77,476	82,337	87,302	92,371
CS	Dulles International	43,096	34,190	22,965	22,565	32,656	33,718	34,780	35,842	36,903
CS	Lynchburg Regional	97,489	88,706	71,765	87,969	90,692	95,224	99,747	104,261	108,766
CS	Newport News Williamsburg	59,479	33,144	23,266	28,834	29,055	29,364	29,597	29,754	29,835
CS	Norfolk International	22,802	16,422	13,269	15,086	15,182	15,334	15,477	15,612	15,737
CS	Reagan National	6,183	2,829	2,097	1,491	2,829	3,611	3,611	3,611	3,611
CS	Richmond International	26,012	32,254	26,515	27,439	31,242	32,083	32,933	33,791	34,658
CS	Roanoke-Blacksburg	25,834	34,113	25,419	25,188	37,446	35,997	34,480	32,895	31,242
CS	Shenandoah Valley Regional	17,421	13,948	14,218	15,758	15,730	15,680	15,625	15,565	15,500
Total Commercial Service Airports		**353,811**	**314,459**	**262,861**	**302,723**	**327,551**	**338,486**	**348,586**	**358,632**	**368,624**
GA	Accomack	11,741	6,323	6,323	5,680	5,511	5,223	4,928	4,625	4,315
GA	Blackstone	1,053	0	366	609	646	693	720	728	717
GA	Blue Ridge	22,700	22,584	22,584	26,075	25,216	23,777	22,328	20,869	19,401
GA	Bridgewater	11,975	15,617	14,911	16,334	16,779	17,347	17,699	17,834	17,753
GA	Brookneal	725	800	800	808	868	973	1,084	1,200	1,323
GA	Chase City	2,600	2,590	5,283	5,386	5,139	4,591	3,876	2,992	1,940
GA	Chesapeake	34,000	43,400	43,400	43,818	46,238	50,311	54,431	58,599	62,815
GA	Chesterfield	59,275	62,400	62,400	62,400	63,107	64,286	65,468	66,652	67,838
GA	Crewe	4,200	4,061	4,273	4,195	4,099	3,903	3,661	3,375	3,043
GA	Culpeper	61,848	71,853	71,853	64,070	69,324	78,540	88,330	98,695	109,634
GA	Danville	19,264	21,852	21,852	21,669	21,363	20,827	20,254	19,646	19,003
GA	Dinwiddie	27,590	20,053	20,053	20,872	20,512	19,877	19,198	18,473	17,705
GA	Eagle's Nest	12,800	12,900	13,787	12,856	13,526	14,673	15,860	17,085	18,350
GA	Emporia	1,120	1,255	1,255	1,881	1,949	2,061	2,173	2,283	2,393
GA	Falwell	8,300	8,219	7,057	8,900	8,561	7,948	7,271	6,532	5,729
GA	Farmville	14,300	13,670	13,670	10,219	10,803	11,775	12,748	13,721	14,693
GA	Franklin	3,700	2,896	2,896	2,830	2,620	2,275	1,934	1,598	1,266
GA	Front Royal	17,000	15,064	15,064	14,215	14,486	14,935	15,379	15,818	16,253
GA	Gordonsville	9,152	10,003	10,104	8,504	8,755	9,174	9,593	10,013	10,432
GA	Hampton Roads	61,047	67,939	67,939	71,428	70,915	70,058	69,196	68,331	67,463

GA	Hanover	32,255	35,046	35,046		63,832	65,774	69,020	72,277	75,545	78,824
GA	Hummel Field	12,990	12,553	10,210		11,400	11,435	11,495	11,554	11,613	11,673
		Actual				Forecast					
Airport Role	Airport	2012	2019	2020		2021	2024	2029	2034	2039	2044
GA	Ingalls Field	11,815	8,827	8,827		8,867	9,574	10,787	12,044	13,345	14,689
GA	Lake Anna	760	861	865		869	910	980	1,052	1,126	1,203
GA	Lake Country	4,633	5,350	4,559		5,593	6,086	6,944	7,846	8,791	9,781
GA	Lawrenceville	2,700	2,500	2,500		2,500	2,500	2,500	2,500	2,500	2,500
GA	Lee County	5,896	3,503	3,503		3,094	3,358	3,821	4,310	4,826	5,369
GA	Leesburg	107,428	102,895	105,268		108,390	108,931	109,833	110,738	111,644	112,552
GA	Lonesome Pine	9,531	10,305	10,305		3,900	4,288	4,900	5,471	6,001	6,489
GA	Louisa	22,125	29,651	29,651		31,900	34,152	38,042	42,102	46,332	50,733
GA	Lunenburg	392	406	407		204	204	206	207	209	210
GA	Luray	7,476	3,428	3,428		9,897	10,121	10,471	10,790	11,077	11,332
GA	Manassas	79,555	74,085	62,005		84,162	85,123	86,725	88,326	89,925	91,523
GA	Mecklenburg-Brunswick	9,600	11,904	11,904		12,098	13,405	15,730	18,241	20,936	23,816
GA	Middle Peninsula	13,306	9,615	9,615		8,977	8,975	8,906	8,757	8,527	8,215
GA	Mountain Empire	10,212	10,901	10,901		7,429	7,063	6,455	5,850	5,248	4,650
GA	New Kent	5,215	15,038	15,038		14,070	14,217	14,462	14,709	14,958	15,209
GA	New London	32,902	32,178	25,408		26,306	24,849	22,303	19,608	16,764	13,773
GA	New Market	16,174	16,055	24,914		24,301	25,668	28,005	30,418	32,906	35,469
GA	New River Valley	6,536	4,069	4,069		3,945	4,049	4,219	4,385	4,546	4,703
GA	Orange	8,461	8,779	8,779		8,169	8,496	9,034	9,563	10,083	10,595
GA	Shannon	30,063	29,531	32,215		31,685	31,132	30,169	29,152	28,081	26,958
GA	Smith Mountain Lake	5,128	5,109	4,905		6,131	6,464	7,019	7,575	8,130	8,685
GA	Stafford	20,547	28,176	28,176		27,538	31,296	38,085	45,531	53,634	62,395
GA	Suffolk	39,877	39,545	39,545		44,542	45,917	48,084	50,097	51,955	53,659
GA	Tangier Island	473	473	473		473	473	473	473	473	473
GA	Tappahannock Essex	4,608	7,021	7,021		7,971	9,125	11,219	13,529	16,054	18,794
GA	Tazewell	4,968	5,220	5,220		5,975	5,956	5,911	5,848	5,768	5,670
GA	Twin County	8,925	11,052	11,052		11,281	10,512	9,183	7,795	6,348	4,843
GA	Virginia Highlands	22,743	23,931	23,931		22,497	23,964	26,479	29,082	31,773	34,551
GA	Virginia Tech	17,195	21,125	21,125		24,505	23,395	21,485	19,500	17,438	15,301
GA	Wakefield	16,347	14,748	12,193		12,844	12,664	12,362	12,058	11,750	11,440
GA	Warrenton-Fauquier	43,350	48,911	48,911		52,818	54,175	56,474	58,817	61,205	63,637
GA	William Tuck	7,452	7,779	7,779		9,413	9,616	9,954	10,290	10,625	10,958
GA	Williamsburg	27,482	26,327	22,946		23,964	24,514	25,444	26,386	27,342	28,312
GA	Winchester	38,250	41,278	41,278		48,618	47,444	45,404	43,260	41,012	38,660
Total GA Airports		1,075,937	1,111,654	1,099,841		**1,172,906**	**1,196,245**	**1,235,828**	**1,276,267**	**1,317,561**	**1,359,711**

Grand Total	1,429,748	1,426,113	1,362,702	1,475,629	1,523,796	1,574,315	1,624,853	1,676,193	1,728,334

Table 5-23: Forecast of GA Operations by Virginia Airport (continued)

		CAGR							
Airport Role	**Airport**	**2012-2019**	**2019-2020**	**2020-2021**	**2019-2024**	**2019-2029**	**2019-2034**	**2019-2039**	**2019-2044**
CS	Charlottesville-Albemarle	0.8%	7.6%	23.8%	4.3%	2.8%	2.3%	2.0%	1.8%
CS	Dulles International	-3.3%	-32.8%	-1.7%	-0.9%	-0.1%	0.1%	0.2%	0.3%
CS	Lynchburg Regional	-1.3%	-19.1%	22.6%	0.4%	0.7%	0.8%	0.8%	0.8%
CS	Newport News Williamsburg	-8.0%	-29.8%	23.9%	-2.6%	-1.2%	-0.8%	-0.5%	-0.4%
CS	Norfolk International	-4.6%	-19.2%	13.7%	-1.6%	-0.7%	-0.4%	-0.3%	-0.2%
CS	Reagan National	-10.6%	-25.9%	-28.9%	0.0%	2.5%	1.6%	1.2%	1.0%
CS	Richmond International	3.1%	-17.8%	3.5%	-0.6%	-0.1%	0.1%	0.2%	0.3%
CS	Roanoke-Blacksburg	4.1%	-25.5%	-0.9%	1.9%	0.5%	0.1%	-0.2%	-0.4%
CS	Shenandoah Valley Regional	-3.1%	1.9%	10.8%	2.4%	1.2%	0.8%	0.5%	0.4%
Total Commercial Service Airports		**-1.7%**	**-16.4%**	**15.2%**	**0.8%**	**0.7%**	**0.7%**	**0.7%**	**0.6%**
GA	Accomack	-8.5%	0.0%	-10.2%	-2.7%	-1.9%	-1.6%	-1.6%	-1.5%
GA	Blackstone	-100.0%	--	66.4%	--	--	--	--	--
GA	Blue Ridge	-0.1%	0.0%	15.5%	2.2%	0.5%	-0.1%	-0.4%	-0.6%
GA	Bridgewater	3.9%	-4.5%	9.5%	1.4%	1.1%	0.8%	0.7%	0.5%
GA	Brookneal	1.4%	0.0%	1.0%	1.6%	2.0%	2.0%	2.0%	2.0%
GA	Chase City	-0.1%	104.0%	2.0%	14.7%	5.9%	2.7%	0.7%	-1.1%
GA	Chesapeake	3.5%	0.0%	1.0%	1.3%	1.5%	1.5%	1.5%	1.5%
GA	Chesterfield	0.7%	0.0%	0.0%	0.2%	0.3%	0.3%	0.3%	0.3%
GA	Crewe	-0.5%	5.2%	-1.8%	0.2%	-0.4%	-0.7%	-0.9%	-1.1%
GA	Culpeper	2.2%	0.0%	-10.8%	-0.7%	0.9%	1.4%	1.6%	1.7%
GA	Danville	1.8%	0.0%	-0.8%	-0.5%	-0.5%	-0.5%	-0.5%	-0.6%
GA	Dinwiddie	-4.5%	0.0%	4.1%	0.5%	-0.1%	-0.3%	-0.4%	-0.5%
GA	Eagle's Nest	0.1%	6.9%	-6.8%	1.0%	1.3%	1.4%	1.4%	1.4%
GA	Emporia	1.6%	0.0%	49.9%	9.2%	5.1%	3.7%	3.0%	2.6%
GA	Falwell	-0.1%	-14.1%	26.1%	0.8%	-0.3%	-0.8%	-1.1%	-1.4%
GA	Farmville	-0.6%	0.0%	-25.2%	-4.6%	-1.5%	-0.5%	0.0%	0.3%
GA	Franklin	-3.4%	0.0%	-2.3%	-2.0%	-2.4%	-2.7%	-2.9%	-3.3%
GA	Front Royal	-1.7%	0.0%	-5.6%	-0.8%	-0.1%	0.1%	0.2%	0.3%
GA	Gordonsville	1.3%	1.0%	-15.8%	-2.6%	-0.9%	-0.3%	0.0%	0.2%
GA	Hampton Roads	1.5%	0.0%	5.1%	0.9%	0.3%	0.1%	0.0%	0.0%
GA	Hanover	1.2%	0.0%	82.1%	13.4%	7.0%	4.9%	3.9%	3.3%
GA	Hummel Field	-0.5%	-18.7%	11.7%	-1.8%	-0.9%	-0.6%	-0.4%	-0.3%
GA	Ingalls Field	-4.1%	0.0%	0.5%	1.6%	2.0%	2.1%	2.1%	2.1%
GA	Lake Anna	1.8%	0.5%	0.5%	1.1%	1.3%	1.3%	1.4%	1.3%
GA	Lake Country	2.1%	-14.8%	22.7%	2.6%	2.6%	2.6%	2.5%	2.4%
GA	Lawrenceville	-1.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
GA	Lee County	-7.2%	0.0%	-11.7%	-0.8%	0.9%	1.4%	1.6%	1.7%
GA	Leesburg	-0.6%	2.3%	3.0%	1.1%	0.7%	0.5%	0.4%	0.4%

Table 5-23: Forecast of GA Operations by Virginia Airport (continued)

		CAGR							
Airport Role	**Airport**	**2012-2019**	**2019-2020**	**2020-2021**	**2019-2024**	**2019-2029**	**2019-2034**	**2019-2039**	**2019-2044**
GA	Lonesome Pine	1.1%	0.0%	-62.2%	-16.1%	-7.2%	-4.1%	-2.7%	-1.8%
GA	Louisa	4.3%	0.0%	7.6%	2.9%	2.5%	2.4%	2.3%	2.2%
GA	Lunenburg	0.5%	0.1%	-49.9%	-12.8%	-6.6%	-4.4%	-3.3%	-2.6%
GA	Luray	-10.5%	0.0%	188.7%	24.2%	11.8%	7.9%	6.0%	4.9%
GA	Manassas	-1.0%	-16.3%	35.7%	2.8%	1.6%	1.2%	1.0%	0.8%
GA	Mecklenburg-Brunswick	3.1%	0.0%	1.6%	2.4%	2.8%	2.9%	2.9%	2.8%
GA	Middle Peninsula	-4.5%	0.0%	-6.6%	-1.4%	-0.8%	-0.6%	-0.6%	-0.6%
GA	Mountain Empire	0.9%	0.0%	-31.9%	-8.3%	-5.1%	-4.1%	-3.6%	-3.4%
GA	New Kent	16.3%	0.0%	-6.4%	-1.1%	-0.4%	-0.1%	0.0%	0.0%
GA	New London	-0.3%	-21.0%	3.5%	-5.0%	-3.6%	-3.2%	-3.2%	-3.3%
GA	New Market	-0.1%	55.2%	-2.5%	9.8%	5.7%	4.4%	3.7%	3.2%
GA	New River Valley	-6.5%	0.0%	-3.1%	-0.1%	0.4%	0.5%	0.6%	0.6%
GA	Orange	0.5%	0.0%	-7.0%	-0.7%	0.3%	0.6%	0.7%	0.8%
GA	Shannon	-0.3%	9.1%	-1.6%	1.1%	0.2%	-0.1%	-0.3%	-0.4%
GA	Smith Mountain Lake	-0.1%	-4.0%	25.0%	4.8%	3.2%	2.7%	2.3%	2.1%
GA	Stafford	4.6%	0.0%	-2.3%	2.1%	3.%	3.3%	3.3%	3.2%
GA	Suffolk	-0.1%	0.0%	12.6%	3.0%	2.0%	1.6%	1.4%	1.2%
GA	Tangier Island	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
GA	Tappahannock Essex	6.2%	0.0%	13.5%	5.4%	4.8%	4.5%	4.2%	4.0%
GA	Tazewell	0.7%	0.0%	14.5%	2.7%	1.3%	0.8%	0.5%	0.3%
GA	Twin County	3.1%	0.0%	2.1%	-1.0%	-1.8%	-2.3%	-2.7%	-3.2%
GA	Virginia Highlands	0.7%	0.0%	-6.0%	0.0%	1.0%	1.3%	1.4%	1.5%
GA	Virginia Tech	3.0%	0.0%	16.0%	2.1%	0.2%	-0.5%	-1.0%	-1.3%
GA	Wakefield	-1.5%	-17.3%	5.3%	-3.0%	-1.7%	-1.3%	-1.1%	-1.0%
GA	Warrenton-Fauquier	1.7%	0.0%	8.0%	2.1%	1.4%	1.2%	1.1%	1.1%
GA	William Tuck	0.6%	0.0%	21.0%	4.3%	2.5%	1.9%	1.6%	1.4%
GA	Williamsburg	-0.6%	-12.8%	4.4%	-1.4%	-0.3%	0.0%	0.2%	0.3%
GA	Winchester	1.1%	0.0%	17.8%	2.8%	1.0%	0.3%	0.0%	-0.3%
Total GA Airports		**0.5%**	**-1.1%**	**6.6%**	**1.5%**	**1.1%**	**0.9%**	**0.9%**	**0.8%**
Grand Total		**0.0%**	**-4.4%**	**8.3%**	**1.3%**	**1.0%**	**0.9%**	**0.8%**	**0.8%**

Note: Totals may not add due to rounding; 2021 actual operations for Charlottesville, Dulles, Lynchburg, Newport News, Norfolk, Reagan National, Richmond, Roanoke, and Leesburg.
Source: DOAV and VATSP Forecast.

Comparison to the TAF

In this section, the Virginia airport activity forecasts are compared to the FAA's 2020 TAF. There are two time periods that are compared, five years out and 10 years out. For purposes of this forecast, the VATSP forecast is being compared to the 2020 TAF in years 2024 and 2029. The 2020 TAF was performed during the Pandemic and has the task of predicting the recovery prior to the vaccine and the subsequent surge in leisure travel. As a result, the 2020 TAF's recovery to 2019 levels slightly lags the reality of the pandemic. While leisure demand has recovered, the carriers have faced challenges in 2021 and into 2022 including a surge in COVID-19 cases and a pilot shortage. Both of these factors impacted Virginia's commercial service airports' recovery to 2019 enplanement levels. The VATSP enplanement forecast is within the 10 percent variance from the 2020 TAF in all cases except at Shenandoah Valley. The variance between the Shenandoah Valley forecast and the 2020 TAF in 2024 is 67.4 percent. By the end of 2021, Shenandoah Valley was at 81 percent of its 2019 enplanements levels and already above the level that the 2020 TAF forecasted for 2029. In 2029, all Virginia commercial service airports are within the 15 percent variance from the 2020 TAF. The only exception is Shenandoah Valley, which the 2020 TAF does not have recovering to its 2019 enplanement level during the forecast period. This is shown in **Table 5-24** below.

Table 5-24: Forecast of Virginia's Commercial Service Airports' Enplanements Compared to the FAA TAF

	Dulles International	Reagan National	Richmond International	Norfolk International	Charlottesville-Albemarle	Roanoke-Blacksburg	Newport News Williamsburg	Lynchburg Regional	Shenandoah Valley
Base Year 2019									
VATSP	12,326,926	11,949,040	2,201,777	1,990,570	386,344	359,999	215,822	92,214	17,278
2020 TAF	12,326,926	11,949,040	2,201,777	1,990,570	386,344	359,999	215,822	92,214	17,278
Variance to 2020 TAF	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*
2024									
VATSP	11,546,858	12,319,012	2,422,340	2,064,515	417,129	383,018	206,027	91,804	18,495
2020 TAF	10,503,104	11,555,953	2,550,051	1,877,444	379,793	350,073	191,350	83,807	11,047
Variance to 2020 TAF	*9.9%*	*6.6%*	*-5.0%*	*10.0%*	*9.8%*	*9.4%*	*7.7%*	*9.5%*	*67.4%*
2029									
VATSP	13,761,248	13,373,249	2,749,706	2,181,391	484,626	401,866	227,965	96,125	19,438
2020 TAF	13,626,798	13,177,210	3,225,871	2,180,200	492,393	401,058	232,583	91,322	12,034
Variance to 2020 TAF	*1.0%*	*1.5%*	*-6.3%*	*0.1%*	*-1.6%*	*0.2%*	*-2.0%*	*5.3%*	*61.5%*

Source: VATSP Forecast and FAA TAF.

Total operations for the 11 towered airports were also compared to the 2020 TAF for the two time periods of 2024 and 2029. In 2024, the forecast for total operations at the 11 towered airports were within 10 percent of the 2020 TAF except at Manassas, where actual operations data for 2021 was utilized in the VATSP forecast. The actual operations data for Manassas was 34 percent higher than the 2021 operations number from the TAF. Use of actual operations at Manassas resulted in a variance from the 2020 TAF that exceeded 10 percent in 2024 and 15 percent in 2029. In 2029, the forecast for total operations at the other 10 towered airports was within 15 percent of the 2020 TAF. This is shown in **Table 5-25**.

Table 5-25: Forecast of Virginia's Total Operations Compared to the FAA TAF

	Dulles International	Reagan National	Richmond International	Norfolk International	Charlottesville-Albemarle	Roanoke-Blacksburg	Newport News/ Williamsburg	Lynchburg Regional	Shenandoah Valley	Manassas	Leesburg	Total
Base Year 2019												
VATSP	286,705	268,102	95,759	71,304	88,037	51,336	43,462	93,996	15,320	74,085	102,895	1,191,001
2020 TAF	286,705	268,102	95,759	71,304	88,037	51,336	43,462	93,996	15,320	74,085	102,895	1,191,001
Variance to 2020 TAF	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2024												
VATSP	281,731	293,104	105,089	67,486	97,291	48,529	38,690	96,680	17,104	85,123	108,931	1,239,758
2020 TAF	261,713	284,308	98,513	63,662	90,713	45,372	39,109	89,532	16,692	68,749	115,332	1,173,695
Variance to 2020 TAF	7.6%	3.1%	6.7%	6.0%	7.3%	7.0%	-1.1%	8.0%	2.5%	23.8%	-5.6%	5.6%
2029												
VATSP	307,706	299,037	110,935	68,898	103,644	47,219	39,348	101,392	17,085	86,725	109,833	1,291,822
2020 TAF	315,036	306,902	118,175	72,340	95,203	47,251	41,478	97,059	18,380	69,825	129,277	1,310,926
Variance to 2020 TAF	-2.3%	-2.6%	-6.1%	-4.8%	8.9%	-0.1%	-5.1%	4.5%	-7.0%	24.2%	-15.0%	-1.5%

Source: VATSP Forecast and FAA TAF.

Due to the variations in the base year and in some cases historical years of based aircraft at the 11 towered airports in Virginia as compared to the TAF, based aircraft at the 11 towered airports was only compared to the TAF on the state level. The forecast is in line with the TAF and falls within the variance allowed by the FAA in the five- and ten-year period.

Table 5-26: Based Aircraft: VATSP Forecast Compared to the TAF

Based Aircraft Comparison VATSP to FAA TAF	
2019- Base Year	
VATSP	1,309
2020 TAF	1,268
Variance	3.2%
2024	
VATSP	1,352
2020 TAF	1,382
Variance	-2.2%
2029	
VATSP	1,371
2020 TAF	1,480
Variance	-7.4%

Source: FAA TAF and VATSP Forecast.

Summary of Aviation Forecasts for the Virginia Aviation System

The aviation activity forecasts are an essential step in updating the VATSP. The forecasts discussed in this chapter will be key in determining the required level of airport facility development needed to accommodate current and future demand. These aviation activity forecasts are unique due to the impacts that COVID-19 has had on the aviation system in Virginia and across the world. Virginia's commercial service airports' TSA passenger throughput was down 67 percent in 2020. However, pre-Pandemic, Virginia was in a strong position, and the VATSP aviation activity forecasts expect Virginia to not only recover to pre-pandemic, but also to continue to grow. In 2019, Virginia served 29 million passengers, of which 82 percent traveled through the Northern Virginia airports. Through 2019, Virginia's small and non-hub airports grew at a faster rate than the large hub airports. This same trend has continued through COVID-19 with a faster recovery back to 2019 passenger levels at the small and non-hub airports. This is in part due to Richmond International's and Norfolk International's new service from Ultra Low-Cost Carriers. With the implications that the COVID-19 variants have on business travel and international travel, the large hub airports' recovery is forecast to lag the small and non-hub airports. By 2044, Virginia airports are expected to enplane 41.5 million passengers. Despite the faster growth of the small and non-hub airports, Virginia's enplanements remain fairly concentrated at the Northern Virginia airports, which are forecast to account for 82 percent of Virginia's passengers.

Virginia's GA airports were also impacted by COVID-19, but to a much lesser extent than the commercial service operations. In 2020, Virginia's GA operations fell by four percent. In 2019, Virginia's GA operations grew by 4.6 percent, while the nation grew by 3 percent. Virginia's GA fleet is heavily single engine piston, which accounted for 79 percent of the fleet in 2019. While, single engine piston aircraft are forecast to remain a dominant segment of the fleet, the actual share declines by six percentage points to 73 percent by 2044. Virginia's business jet fleet declined from 2015 to 2019; however, the GA airports experienced an increase in business jet aircraft in 2020 and 2021 from 155 business jets in 2019 to 204 in 2021. The growth in the business jet fleet is forecast to continue, which is consistent with the forecast for the nation.

Overall, Virginia is expected to experience growth at both the commercial service and GA airports due to Virginia's strong fundamentals with a strong and growing economy and a varied and healthy group of 66 airports.

The forecasts of activity were completed and approved by the FAA in late 2021, but the VATSP process did not conclude until Spring of 2023. Consequently, a brief assessment of where the commercial service airports were in their continued recovery from the pandemic was conducted. As of mid-2022, calculations showed that the industry would turn a profit in 2022. Despite strong demand, the nation's recovery was stalled due to severe operational difficulties, resulting in the industry remaining at 90 percent of 2019 demand. In contrast to the national trend, Virginia's recovery increased steadily from January 2022 to July 2022. By this point, six Virginia airports exceeded 90 percent of their 2019 levels, with two above 100 percent. Service at Virginia's airports has essentially returned, with Norfolk International and Richmond International enjoying service from new carriers. Although recovery is still incomplete at Charlottesville-Albemarle, Newport News-Williamsburg, and Shenandoah Valley, the Commonwealth ranks third in TSA throughput compared to its peer states.

Chapter 6: Inventory

This chapter includes an inventory of airport information, drive time access maps, and navigational aid (NAVAIDs) equipment at the airports in Virginia. Changes in the aviation system since the last plan was released in 2016 are identified herein, which include the updated airport roles referenced in **Chapter 3**. A database was created that catalogs and stores all collected information. The contents of the database (i.e., topics to be included) and the level of detail needed for each data set were approved by the Virginia Department of Aviation (DOAV) before data collection began. The inventory effort included the review of existing airport documents such as Airport Layout Plans and Federal Aviation Administration (FAA) 5010 Forms, as well as a survey effort that involved all 66 public-use airports.

The results of this inventory effort are explained in greater detail in the following sections:

- The Virginia Aviation System
- System Improvements Since 2016 Virginia Air Transportation System Plan (VATSP)
- Inventory
- Navigational Aids

The Virginia Aviation System

The Virginia aviation system consists of 66 airports located throughout Virginia, from the western side of the state to islands in the Chesapeake Bay. Nine of these airports provide scheduled commercial airline service, including two in northern Virginia – Ronald Reagan National Airport and Washington Dulles International Airport – that provide access to the nation's capital. The 57 airports that focus on GA services range in purpose:

- Some provide flight training.
- Some are economic engines for business growth.
- Some are specialized, serving a niche market (such as Bridgewater).
- Some fulfill a variety of functions.
- All provide access to Virginia's people and businesses.

The management, operation, and services provided by these airports come from a mix of public and private organizations. In partnership, they work together to provide the assortment of services found at these airports. Ownership of these airports is predominately by municipalities or public agencies, although 10 of the system airports are privately owned. Nearly all of the passenger and air cargo airline services are provided by private businesses (some foreign airlines that serve Dulles are owned by foreign governments). Both private and public entities provide the many services offered at these airports. For example, flight training and aircraft maintenance are provided by private companies or individuals, while fuel sales are offered by private companies at most airports with some municipally owned airports also providing fuel service. In short, the Virginia aviation system operates because of the partnership that exists between the private and public sector.

System Improvements Since 2016 VATSP

Since the last VATSP, DOAV has administered more than $74 million in Commonwealth Aviation Funds (CAF) that have been invested in Virginia's airports. The Virginia Aviation Board (VAB) authorizes CAF money for matching funds on federally funded airport projects, as well as for projects that are not eligible for federal Airport Improvement Program grants.

This money has helped fund numerous capital improvements and capital maintenance projects that sustain and enhance the services found at Virginia's airports. These projects include improvements on both the airside and landside of airports, with examples ranging from runway extensions and expansions of apron space to renovations of terminals and parking lots. The largest investments made by the state since the last system plan resulted in a new terminal building at Warrenton-Fauquier Airport, a pavement mill and overlay of Norfolk International Airport's Runway 5/23, and taxiway rehabilitations at Richmond International Airport. Other improvements include a variety of airport improvements.

Key Takeaways

- The VAB has invested more than $74 million from the Commonwealth Aviation Fund into Virginia's airports since the 2016 VATSP.
- Investments in airfield and landside improvements have resulted in a more efficient aviation system.

Through the CAF, the VAB has authorized funding for new or renovated terminal buildings at seven airports since the last system plan. Those airports that received new or renovated terminals were:

- Chesapeake Regional Airport (CPK)
- Danville Regional Airport (DAN)
- Hanover County Municipal Airport (OFP)
- Luray Caverns Airport (LUA)
- Warrenton-Fauquier Airport (HWY)
- Winchester Regional Airport (OKV)

Other major improvements authorized by the VAB include funding for runway extensions at five airports since the 2016 VATSP:

- Virginia Tech/Montgomery Executive (BCB) – runway extension completed
- Hummel Field (W75) – runway extension completed
- Stafford Regional Airport (RMN) – runway extension completed
- Blue Ridge Airport (MTV) – environmental assessment and design completed
- Virginia Highlands Airport (VJI) – runway extension planned for completion in October 2023

The VAB has also encouraged the development of aircraft hangars at system airports. Since the 2016 VATSP, hangar site preparation has occurred at:

- Chesapeake Regional Airport (CPK)
- Danville Regional Airport (DAN)
- Dinwiddie County Airport (PTB)
- Emporia-Greensville Regional Airport (EMV)
- Hampton Roads Executive Airport (PVG)
- Leesburg Executive Airport (JYO)
- Louisa County Airport (LKU)
- Middle Peninsula Regional Airport (FYJ)
- New Kent County Airport (W96)
- Richmond Executive - Chesterfield County Airport (FCI)
- Stafford Regional Airport (RMN)
- Tazewell County Airport (JFZ)
- Twin County Airport (HLX)
- Virginia Tech - Montgomery Executive Airport (BCB)
- Warrenton-Fauquier Airport (HWY)
- Williamsburg-Jamestown Airport (JGG)

These examples are a sampling of the extensive improvements that have occurred in recent years at Virginia's airports, thanks to the VAB and the use of CAF.

Inventory

An understanding of existing facilities, conditions, access, and plans for the 66 airports that are part of the VATSP serves as the basis for many of the analyses and recommendations presented in this report. The inventory consists of a database of airport information and a digest of drive time access maps. The inventory updates information from the previous VATSP effort and creates a common data repository with relevant information about each airport that will ultimately be used to make decisions related to airport development, airport role classification, planning, and funding. The information collected for this inventory database is:

- Airport ownership and funding
- Airside facilities including runways, taxiways, lighting systems, and NAVAIDs
- Landside facilities including hangars, aprons, terminal structures, parking facilities, and electrical power access capabilities
- Airport services including information on Fixed Base Operators (FBOs), fueling, flight instruction, transportation/access, air ambulance operations, and available equipment
- Emerging technologies including impacts and plans for Uncrewed Aerial Systems (UASs), Urban/Advanced Air Mobility (UAM/AAM) concepts, and NextGen concepts such as remote towers
- Economic development including non-aeronautical revenue streams
- Community involvement

This section provides information on the process utilized to create this inventory. It also presents several relevant summary statistics based on the information collected. The next section provides information on Virginia's access to airports through drive time maps and the method of determining airport drive times.

Inventory Process

The information contained in the inventory for the 66 airports in the VATSP is based on a variety of public and proprietary data sources. A primary goal of this effort was to capture relevant information at the appropriate levels that could ultimately feed and support capital and operational planning decisions for DOAV. The data collection effort included public use airports across Virginia and was composed of a data mining effort as well as a survey distributed to all airports.

To gain the level of detail needed to support the goals and objectives laid out for the VATSP, the following information sources were used as a starting point for the inventory:

- FAA Airport Data and Information Portal - FAA Form 5010 (Airport Master Record)
- FAA Chart Supplement
- FAA National Flight Data Center (NFDC) Aeronautical Information
- FAA National Airspace System Resource (NASR) System
- Airport Layout Plans (ALP) obtained from the FAA and DOAV
- AirNav (https://airnav.com)
- DOAV Facilities and Equipment (NAVAID) Study (2010)
- Airport Websites
- Data contained in Airport IQ

The information obtained from these data sources was processed and merged into a master database. This inventory database was used for subsequent analyses throughout the system plan update process. More detailed information from the database can be found in **Appendix B**.

Airport Surveys

Following this initial inventory effort, an online survey was developed and distributed to points of contact for each of the 66 airports. Survey respondents included airport managers, operators, and contractors. The purpose of the survey was three-fold:

1. To verify and update information gained from published data sources regarding airport facilities and airport services
2. To provide guidance on conflicting information obtained from other data sources
3. To explore airport practices and plans across a variety of other areas including emerging technologies and economic development

The survey was developed and distributed to airport points of contact using an online platform. It contained a total of 55 questions that were individually customized for each airport according to information previously obtained. The online survey was also reactive to respondent selections in terms of the questions that were provided and only presented specific questions based on prior responses. Targeted follow-ups via e-mail and telephone calls were conducted to foster a higher response rate and to clarify responses already provided. A total of 61 airports responded to the survey. Information for the remaining airports was supplemented using DOAV historical data. Select statistics and tables based on this inventory are presented in the following sections. An example survey illustrating questions and tailored responses is included in **Appendix B**.

Summary of Key Information

Data collected through the inventory process effort forms the basis of reports and analyses throughout the successive chapters. Detailed results and tables of the inventory data are included in **Appendix B**. This section provides summary results of some of the more important data elements.

Detailed inventory data was collected and is presented and categorized using four airport roles as defined through the aviation system planning process. Airports in the system plan were categorized based on a variety of factors that included primary runway length, type of fuel available, number of based aircraft, and sponsor type. The latest version of airport service roles for Virginia airports include:

Commercial Service (CM): Commercial Service Airports provide scheduled air carrier services for the Virginia population to both domestic and international destinations.

Regional Business (RB): GA Regional Business Airports serve a large market area and are predominantly used to support corporate and business aviation activities. These airports offer a large range of services and operate as reliever airports to highly congested commercial service airports. They can also accommodate corporate jet aircraft.

Community Business (CB): GA Community Business Airports serve a smaller market than regional business airports and offer comparatively fewer services. The airports provide services to smaller piston engine aircraft used for business, pleasure, and flight training.

Local Service (LS): Local Service Airports have the least number of operations compared to other GA airports described above. These airports provide limited services and serve a small market. They generally require minimal support facilities and primarily consist of single engine operations including flight training and flights for pleasure.

Based on the above descriptions, the Virginia Aviation System plan consisted of nine Commercial Service Airports, 26 Regional Business Airports, 20 Community Business Airports, and 11 Local Service Airports. An updated breakdown of the 66 Virginia airports in terms of service roles is presented in **Figure 6-1**.

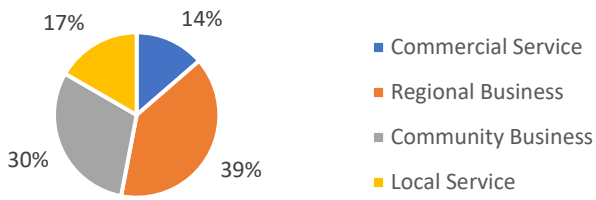


Figure 6-1: VATSP Airport Roles

Many of the detailed statistics as well as inventory data present information based on these airport categories.

Primary Runway Lengths

The collection of information regarding primary runways was an integral part of the inventory effort. Runway length plays an instrumental role in the definition of aircraft types that can be served by a particular airport. Airports with longer runway lengths can accommodate a larger variety of aircraft types and support different operational needs. The primary runway length was also used in the categorization of airports within the four system roles described previously. A summary of airport primary runway lengths within Virginia's aviation system is provided in **Table 6-1**.

Table 6-1: Primary Runway Lengths

Runway Length	Number of VA Airports
less than 4,000 ft	20 (30%)
4,000 ft to 5,000 ft	10 (15%)
5,000 ft to 5,500 ft	17 (26%)
5,500 ft to 6,000 ft	7 (11%)
greater than 6,000 ft	12 (18%)

Instrument Approach Capabilities

An instrument approach provides pilots with guidance on the location of the runway by ensuring the approach section of the flight is adequately protected from obstacles, and the pilot can safely descend for landing during periods of low visibility. Instrument approach capability increases the utility of an airport as it makes it possible for operations to continue during periods of inclement weather or poor visibility. The instrument approach capability is listed as either no instrument approach, circling approach, non-precision, approach with vertical guidance, or precision approach. A circling approach is the visual phase of an instrument approach to bring an aircraft into position for landing on a runway that is not suitably located for a straight-in approach or a runway other than the one the instrument approach was designed for. A non-precision instrument approach provides only course information. Pilots receive guidance horizontally but not vertically. An approach with vertical guidance is an instrument approach that provides both vertical and horizontal guidance without the accuracy of a precision approach. A precision approach provides both horizontal and vertical guidance for aircraft landing, with minimums of 200-foot cloud ceiling and ½-mile visibility or better.

Results show that all 66 airports covered by the VATSP had instrument approach capabilities. **Table 6-2** provides a detailed summary of instrument approach capabilities for all Virginia airports:

Table 6-2: Instrument Approach Capabilities

Airport Role	Precision	Vertical Guidance	Non-Precision	Circling
Commercial Service	8 (12%)	1 (2%)	0 (0%)	0 (0%)
Regional Business	5 (8%)	21 (32%)	0 (0%)	0 (0%)
Community Business	0 (0%)	9 (14%)	6 (9%)	5 (8%)
Local Service	0 (0%)	0 (0%)	7 (11%)	4 (6%)
TOTAL	**13 (20%)**	**31 (47%)**	**13 (20%)**	**9 (14%)**

Results from the inventory effort showed that most airports in the system (about 47 percent) have instrument approaches with vertical guidance. All commercial service and regional business airports have either a precision approach or an approach with vertical guidance, thus improving operational capabilities and economic returns as airports are less likely to be affected by inclement weather and low visibility.

NAVAIDs

Information on the condition of NAVAIDs, ownership responsibility, and maintenance responsibility was collected through the survey and inventory process. NAVAIDs that were assessed included airport-based NAVAIDs such as Automated Weather Observing Systems (AWOS), wind cones, segmented circles, and rotating beacons as well as runway specific navigation. Runway NAVAIDs included Precision Approach Path Indicators (PAPI), Omni-Directional Approach

Lighting Systems (ODALS), localizer antenna, and glideslope antenna, among others. Information regarding NAVAID ownership and maintenance responsibility are presented in **Figures 6-2 and 6-3**:

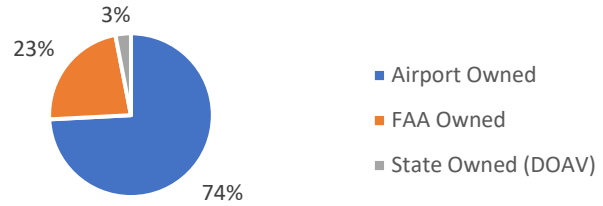


Figure 6-2: NAVAID Ownership

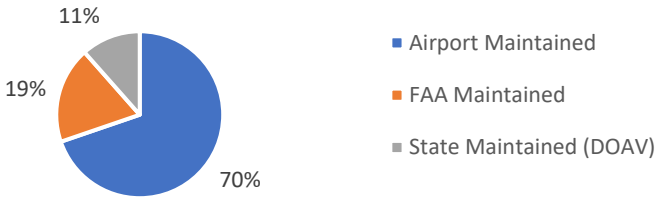


Figure 6-3: NAVAID Maintenance

Results indicated that about 74 percent of the NAVAIDs within the system are owned by Virginia airports, and 70 percent are locally maintained. The remaining NAVAIDs are primarily owned by the FAA with maintenance responsibility assigned to the FAA or the State of Virginia.

Airport Lighting and Visual Aids

The study categorized airport lighting systems based on the level of brightness or intensity of the primary runway edge lights used to outline the edges of runways during darkness or restricted visibility conditions. Airports with lower visibility minimums require higher intensity edge lighting systems to facilitate instrument approach operations. The four runway edge lighting categories used were:

- High intensity runway lights (HIRL)
- Medium intensity runway lights (MIRL)
- Low intensity runway lights (LIRL)
- None (Primary runway does not have edge lighting)

The results from this study are presented in **Table 6-3** and showed that a large percentage—more than 92 percent—of airports within the Virginia system have medium and high runway edge lighting systems. All commercial service airports had HIRL systems.

Table 6-3: Runway Edge Lighting

VATSP Role	HIRL	MIRL	LIRL	None
Commercial Service	9 (14%)	0 (0%)	0 (0%)	0 (0%)
Regional Business	12 (18%)	14 (21%)	0 (0%)	0 (0%)
Community Business	1 (2%)	18 (27%)	0 (0%)	1 (2%)
Local Service	0 (0%)	7 (11%)	2 (3%)	2 (3%)
TOTAL	**22 (33%)**	**39 (59%)**	**2 (3%)**	**3 (5%)**

Airport Facilities and Services

As part of the inventory data collection effort, airports had the opportunity to provide information regarding the availability of local maintenance services. Survey results indicated that more than 56 percent of the airports can support maintenance services for turbine or piston aircraft or had major airframe maintenance facilities. Approximately 24 percent of the airports had no maintenance facilities, with the remaining percentage unknown.

In addition to maintenance facility availability, the inventory process reviewed the availability of FBO within system plan airports. FBO availability at airports appears closely aligned with the availability of maintenance services with 58 percent of Virginia airports hosting FBO operators and 27 percent that did not have FBO services available.

The inventory process also collected information regarding the availability of re-fueling services across all system airports. The results presented in **Figure 6-4** indicate that jet fuel and/or avgas was available at 91 percent of the airports, with only 9 percent having no re-fueling capabilities.

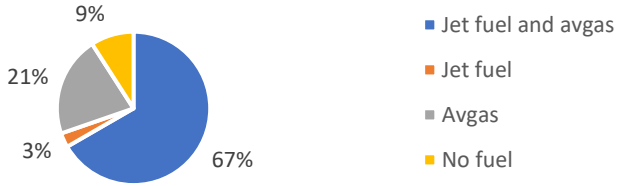


Figure 6-4: Fuel Availability

Air Ambulance Operator

The inventory process collected information on airports that supported based air ambulance services. This information was subsequently used to analyze Virginia "scene call" population coverage, which quantified the states' availability to render emergency services between the scene of an incident and the nearest trauma center through air ambulance services. The analysis is based on published as well as survey data and indicated that only 20 percent of Virginia airports host emergency air ambulance operators.

Emerging Concepts and Technologies

The system plan and survey sought to assess airport and aviation system readiness to facilitate future UAM and AAM aviation concepts. The inventory process collected information on the use and perceived economic impacts of AAM/UAM/uncrewed aerial vehicles (UAV), the availability of airside/landside facilities to accommodate operations by electric vertical take-off and landing (eVTOL), and provisions made for eVTOL electric charging stations.

Regarding the availability of eVTOL charging stations, the survey results showed that 23 percent of system airports had already started making provisions for electric charging stations for future UAM operations while 63 percent of the airports had not factored these novel use cases into their planning processes.

Airports were also surveyed regarding space availability for future eVTOL operations. Examples of the types of spaces identified by system airports included helipad locations, apron space that can be repurposed, ramps, and existing parking structures. Most airports – more than 56 percent– indicated a ready ability to assign or repurpose space to accommodate future eVTOL operations.

Community and Economic Development

The survey included questions on the type of community and economic development programs offered by system airports. **Figure 6-5** provides a summary of the survey results by airport category for airports that responded to hosting either internships, job shadowing programs, air shows, flights for veterans, or career days. The results show that a majority of Commercial Service Airports—more than 78 percent—host community involvement programs, a trend that steadily decreases with airport size and categorization.

Information on local airport economic development prospects was also collected to assess airport readiness for future development and expansion. Of the system airports, 47 percent indicated that economic development areas on or off airport were being considered. Only 12 percent of the airports indicated no availability or plans for economic development.

A similar trend was found in terms of the availability of site-ready areas for economic development with 38 percent of system airports indicating that they had designated locations on or off airport that were zoned and development-ready. Approximately 21 percent of system airports indicated that they did not have any sites available for future economic development.

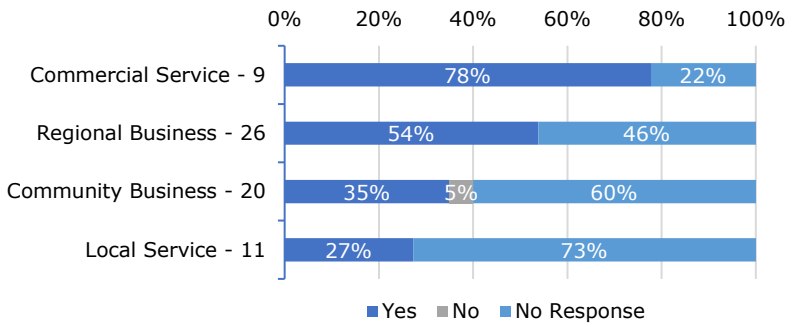


Figure 6-5: Airports that Host a Community Program

Aviation System Population Coverage

The other element of the inventory effort involved characterizing Virginians' access to the aviation system. This was done through a drive time analysis that measured the percent of Virginia's 2021 population contained within a specified driving distance of system airports. This analysis accounted for the road network and typical driving speeds in 2021. Generally, drive

times of 30 minutes were used to evaluate the region within which Virginians were judged to have access to system airports, based on typical drive times of U.S. workers.[10] For access to commercial service airports, a drive time of 45 minutes was assessed to reflect the greater distances air passengers tend to travel to make use of airline service.

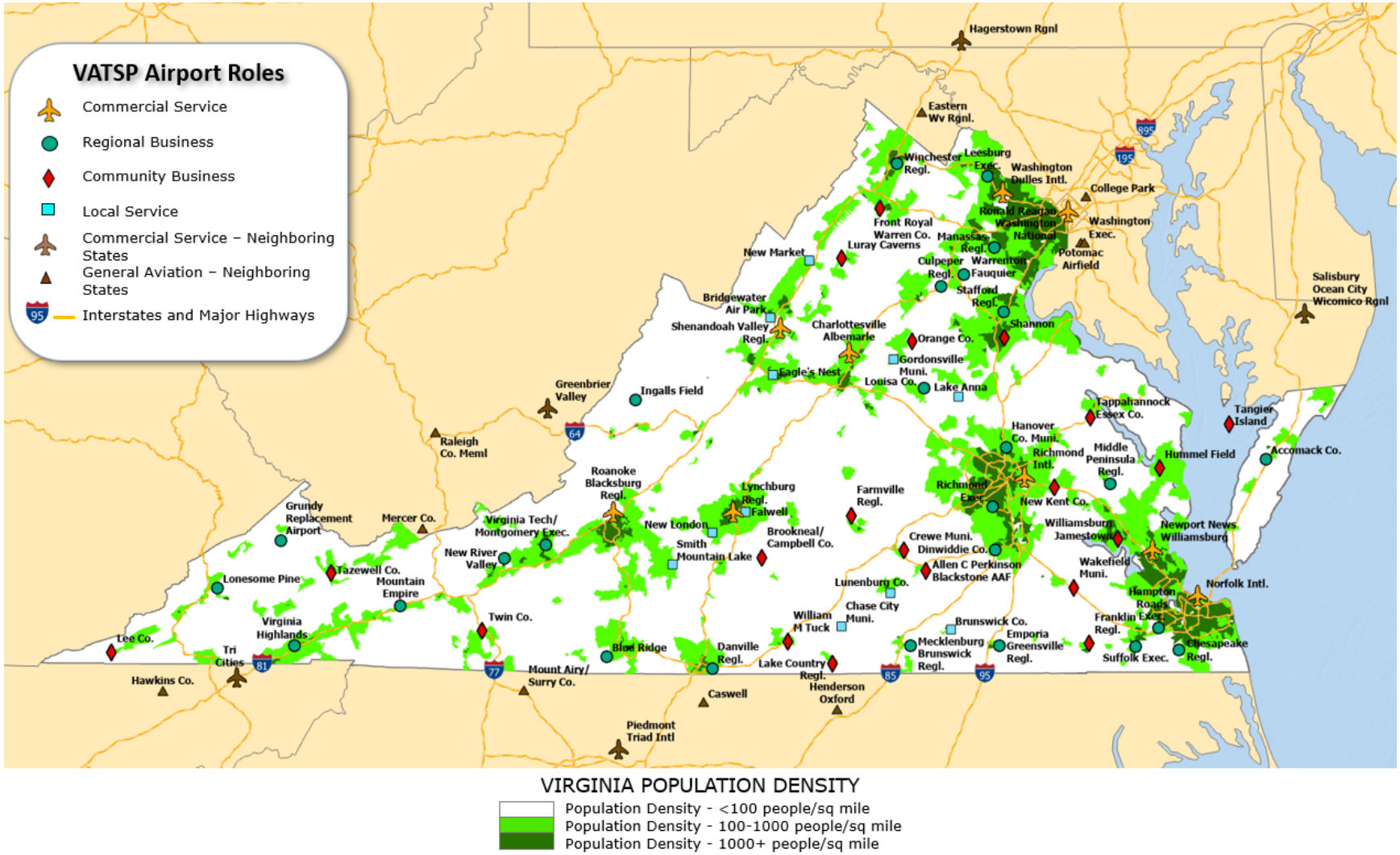
Several performance measures were evaluated, such as the population coverage of the entire aviation system, as well as subsets of the aviation system, based on various facility parameters at the system airports.

The population coverage analysis examined the following performance measures:

- Population coverage by commercial service airports: 45-minute drive time
- Population coverage by all airports: 30-minute drive time
- Population coverage by all airports: 45-minute drive time for commercial service airports and/or 30-minute drive time for general aviation airports
- Population coverage by airports with 6,000 foot or longer runways: 30-minute drive time
- Population coverage by airports with 5,500 foot or longer runways: 30-minute drive time
- Population coverage by airports with 5,000 foot or longer runways: 30-minute drive time
- Population coverage by airports with 4,000 foot or longer runways: 30-minute drive time
- Population coverage by airports providing based flight training: 30-minute drive time
- Population coverage by airports that can serve business aircraft: 30-minute drive time
- Population coverage by airports with based air ambulance operators: 30-minute drive time
- Population coverage by airports that can serve air ambulance aircraft: 30-minute drive time
- Population coverage by airports expected to serve urban air mobility operations

Each coverage map displays the underlying population density of Virginia. **Figure 6-6** is a map showing the 2021 population densities found in Virginia. Also depicted are the system airports and major highways and interstates.

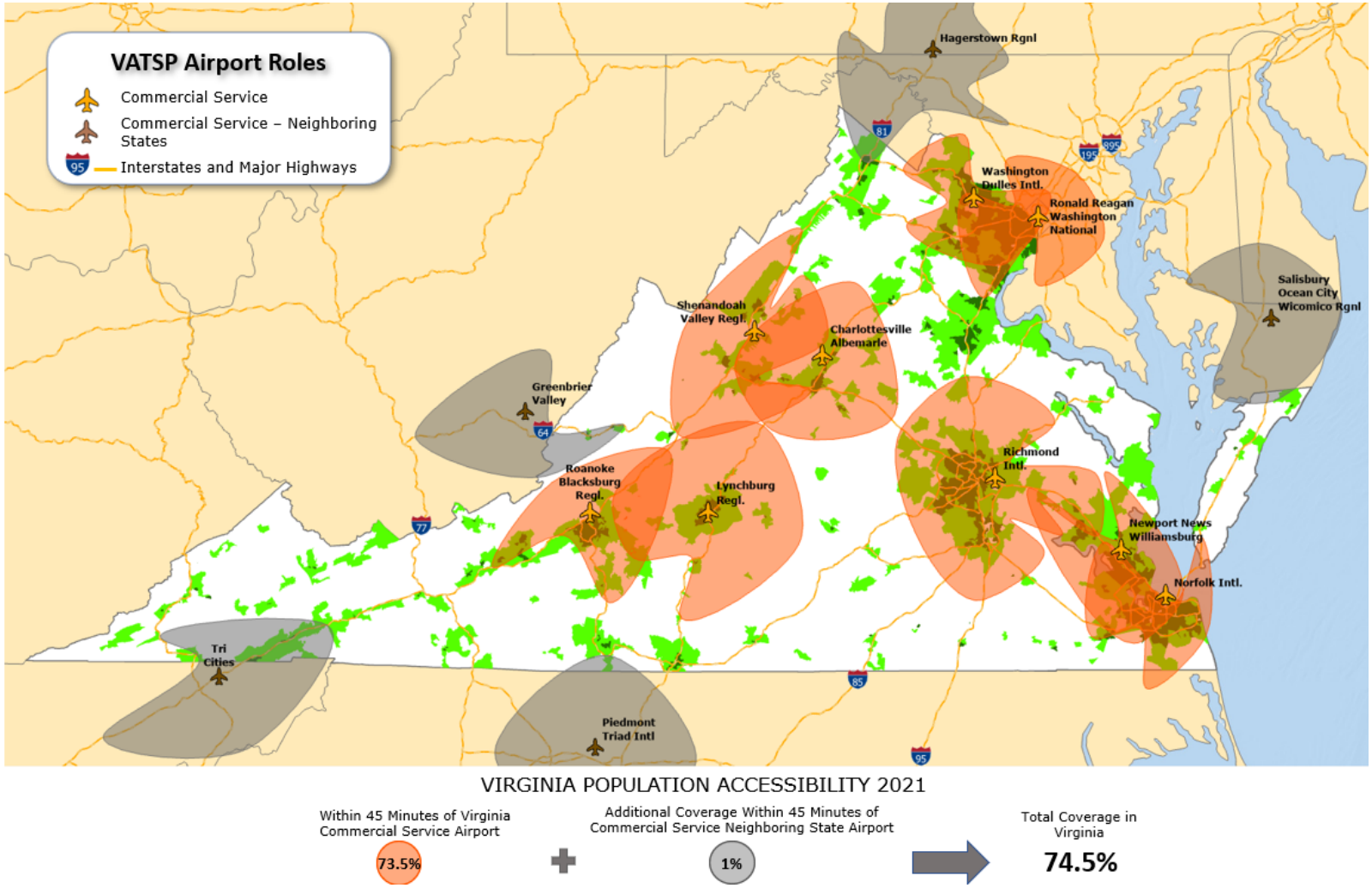
[10] The average one-way commute in the U.S. was approximately 28 minutes in 2019, as reported by the U.S. Census (https://www.census.gov/ newsroom/press-releases/2021/one-way-travel-time-to-work-rises.html).



Source: Cignus, LLC.

Figure 6-6: Population Density Throughout Virginia in 2021

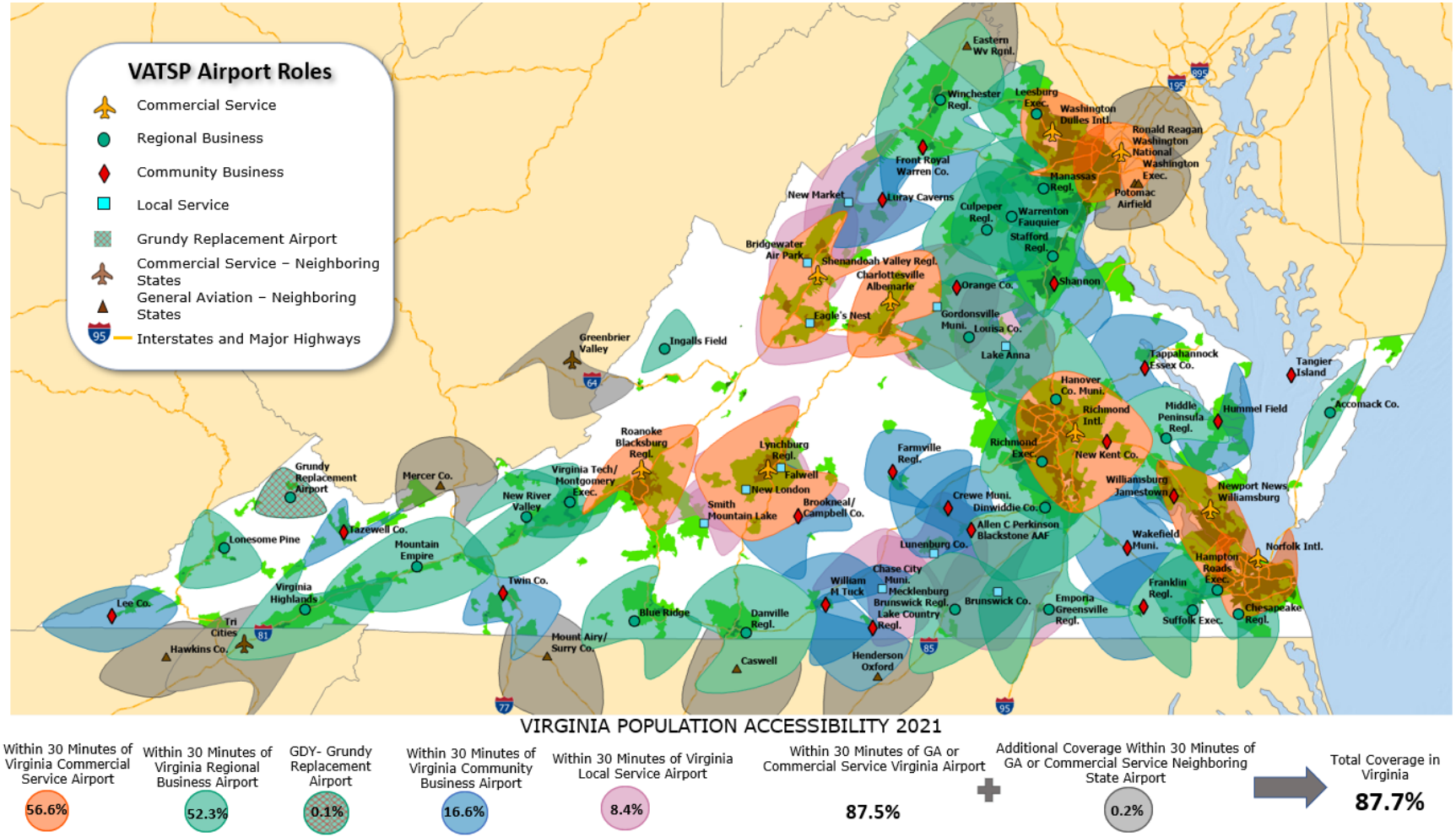
Figure 6-7 shows population coverage provided by Virginia's commercial service airports, along with commercial service airports in neighboring states that fall within a 45-minute drive of Virginia's inhabitants. The commercial service airports provide coverage to nearly 75 percent of Virginia's population



Source: Cignus, LLC.

Figure 6-7: Population Coverage by Commercial Service Airports in 2021 (45 minutes)

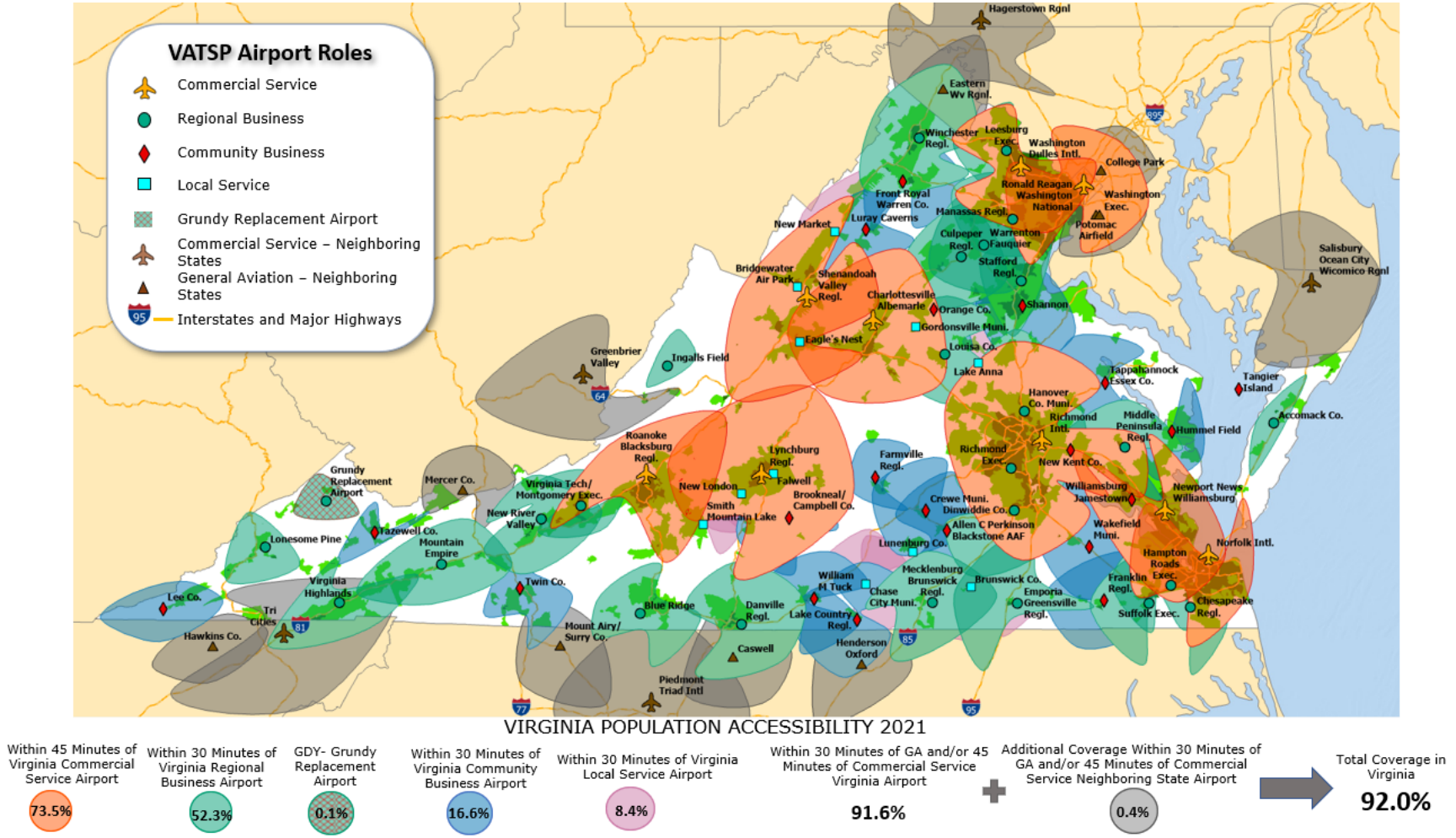
Figure 6-8 illustrates access that GA users have to system airports and airports in neighboring states using a 30-minute drive time standard. It shows that nearly 88 percent of Virginia's 2021 population live within 30 minutes of airports with GA services. This includes the GA services provided by commercial service airports, as well as the planned Grundy Replacement Airport, which will provide aviation access to those in western Virginia.



Source: Cignus, LLC.

Figure 6-8: Population Coverage by All System Airports in 2021 (30 minutes)

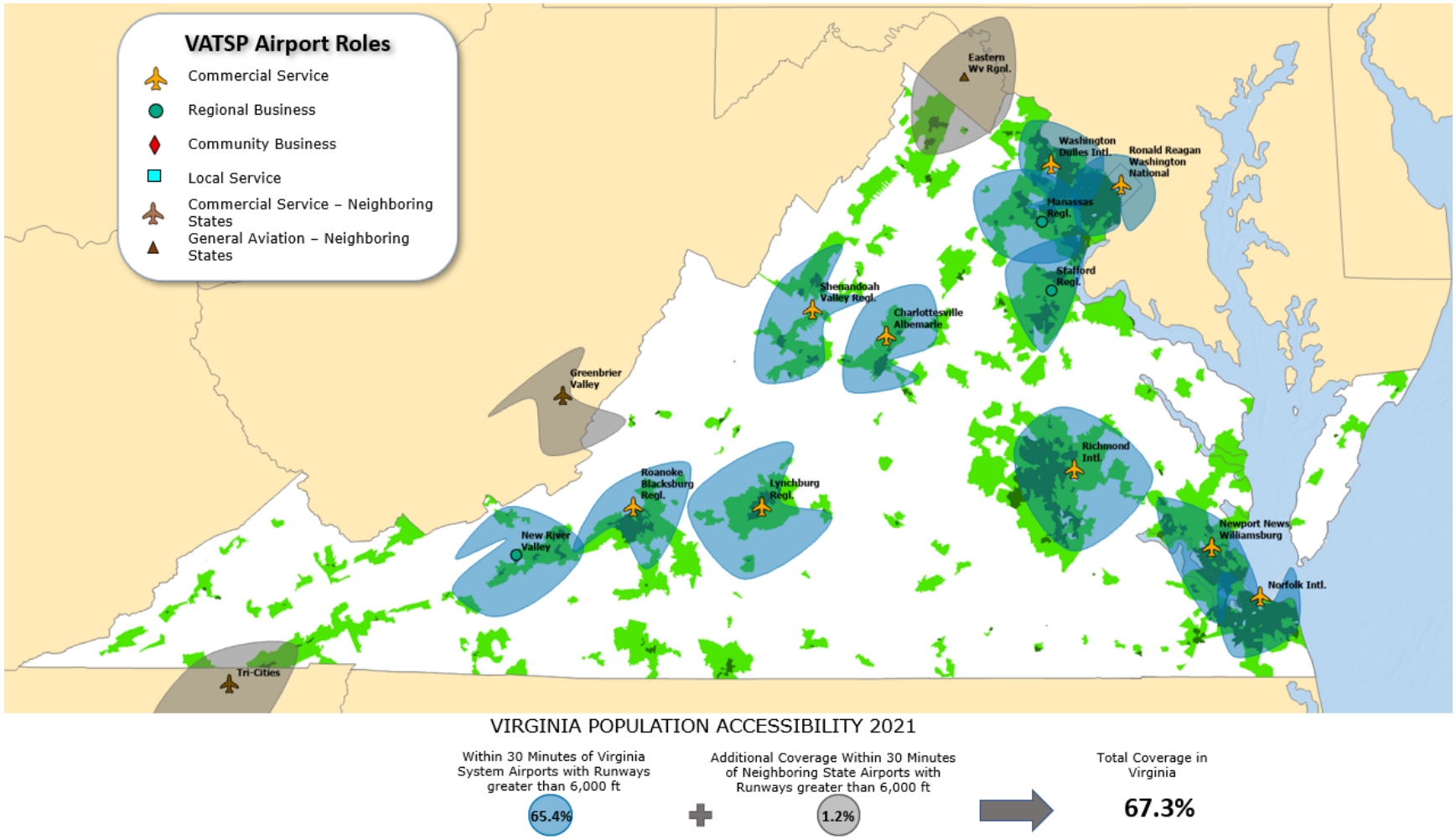
The combined coverage of both GA and commercial airline users resulted in 92 percent of Virginia's residents living within airport coverage areas. **Figure 6-9** demonstrates this coverage, which includes airports in neighboring states and the Grundy Replacement Airport.



Source: Cignus, LLC.

Figure 6-9: Population Coverage by All System Airports in 2021
(45 minutes for commercial service airports and/or 30 minutes for GA airports)

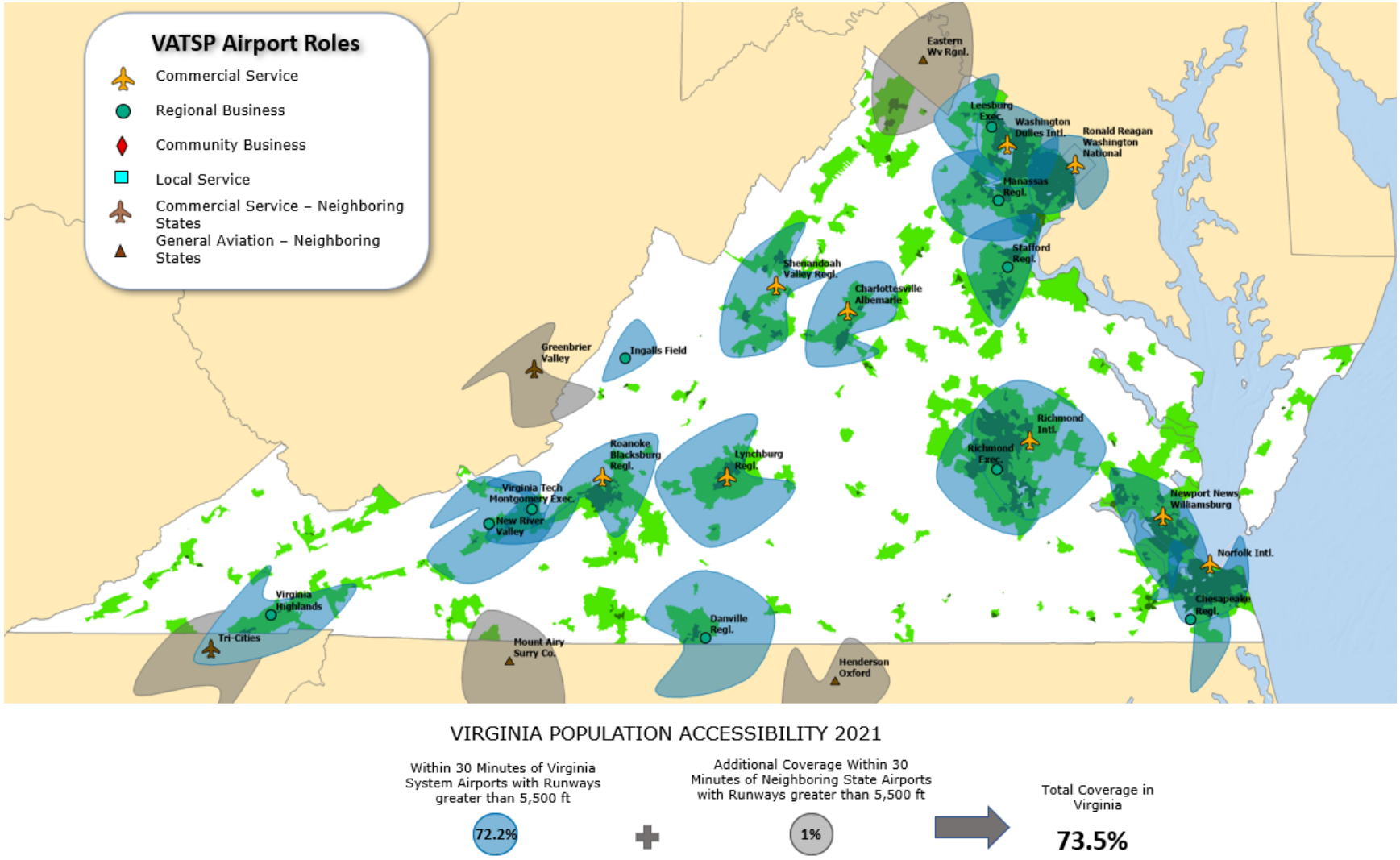
In addition to the overall population coverage provided by the aviation system, an analysis of subparts of the system was undertaken. The next set of population coverage maps analyzes the system coverage based on runway length at the system airports. The analysis starts by looking at the population coverage provided by the group of airports with 6,000-foot runways or longer, as shown in **Figure 6-10**. Population coverage by these airports was estimated at approximately 67 percent. This subset of the aviation system is predominately commercial service airports, but it also includes Stafford Regional Airport (RMN), which was in the process of extending its 5,000-foot runway to 6,000 feet.



Source: Cignus, LLC.

Figure 6-10: Population Coverage by Airports with 6,000-Foot or Longer Runways in 2021 (30 minutes)

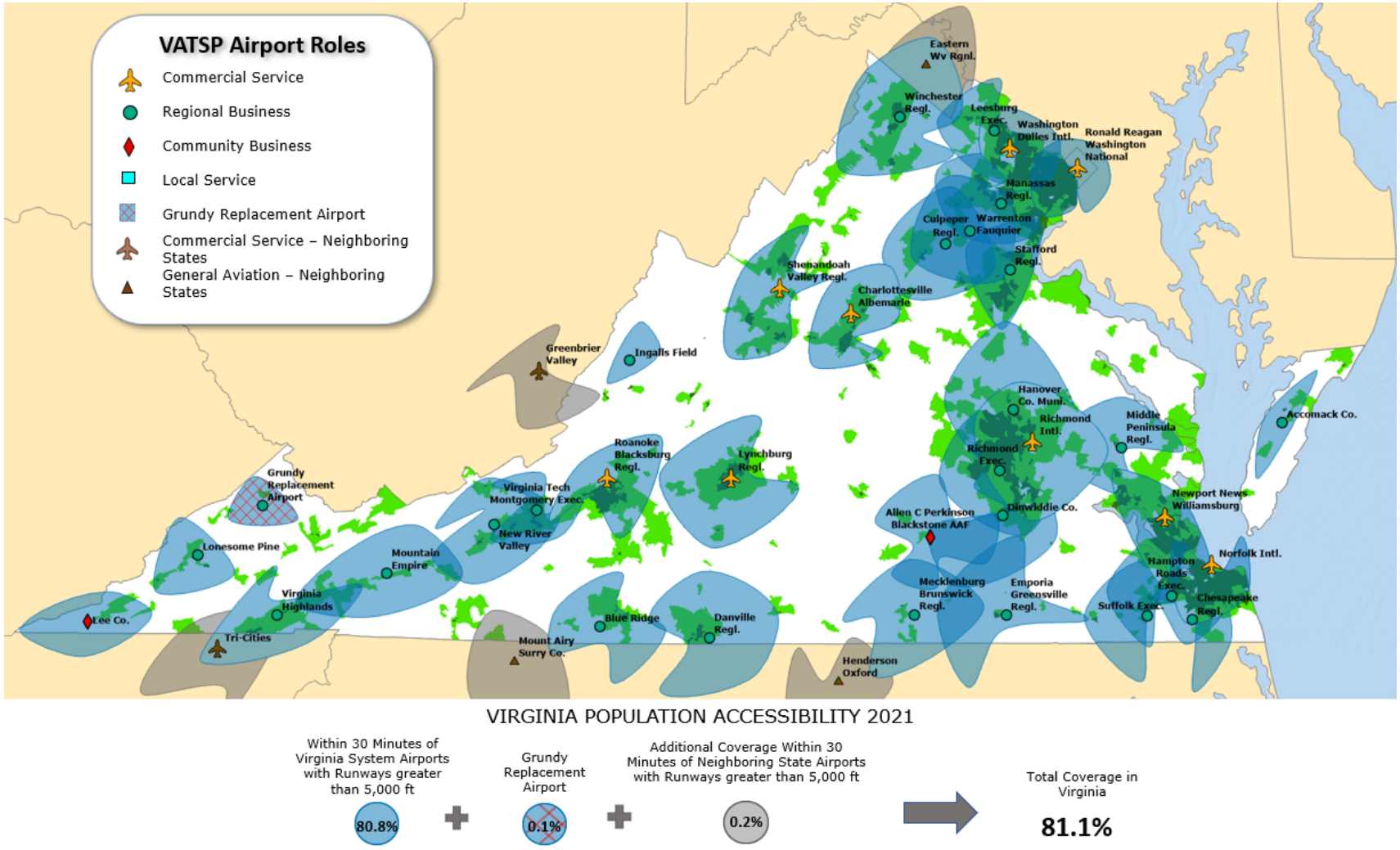
When the runway length criteria is lowered to a minimum runway length of 5,500 feet, population coverage increases to approximately 73 percent, as depicted in **Figure 6-11**.



Source: Cignus, LLC.

Figure 6-11: Population Coverage by Airports with 5,500-Foot or Longer Runways in 2021 (30 minutes)

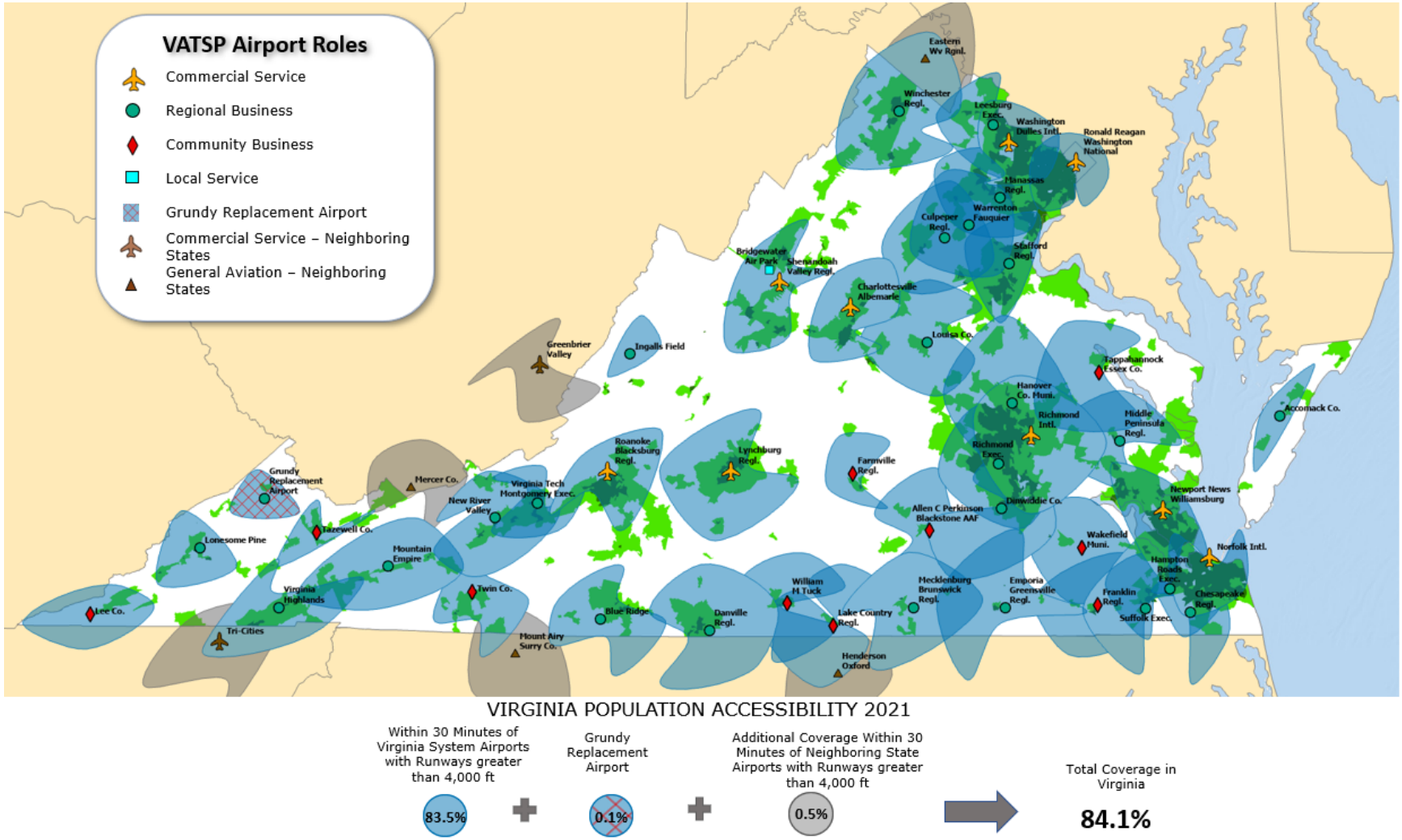
Adjusting the criteria to airports with a 5,000-foot runway or longer revealed that the population coverage climbed to 81 percent, as shown in **Figure 6-12**. This analysis includes Virginia Highlands (VJI), Farmville Regional (FVX), and Tappahannock-Essex County (XSA), all of which were assumed to extend their runways to at least 5,000 feet. It also includes Grundy Replacement Airport, which is assumed to have a 5,000-foot runway when completed.



Source: Cignus, LLC.

Figure 6-12: Population Coverage by Airports with 5,000-Foot or Longer Runways in 2021 (30 minutes)

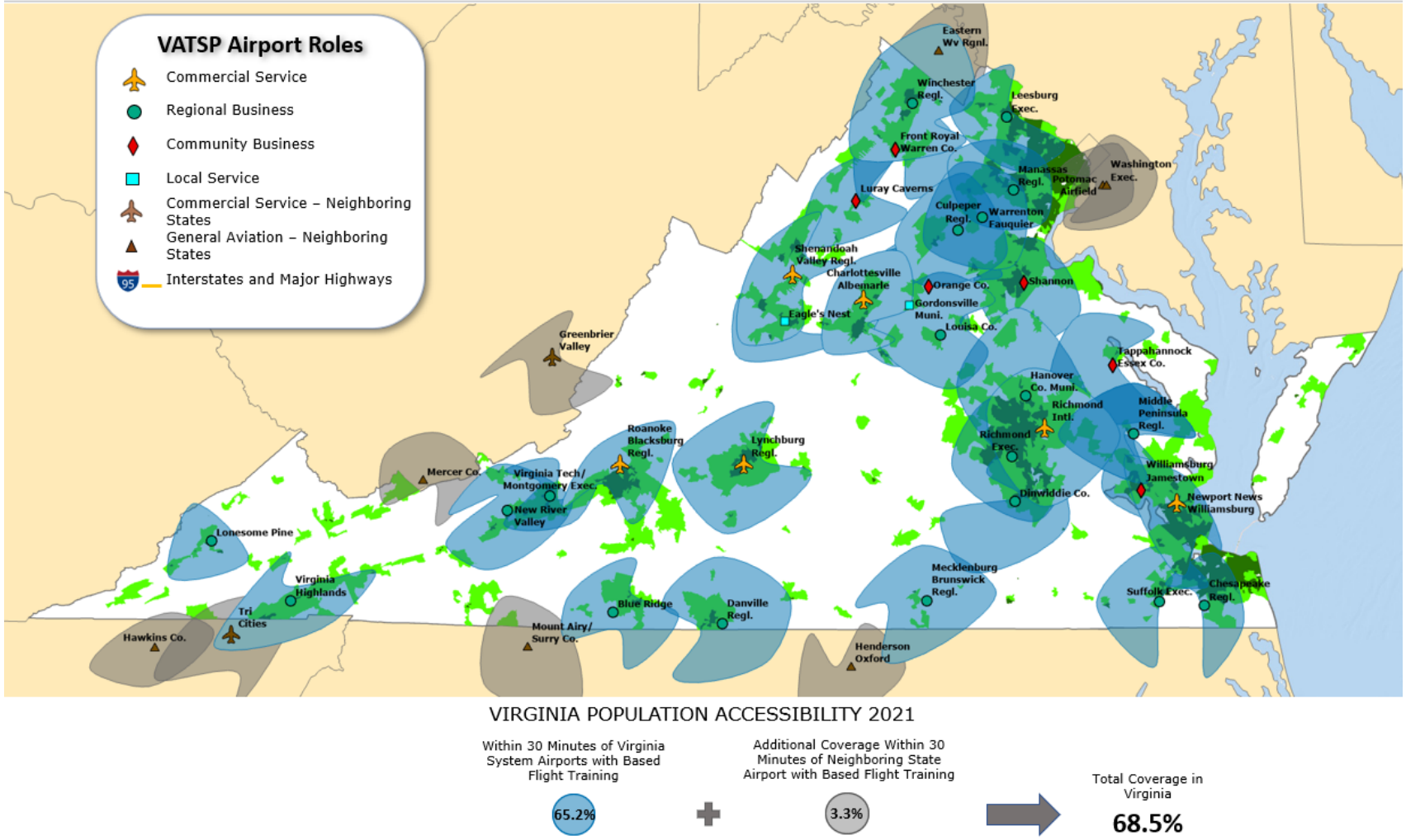
Finally, **Figure 6-13** shows the extensive coverage provided by airports with runways of 4,000 feet or longer. More than 84 percent of Virginia's population is within 30 minutes of an airport with a runway of at least 4,000 feet long. Additionally, Bridgewater Air Park (VBW) was assumed to extend its 2,745-foot runway out to 4,034 feet.



Source: Cignus, LLC.

Figure 6-13: Population Coverage by Airports with 4,000-Foot or Longer Runways in 2021 (30 minutes)

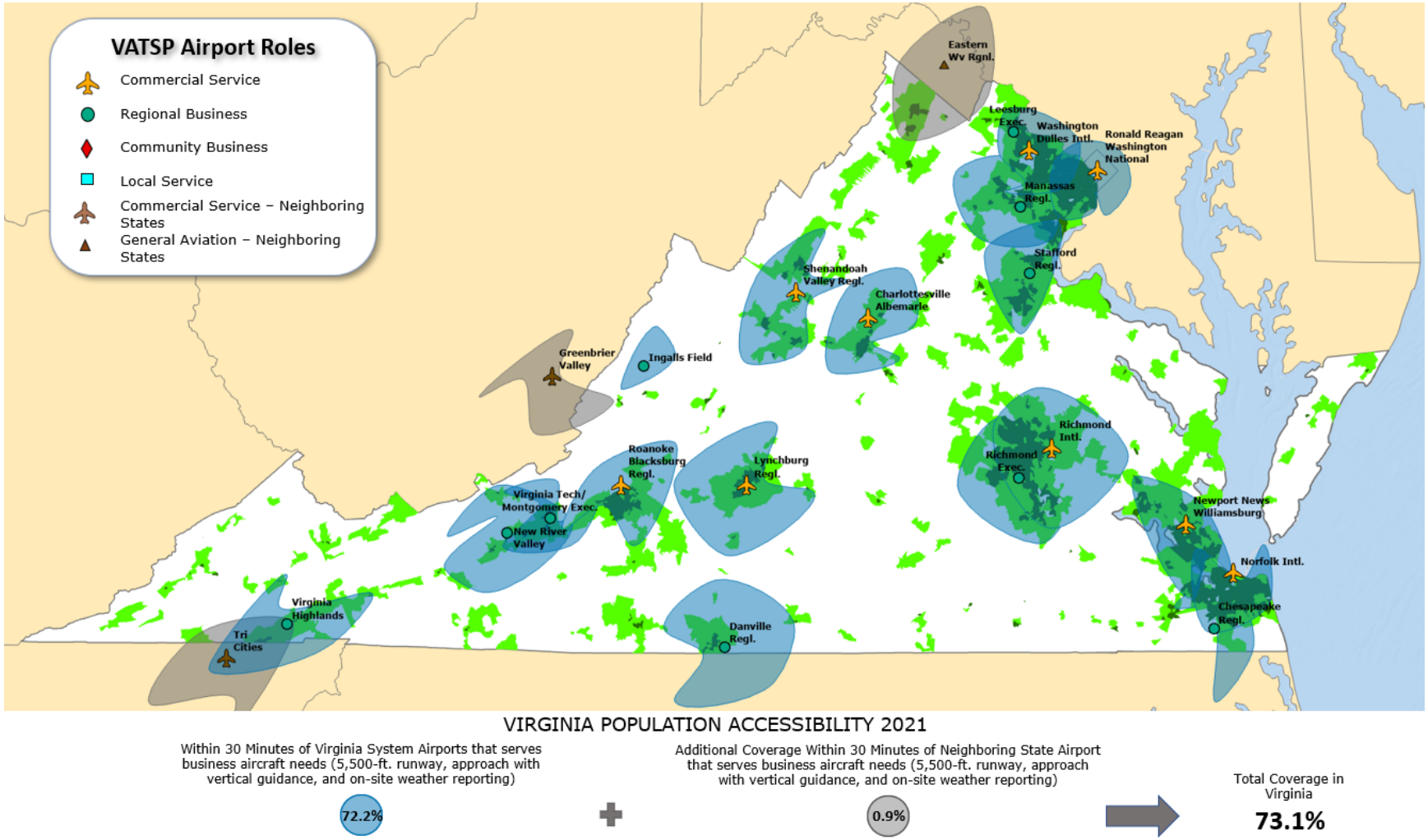
Figure 6-14 highlights the coverage provided by system airports that feature a flight training operation based at the airport. With the shortage of commercial pilots expected to get worse, the convenient availability of flight training to Virginia's population is important in helping Virginia maintain its economic edge in aviation. More than 68 percent of Virginia's population is within 30 minutes of an airport that offers flight training.



Source: Cignus, LLC.

Figure 6-14: Population Coverage by Airports Providing Based Flight Training in 2021 (30 minutes)

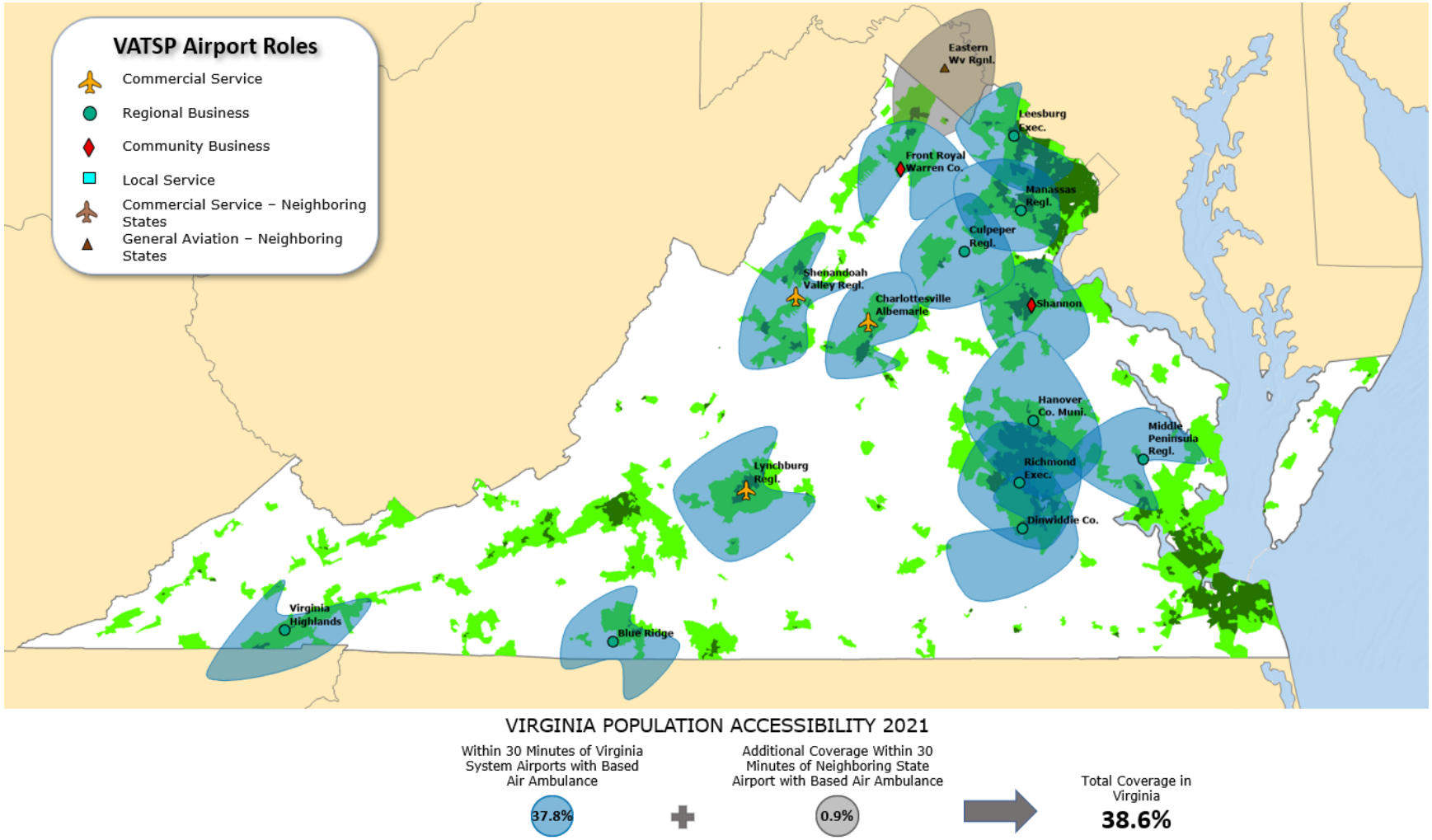
Business aviation is a key component of economic development and the ability to support business aircraft is critical to an efficient aviation system. Airports that can serve business aircraft were defined as those with at least a 5,500-foot runway, an approach with vertical guidance, and automated weather reporting. The airports that meet those criteria and their associated 30-minute drive times are shown in **Figure 6-15**. These airports provide 73 percent of Virginia's population with access to business capable facilities.



Source: Cignus, LLC.

Figure 6-15: Population Coverage by Airports that can Serve Business Aircraft in 2021 (30 minutes)

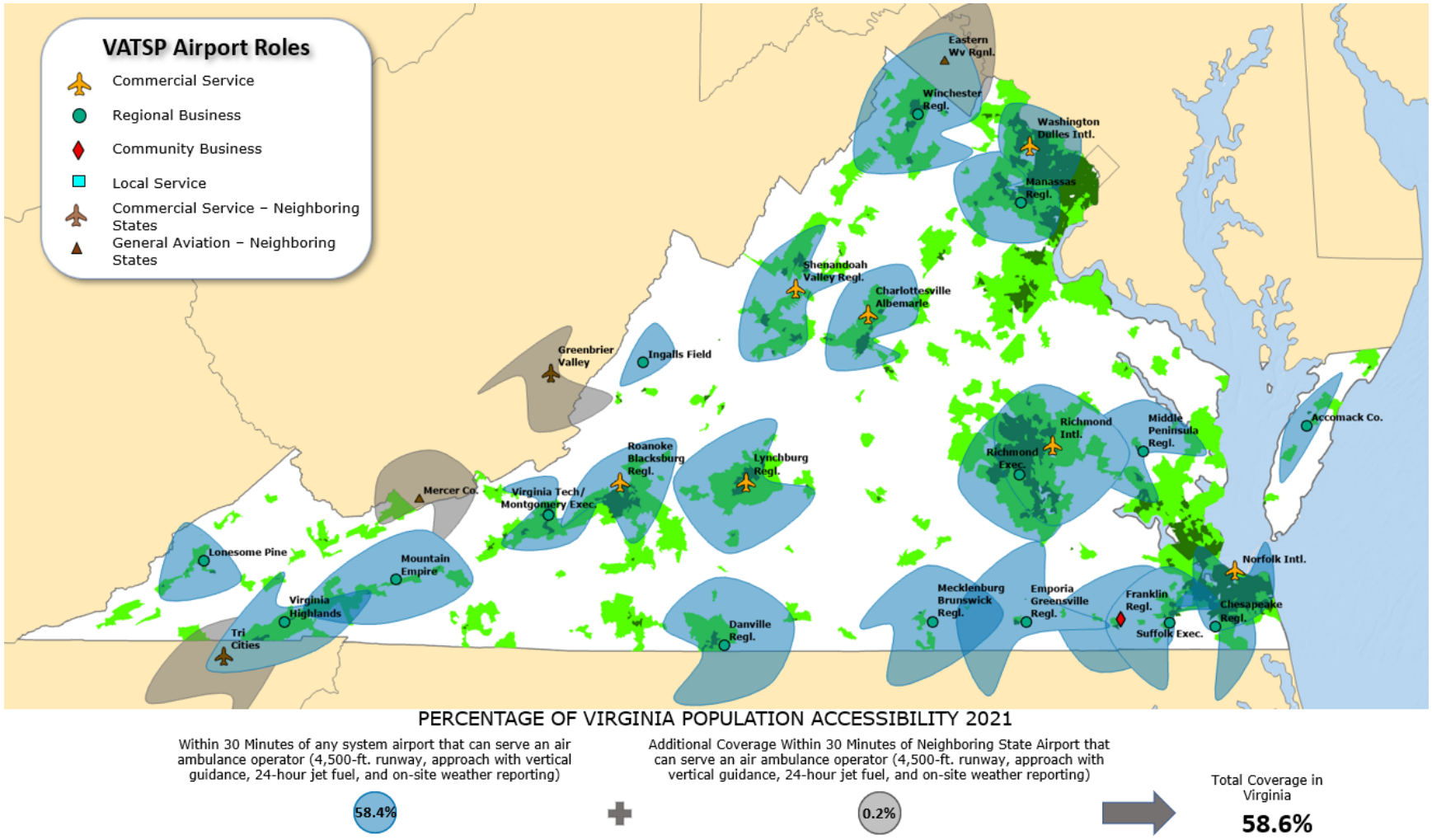
The Virginia aviation system also supports the healthcare industry through movement of various medical assets, such as patient transport operations. **Figure 6-16** shows those system airports that have based air ambulance operators and their respective 30-minute drive times. Those airports provide air ambulance access to approximately 38 percent of Virginia's population.



Source: Cignus, LLC.

Figure 6-16: Population Coverage by Airports with Based Air Ambulance Operators in 2021 (30 minutes)

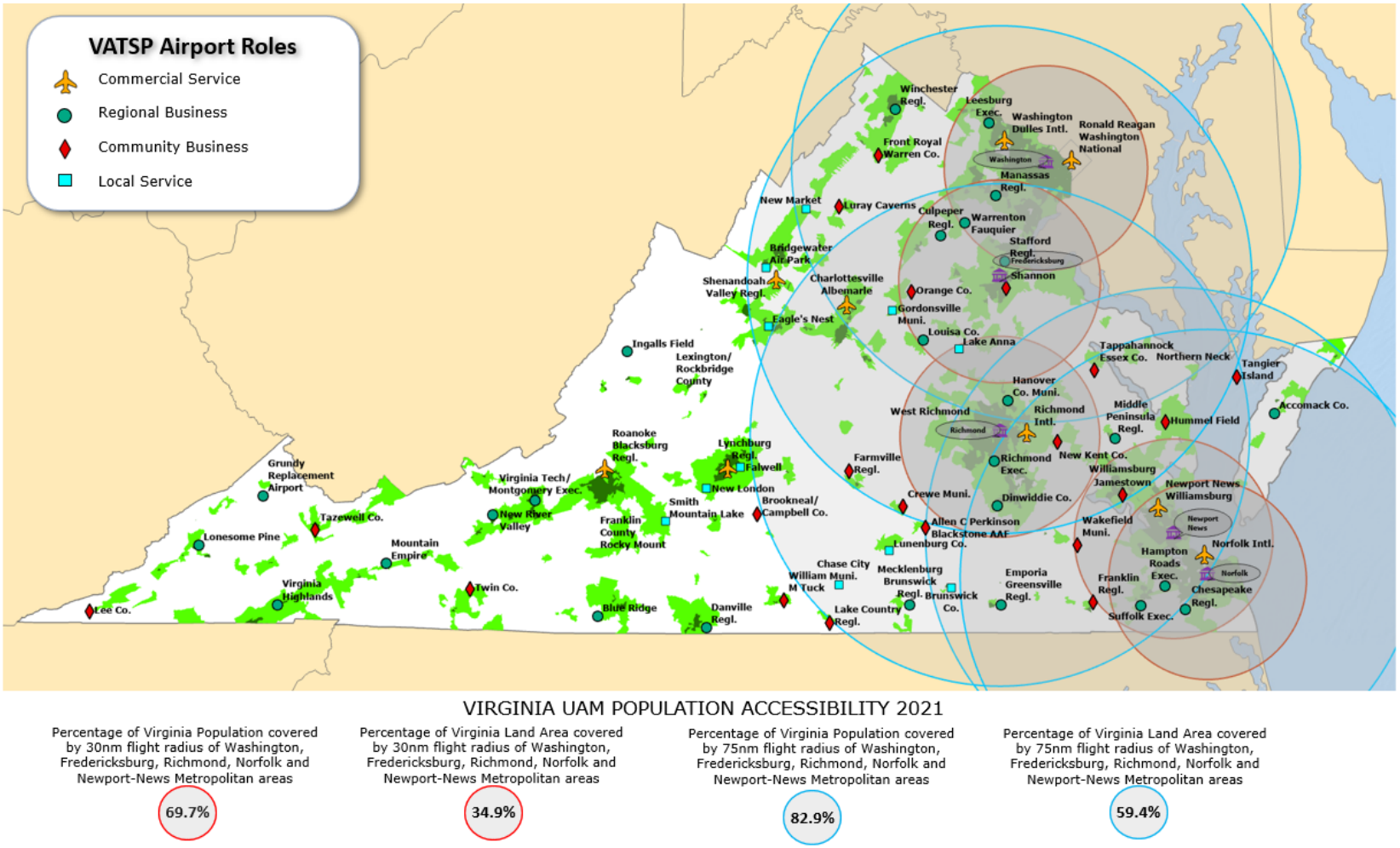
Even airports without based air ambulance service may support those operations. **Figure 6-17** examines the population coverage provided by airports capable of serving fixed-wing air ambulance aircraft. Based on typical air ambulance aircraft in use, these airports were defined as those with a runway of at least 4,500 feet, an approach with vertical guidance, jet fuel available 24 hours per day, and automated weather reporting. **Figure 6-17** shows that these airports can provide air ambulance services to nearly 59 percent of people in Virginia.



Source: Cignus, LLC.

Figure 6-17: Population Coverage by Airports that can Serve Air Ambulance Aircraft in 2021 (30 minutes)

The development of UAM technologies is expected to first see implementation in built up metropolitan areas, such as Washington, Fredericksburg, Richmond, Newport News, and Norfolk. **Figure 6-18** shows both the population and land coverage resulting from UAM flight operations. Projected performance parameters for UAM aircraft indicate that coverage within 30 nautical mile (nm) and 75nm rings from each urban center will be typical. With the limited 30nm ring, population coverage is nearly 70 percent and land coverage is 35 percent. The larger 75nm ring expands population coverage to nearly 83 percent and land coverage to 59 percent.



Source: Cignus, LLC.

Figure 6-18: Population Coverage by Airports Expected to Serve Urban Air Mobility Operations

Navigational Aids

The NAVAIDS were inventoried based on data included in previous DOAV studies, publicly available FAA data sources, and on input provided by airport sponsors from an inventory web survey. NAVAIDs in Virginia are owned by either the Commonwealth, the FAA, or by individual airports. Key to this review is the assessment of maintenance and calibration costs.

The following NAVAIDs were included in the analysis:

- Approach Lighting
  - High Intensity Approach Lighting System with Sequenced Flashing Lights (ALSF-2)
  - Medium Intensity ALS with Runway Alignment (MALSR)
  - Medium Intensity ALS with Sequenced Flashing Lights (MALSF)
  - Medium Intensity Approach Lighting System (MALS)
  - ODALS
- Distance Measuring Equipment (DME)
- Glideslope Antenna
- Localizer Antenna
- Localizer Type Directional Aid
- Marker Beacons
- Nondirectional Beacon (NDB)
- Remote Transmitter and Receiving Site (RTR) / Remote Communication Outlet (RCO)
- Runway Edge Lighting
  - HIRL
  - MIRL
  - LIRL
  - Nonstandard
- Runway End Identifier Lights (REIL)
- Runway Visual Range (RVR)
- Touchdown Zone Lights (TDZ)
- Visual Approach Indicator
  - Approach Path Alignment Panels (APAP)
  - PAPI
  - Visual Approach Slope Indicator (VASI)
- Very-High Frequency Omni-Directional Range (VOR)
- Weather Reporting
  - Automated Surface Observing System (ASOS)
  - AWOS
- Wind Indicator (i.e., wind tetrahedron, windcone)

Much of this analysis resulted in airport-specific tables that can be used by individual airports to assist in the preparation of their development plans for the planning period. The development plans were prepared by reviewing the identified recommended NAVAID improvement plans previously identified in VATSP studies. These previously identified improvement plans were compared to the existing NAVAIDs in place at each airport based on the inventory process for this VATSP update. Development plan items that were completed were removed from the list of improvement recommendations. Items that have not yet been completed were carried forward and described in the recommended development tables in the subsequent section.

Additionally, an analysis was conducted to review the condition and age of existing NAVAIDs at each airport to determine which NAVAID replacement projects should be added to each airport's recommended development plan. NAVAIDs that were identified as in "Poor" or "Inoperative" condition, based on the inventory process, were recommended for replacement. Additionally, NAVAIDs that did not have an associated condition metric but were more than 30 years old were identified for replacement. Where applicable, recommendations to replace NAVAID systems meeting the above-described criteria considered NAVAID systems that are defunct. For example, VASI systems identified for replacement would be replaced by PAPI systems since the FAA no longer supports VASI systems. Similarly, NDB systems are slowly being retired by the FAA as their technology is aging and their capability is being replaced by more accurate and advanced NAVAID systems. Therefore, NDB systems meeting the replacement criteria described above were not included in the recommended improvement lists.

Summary

This chapter provided an overview of the information collected during the inventory process. In addition to facility information gathered on each system airport, additional information was obtained on topics ranging from local community outreach to anticipated activity from eVTOL aircraft. Additionally, each airport was assessed for its population coverage to evaluate the access that the aviation system provides Virginia's population and businesses.

This information will be used in subsequent chapters to analyze demand for future aviation services and needed improvements throughout the system that will help the system operate more efficiently and safely. Detailed information from the inventory effort is found in **Appendix B**, and the NAVAID tables are located in **Appendix C.**

Source: Nancy Lewis.

Chapter 7: Alternatives Analysis

The alternatives analysis is broken down into two main components. The first is an analysis of the geographic coverage provided by the Virginia aviation system. This analysis looks at the overall system, as well as subparts of the system in terms of coverage provided by specific facilities or services that airports provide users. The second part evaluates the facilities, equipment, and services (FE&S) at each system airport against recommended targets that are based on the airport's assigned role. Any FE&S falling short of its target is documented. More specifically, these two components looked at the following aspects of the aviation system:

Geographic Coverage Analysis:

- Population Coverage
- Flight Support Coverage
- Other Coverage

Facility, Equipment, and Service Analysis by Airport:

- Primary Runway Length, Width, and Strength
- Primary Runway Instrumentation
- Taxiway System
- Automated Weather Reporting
- Visual Guidance
- Instrument Approach Minimums on Primary Runway
- Remote Towers
- Terminal Facilities
- Hangar Space
- Maintenance Equipment
- Airport Parking (non-revenue)
- Airport Parking (revenue)
- Pavement Condition
- Utilities
- Other Performance Measures

Geographic Coverage Analysis

The geographic coverage analysis is broken into three sections based on the assessment of different types of coverage. The first section takes a forward look at how the aviation system is expected to serve the future population of Virginia. Population projections for 2030 were used in the population density depicted on the maps. The expected changes in population did not alter the population density from 2021 to 2030 at the scale depicted on the maps, but it did change the percentage of population covered in many cases.

As was explained in the inventory chapter, drive time analysis was used to estimate the population coverage, accounting for the road network around each airport and typical driving speeds. The same standards of a 30-minute drive time for general aviation (GA) users and a 45-minute drive time for commercial service airports were used for this analysis. Several performance measures were evaluated, such as the population coverage of the entire aviation system, as well as subsets of the aviation system, based on various facility parameters at the system airports.

The second section provides an analysis of the geographic coverage provided to support flight operations, such as fuel availability. It showed the extent of coverage using 30nm ranges from each applicable airport.

The final section consists of geographic analysis of several aspects of the aviation system that provided other pertinent measures of interest.

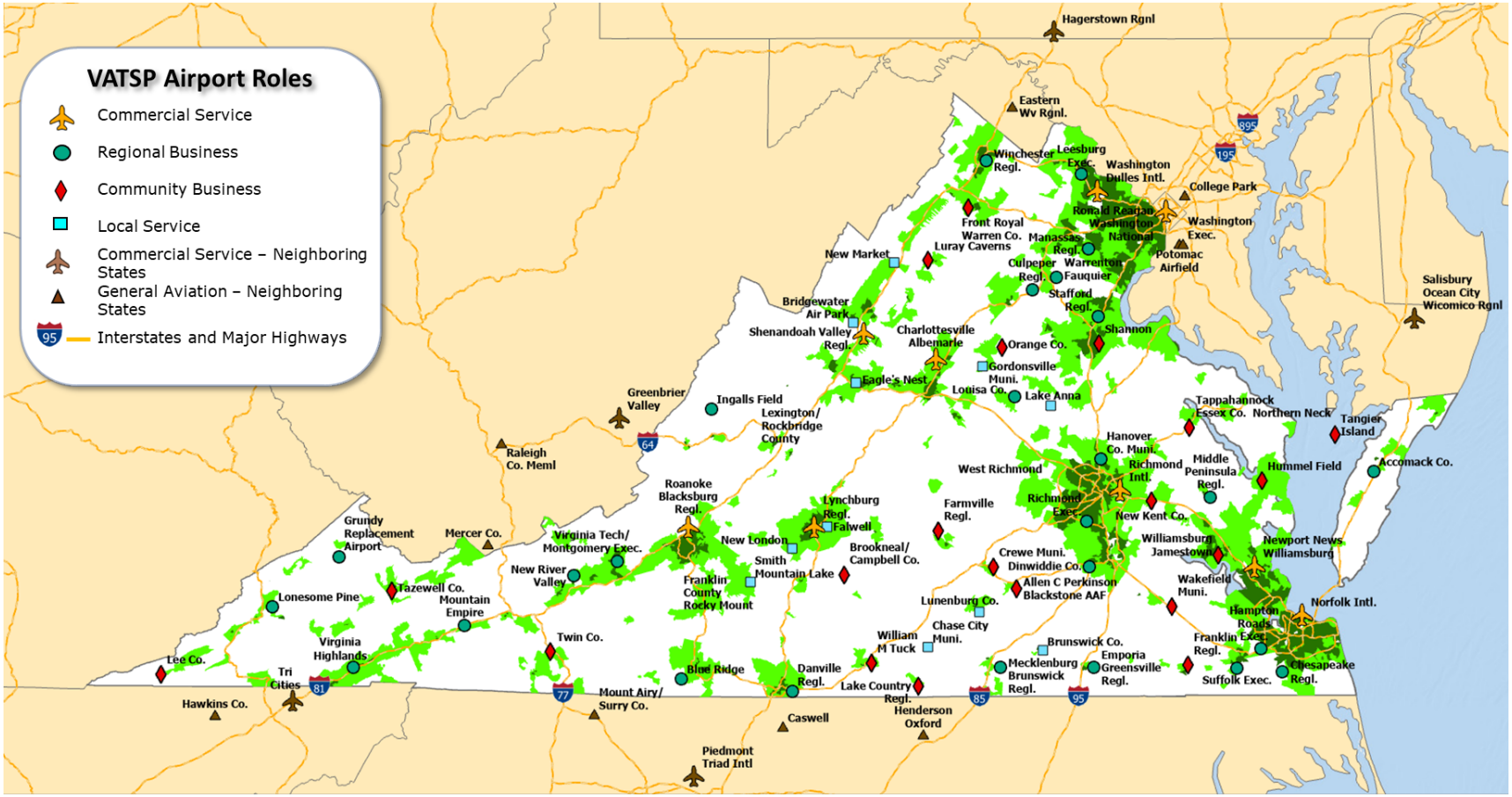
Population Coverage

The population coverage section starts with a map showing the projected density of Virginia's population in 2030 throughout the state in **Figure 7-1**. The analysis examined the following performance measures using Virginia's population projected to 2030:

- Population coverage by commercial service airports: 45-minute drive time
- Population coverage by all airports: 30-minute drive time
- Population coverage by all airports: 45-minute drive time for commercial service airports and/or 30-minute drive time for GA airports
- Population coverage by airports with 4,000-foot or longer runways: 30-minute drive time
- Population coverage by airports with 5,000-foot or longer runways: 30-minute drive time
- Population coverage by airports with 5,500-foot or longer runways: 30-minute drive time
- Population coverage by airports with 6,000-foot or longer runways: 30-minute drive time
- Population coverage by airports providing based flight training: 30-minute drive time
- Population coverage by airports that can serve business aircraft: 30-minute drive time
- Population coverage by airports with based air ambulance operators: 30-minute drive time
- Population coverage by airports that can serve air ambulance aircraft: 30-minute drive time
- Population coverage by airports expected to serve urban air mobility operations

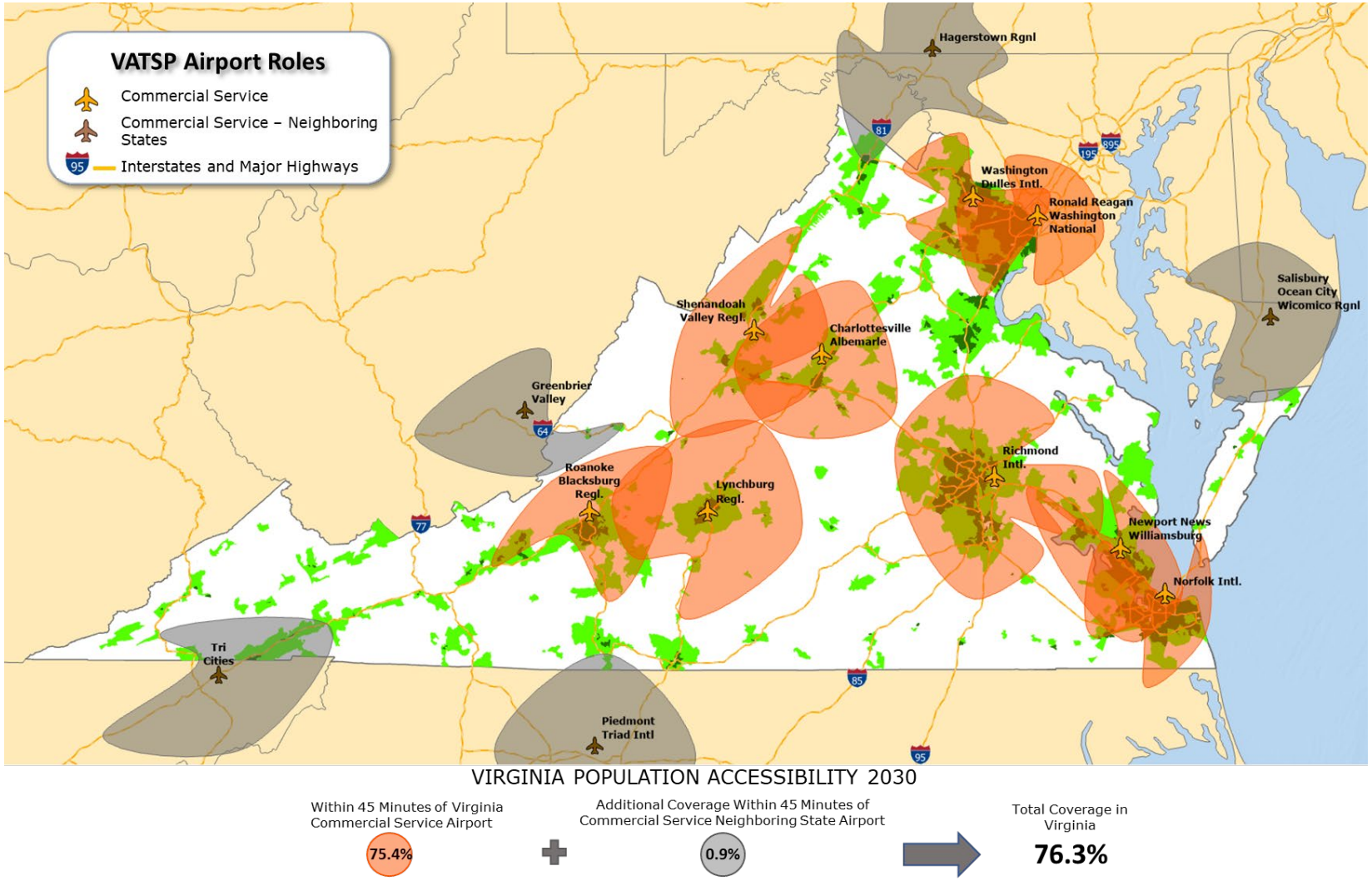
The overall system coverage evaluation started with the drive time coverage provided by the commercial service airports. **Figure 7-2** shows population coverage provided by Virginia's commercial service airports, along with commercial service airports in neighboring states that are within a 45-minute drive of Virginia's inhabitants. The commercial service airports provide coverage to more than 76 percent of Virginia's projected 2030 population.

Source: Richard Lewis.



Source: Cignus, LLC.

Figure 7-1: Population Density Throughout Virginia in 2030

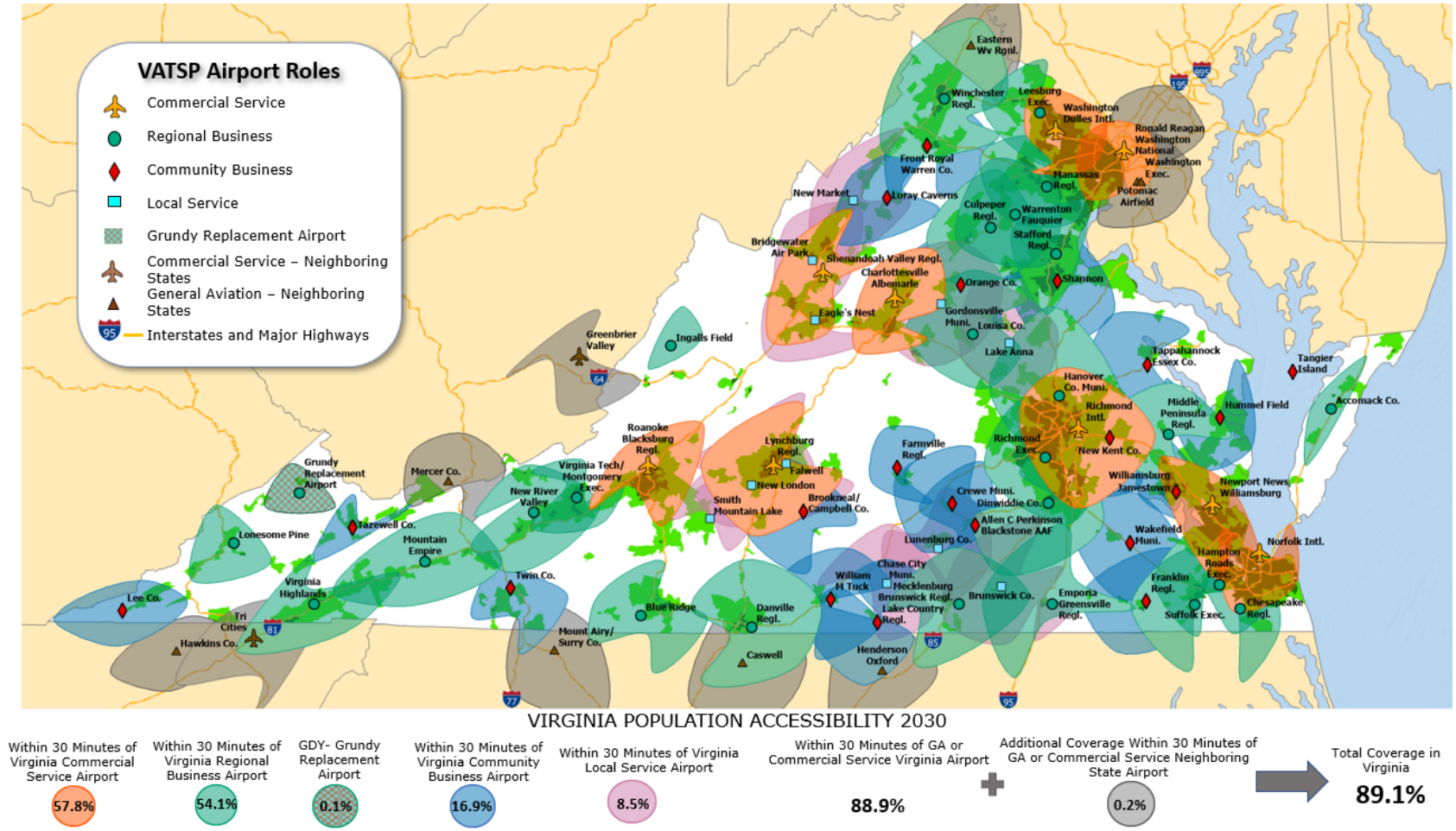


Source: Cignus, LLC.

Figure 7-2: Population Coverage by Commercial Service Airports in 2030 (45 minutes)

Figure 7-3 depicts the expected 2030 population coverage provided to GA users from system airports and airports in neighboring states using a 30-minute drive time standard. It shows that more than 89 percent of Virginia's population has 30-minute access to GA services. This includes the commercial service airports that also provide GA services. It also includes the planned Grundy Replacement Airport in western Virginia, although this airport is expected to provide coverage to only 0.1 percent of Virginia's population.

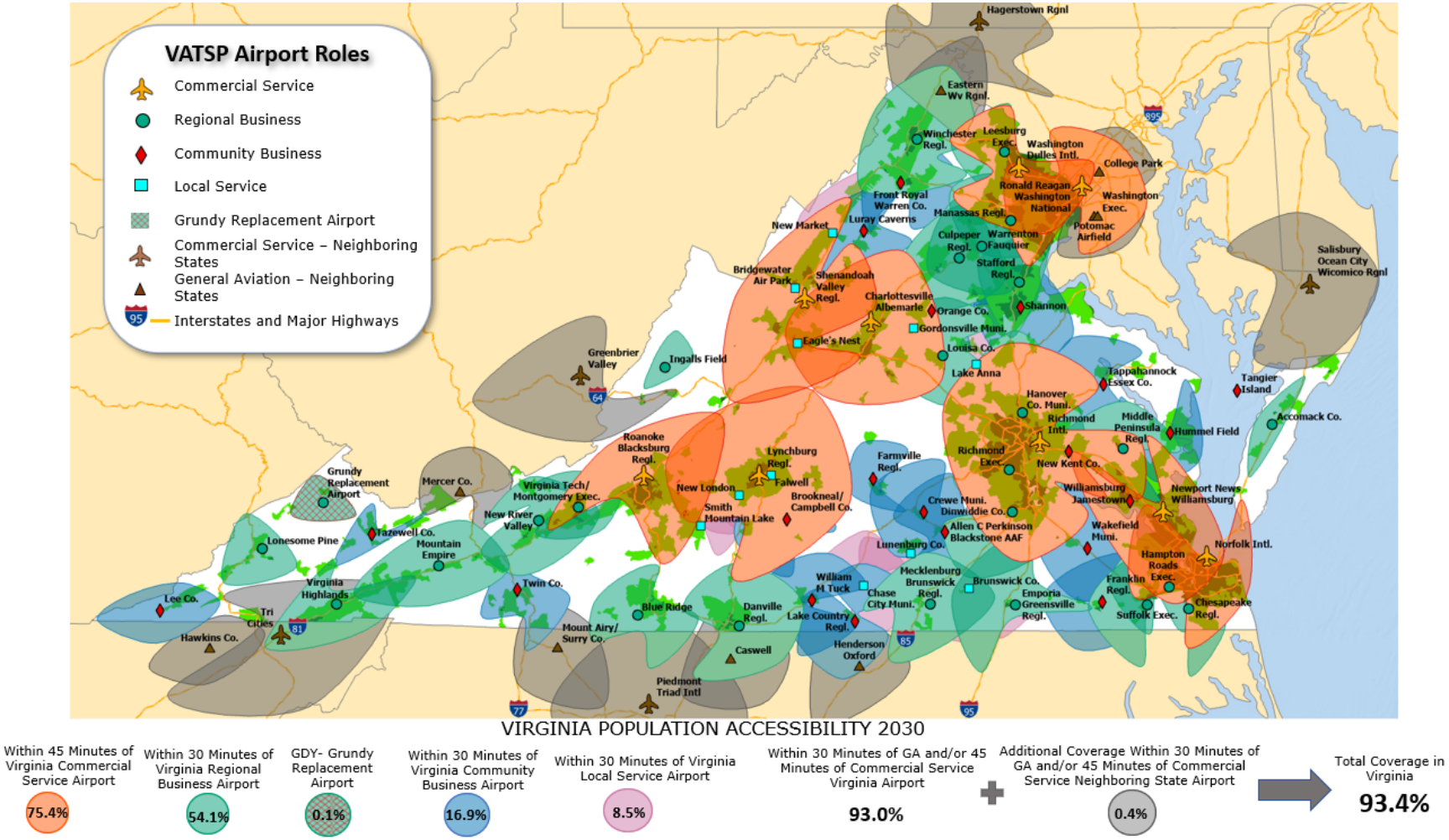
There are several areas with higher population density that fall outside the areas of airport coverage. The most notable are an area east of Tappahannock Essex County Airport (XSA), an area east of Shannon Airport (EZF), an area just west of Richmond, and an area south of Roanoke-Blacksburg Regional Airport (ROA). A large geographic area with some population is southeast of Ingalls Field and lacks airport service.



Source: Cignus, LLC.

Figure 7-3: Population Coverage by All System Airports in 2030 (30 minutes)

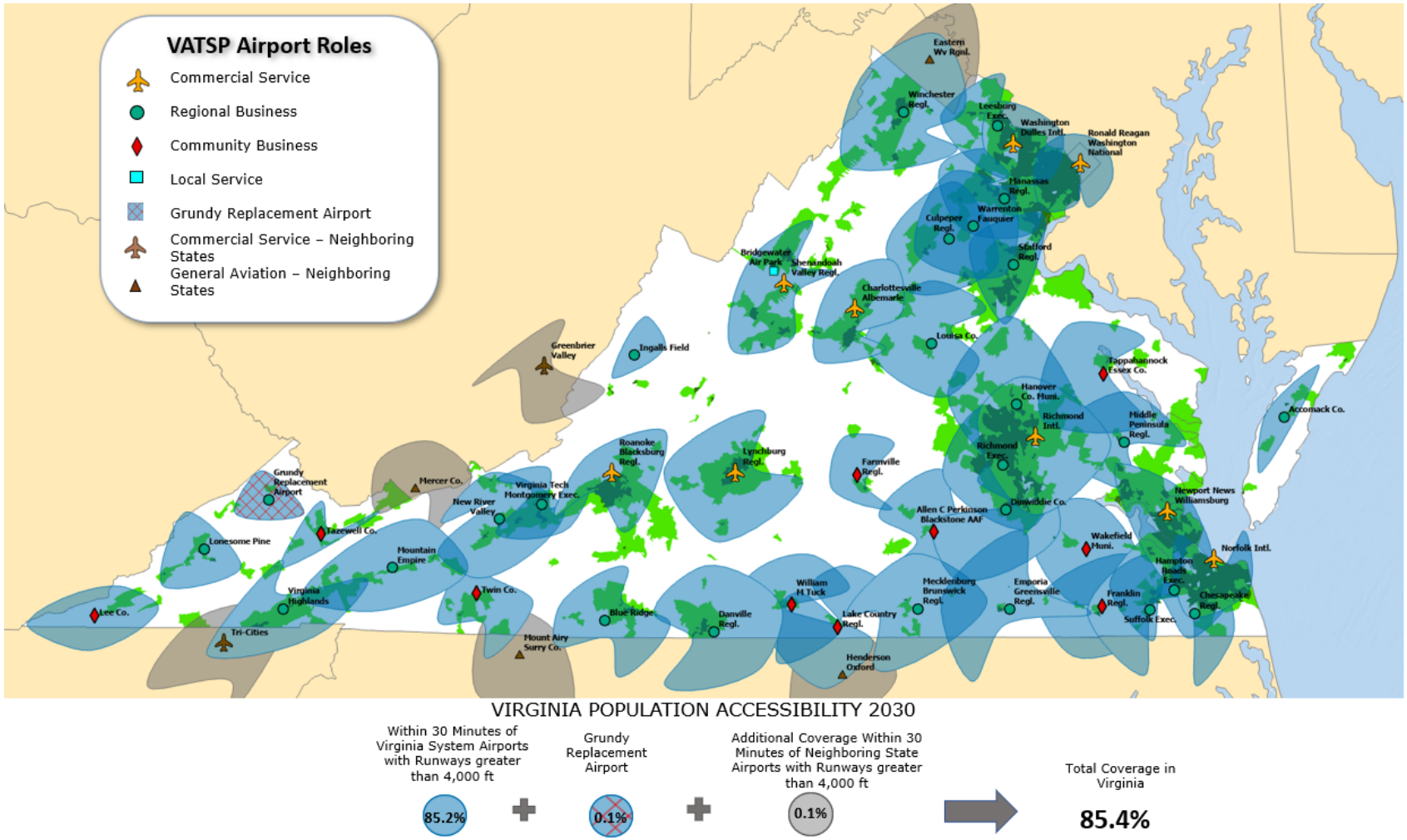
When the coverage for both GA and commercial airline users was combined, the percentage of Virginia's 2030 residents within airport coverage areas increased to more than 93 percent. This is shown in **Figure 7-4** and includes airports in neighboring states and the Grundy Replacement Airport.



Source: Cignus, LLC.

Figure 7-4: Population Coverage by All System Airports in 2030 (45 minutes for commercial service airports and 30 minutes for GA airports)

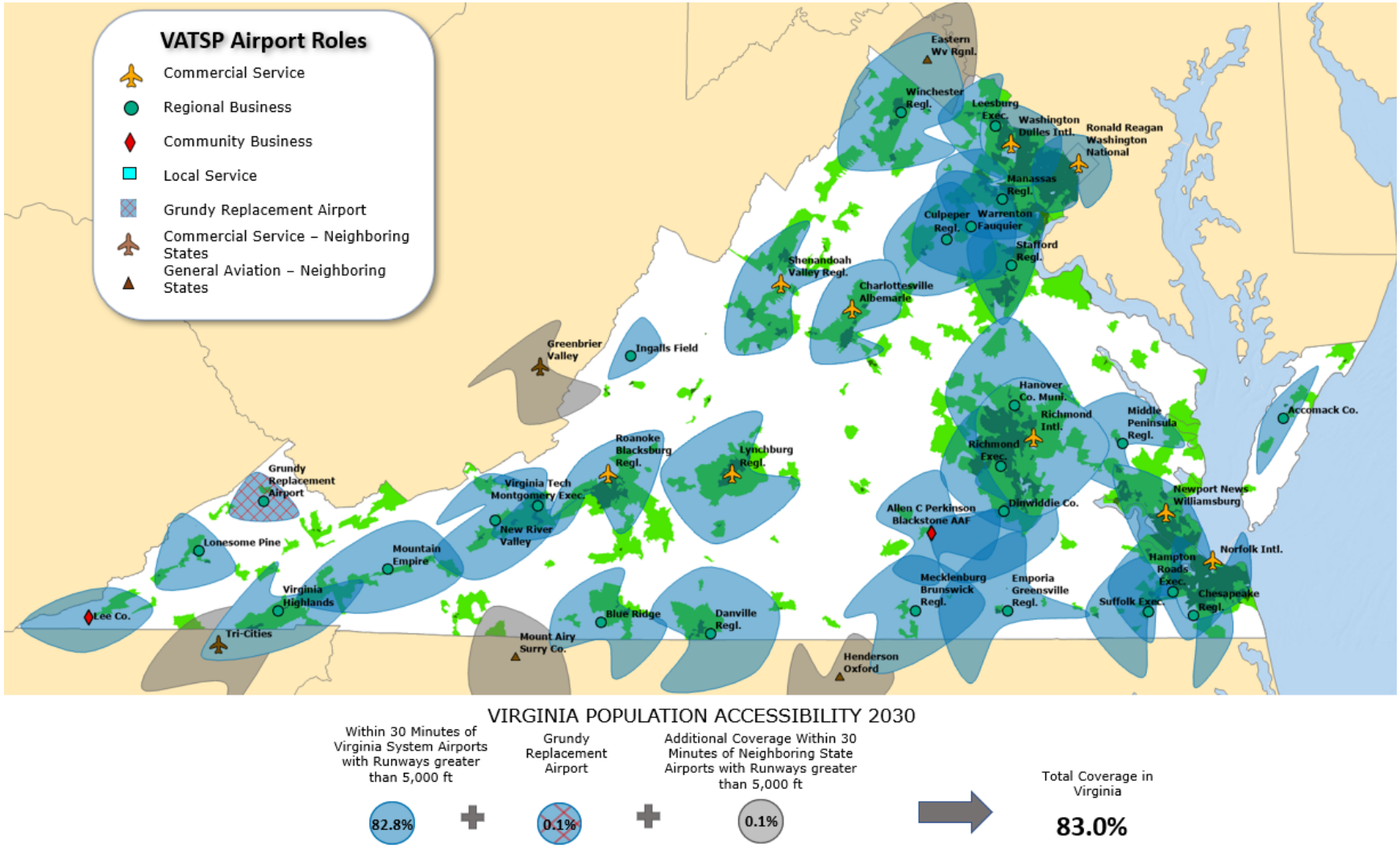
Next, system airports were grouped by runway length to show expected 2030 population coverage, starting with airports that had runways of 4,000 feet or longer. **Figure 7-5** shows the extensive coverage provided by this subset of the aviation system. More than 85 percent of Virginia's population is within 30 minutes of an airport with a runway of at least 4,000 feet in length. This analysis, and the next analysis, assumes that Grundy Replacement Airport has a 5,000-foot runway. Additionally, Bridgewater Air Park (VBW) was assumed to extend its 2,745-foot runway out to 4,034 feet.



Source: Cignus, LLC.

Figure 7-5: Population Coverage by Airports with 4,000-Foot or Longer Runways in 2030 (30 minutes)

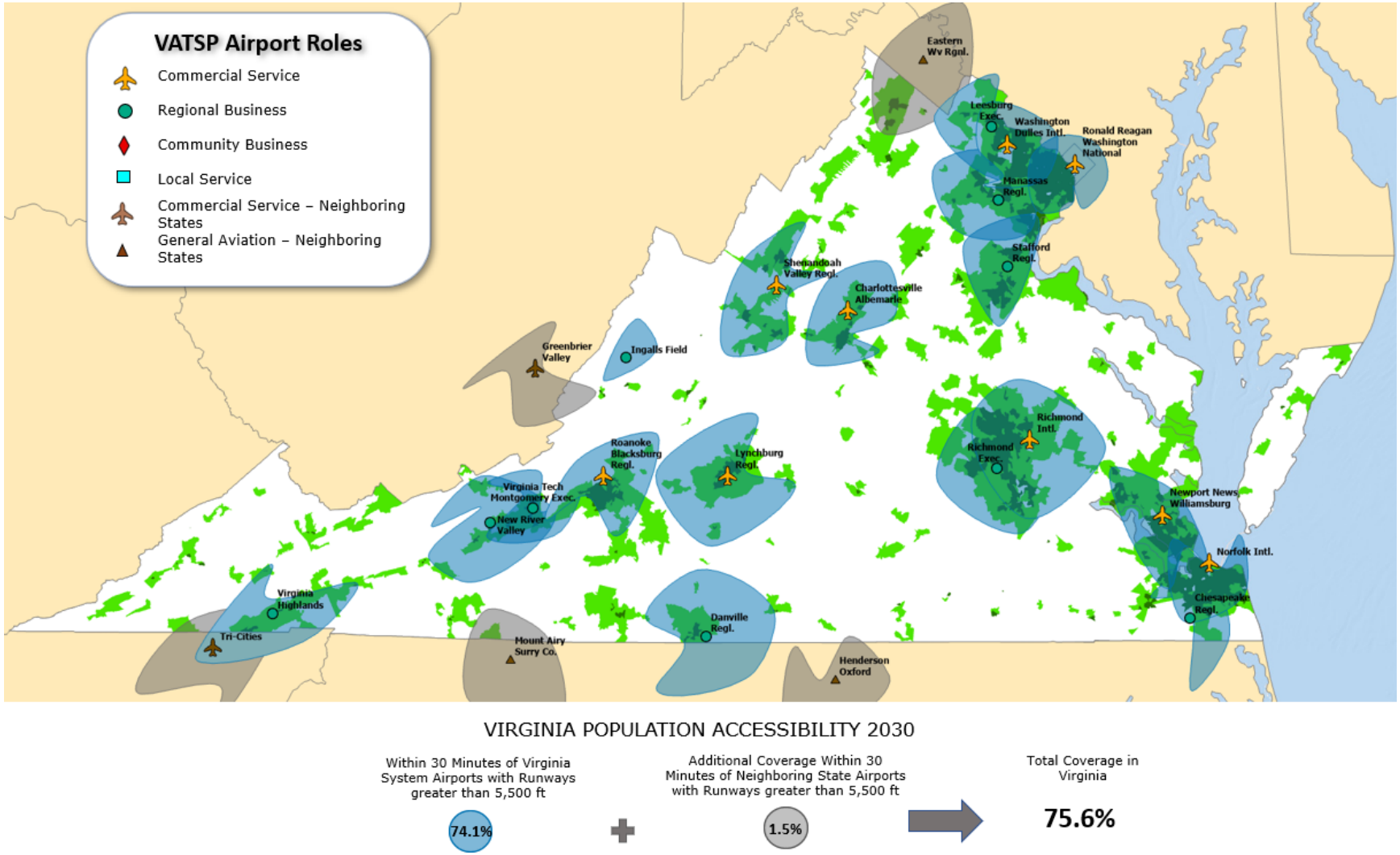
Adjusting the criteria to airports with a 5,000-foot runway or longer revealed that the 2030 population coverage dropped only slightly to 83 percent, as shown in **Figure 7-6**. This analysis includes Virginia Highlands (VJI), Farmville Regional (FVX), and Tappahannock-Essex County (XSA), all of which were assumed to extend their runways to at least 5,000 feet.



Source: Cignus, LLC.

Figure 7-6: Population Coverage by Airports with 5,000-Foot or Longer Runways in 2030 (30 minutes)

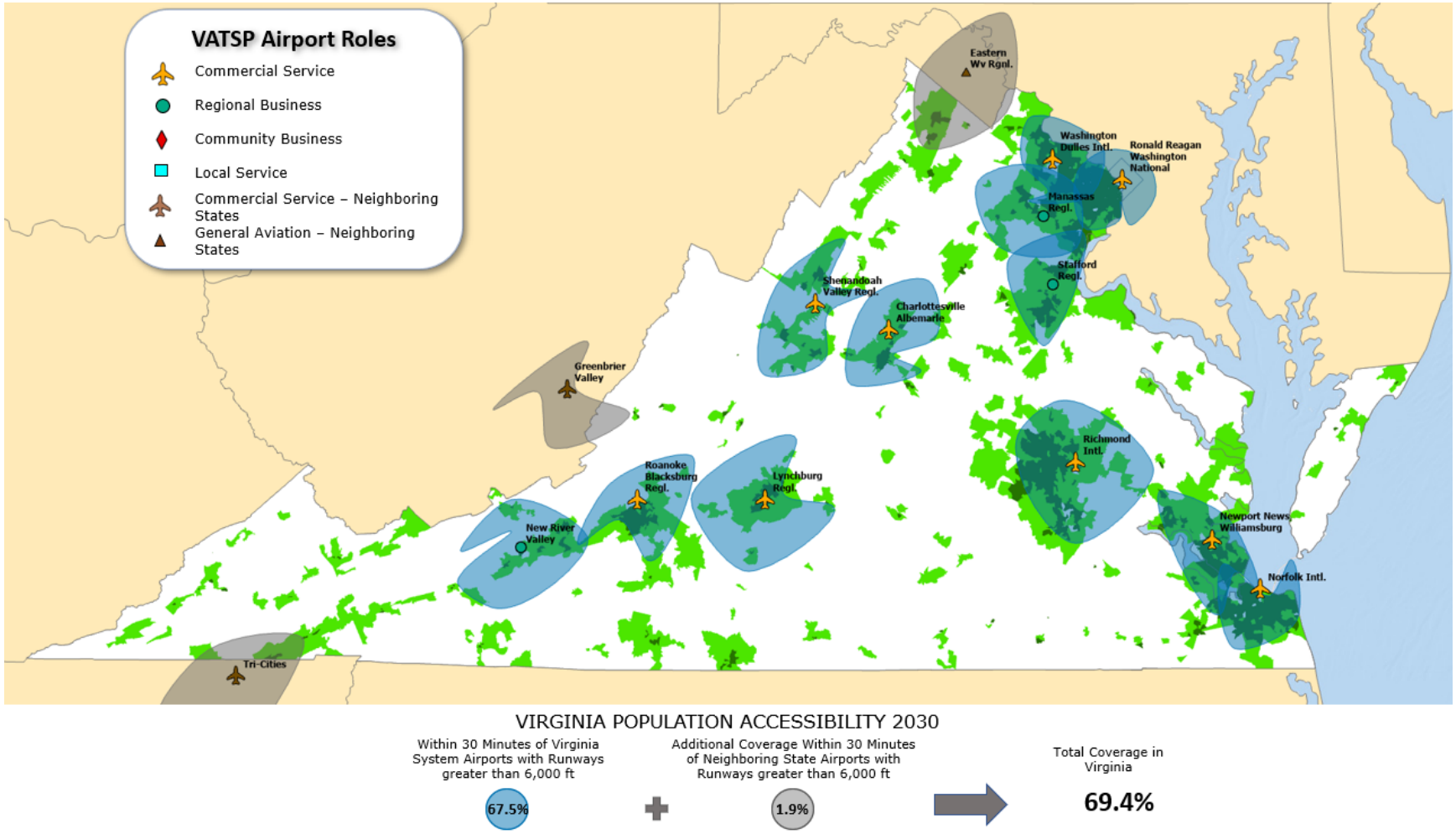
Bumping the criteria to a minimum runway length of 5,500 feet shows that 2030 population coverage declines to approximately 76 percent, as depicted in **Figure 7-7**.



Source: Cignus, LLC.

Figure 7-7: Population Coverage by Airports with 5,500-Foot or Longer Runways in 2030 (30 minutes)

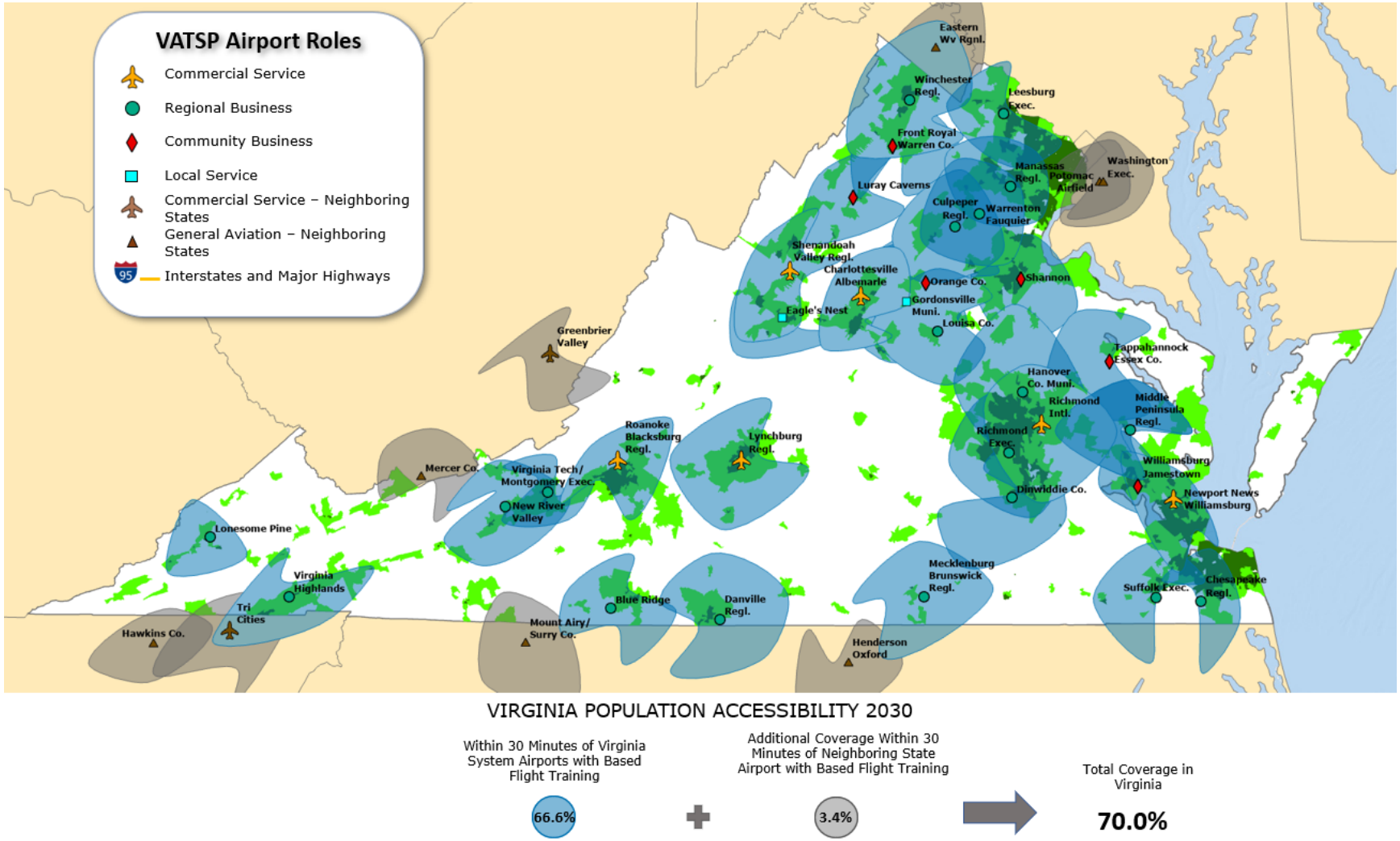
Figure 7-8 depicts the 2030 projected population coverage provided by those airports with runways of 6,000 feet in length or more. This subset of the aviation system is predominately commercial service airports, but it also includes Stafford Regional Airport (RMN), which was in the process of extending its 5,000-foot runway to 6,000 feet. Population coverage in 2030 by these airports was estimated at approximately 69 percent.



Source: Cignus, LLC.

Figure 7-8: Population Coverage by Airports with 6,000-Foot or Longer Runways in 2030 (30 minutes)

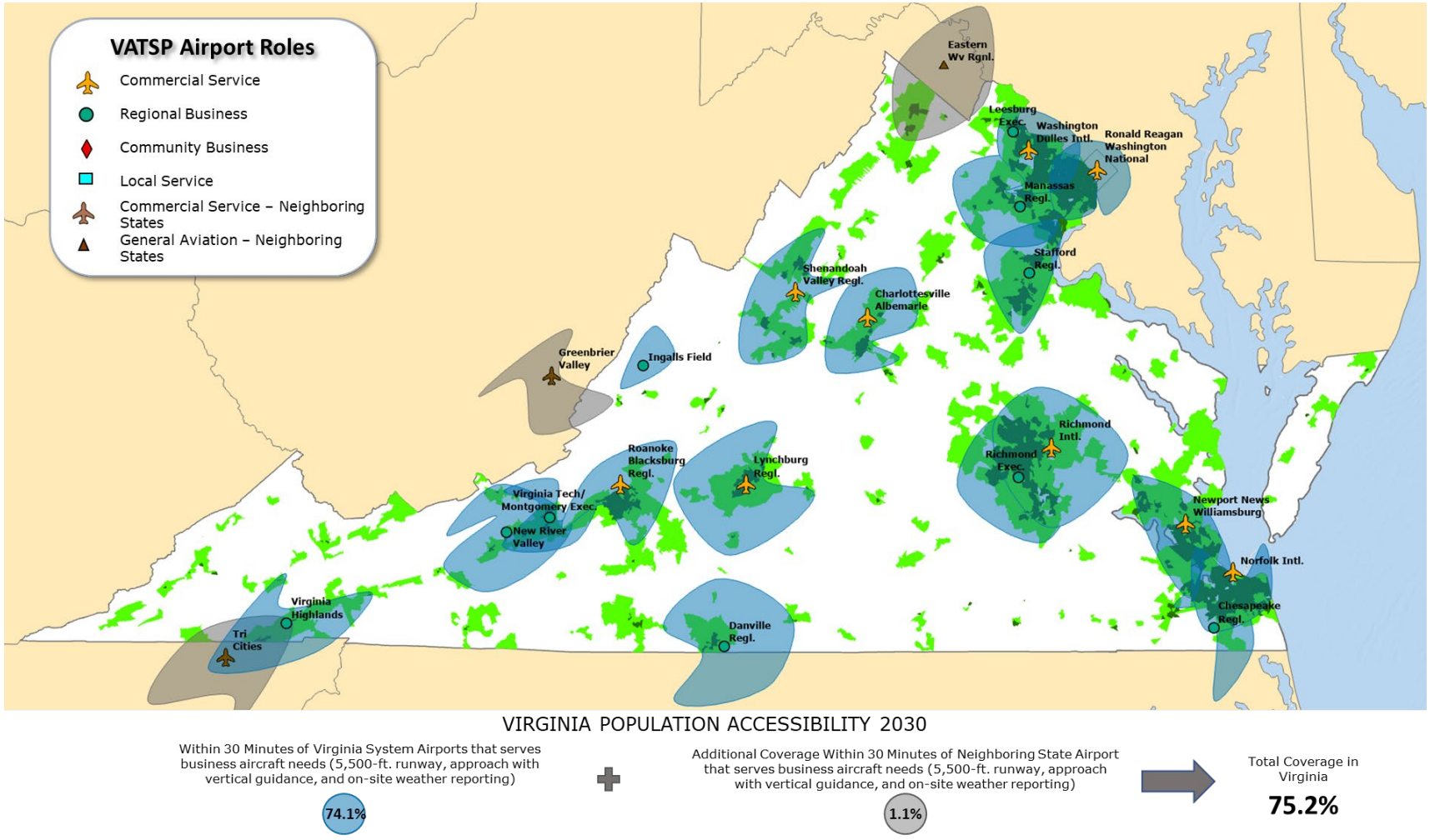
Figure 7-9 illustrates the coverage provided by system airports that host a flight training operation based at the airport. Seventy percent of Virginia's 2030 population was forecast to be within 30 minutes of an airport that offers flight training.



Source: Cignus, LLC.

Figure 7-9: Population Coverage by Airports Providing Based Flight Training in 2030 (30 minutes)

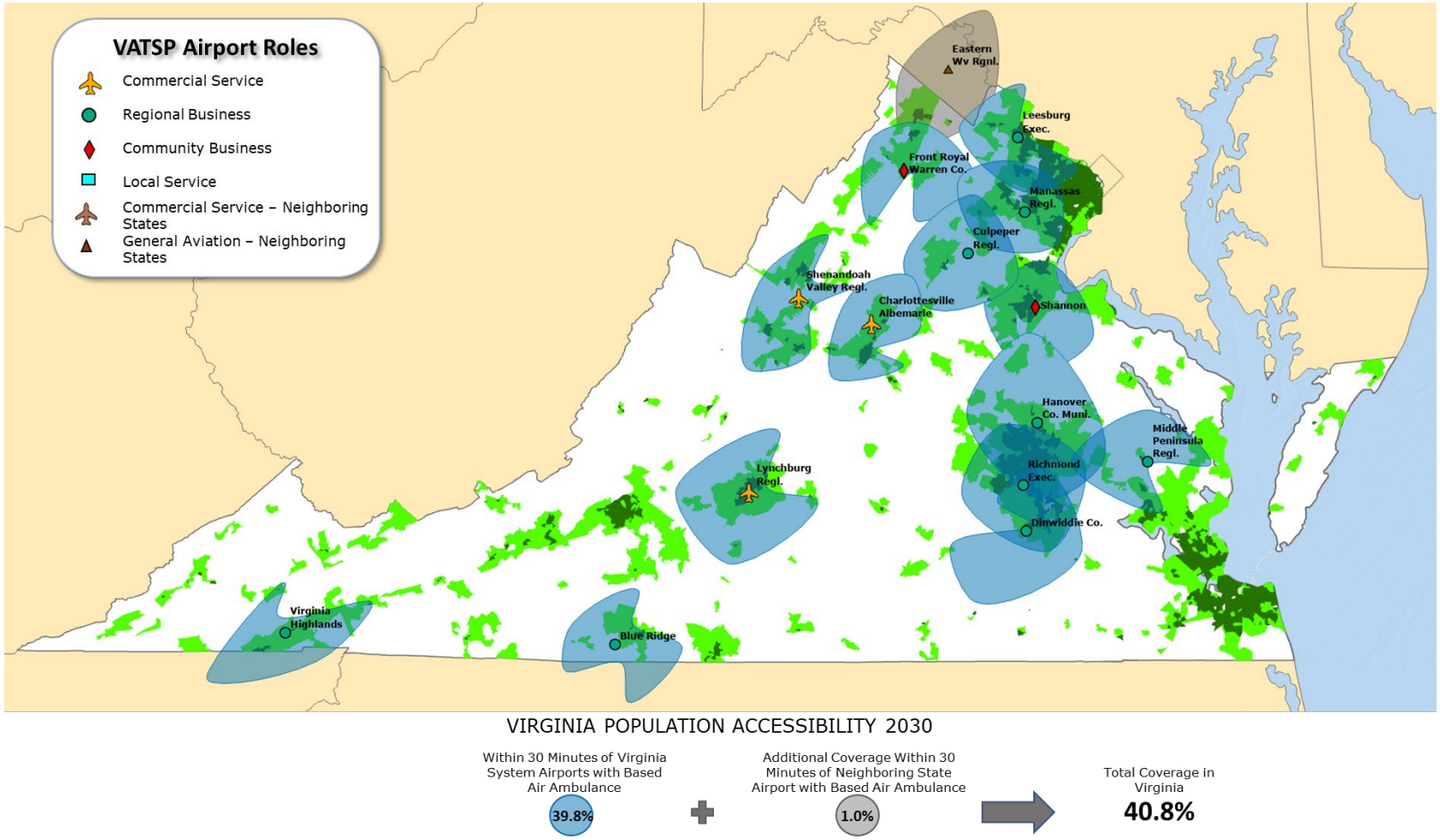
General aviation is an important tool for many businesses, and the ability to support those aircraft used by businesses is a vital component of an aviation system. Airports that can serve business aircraft were defined as those airports with at least a 5,500-foot runway, an approach with vertical guidance, and automated weather reporting. **Figure 7-10** shows the system airports that meet those criteria and their respective 30-minute drive times. Combined, these airports provide access to 75 percent of Virginia's 2030 population.



Source: Cignus, LLC.

Figure 7-10: Population Coverage by Airports that can Serve Business Aircraft in 2030 (30 minutes)

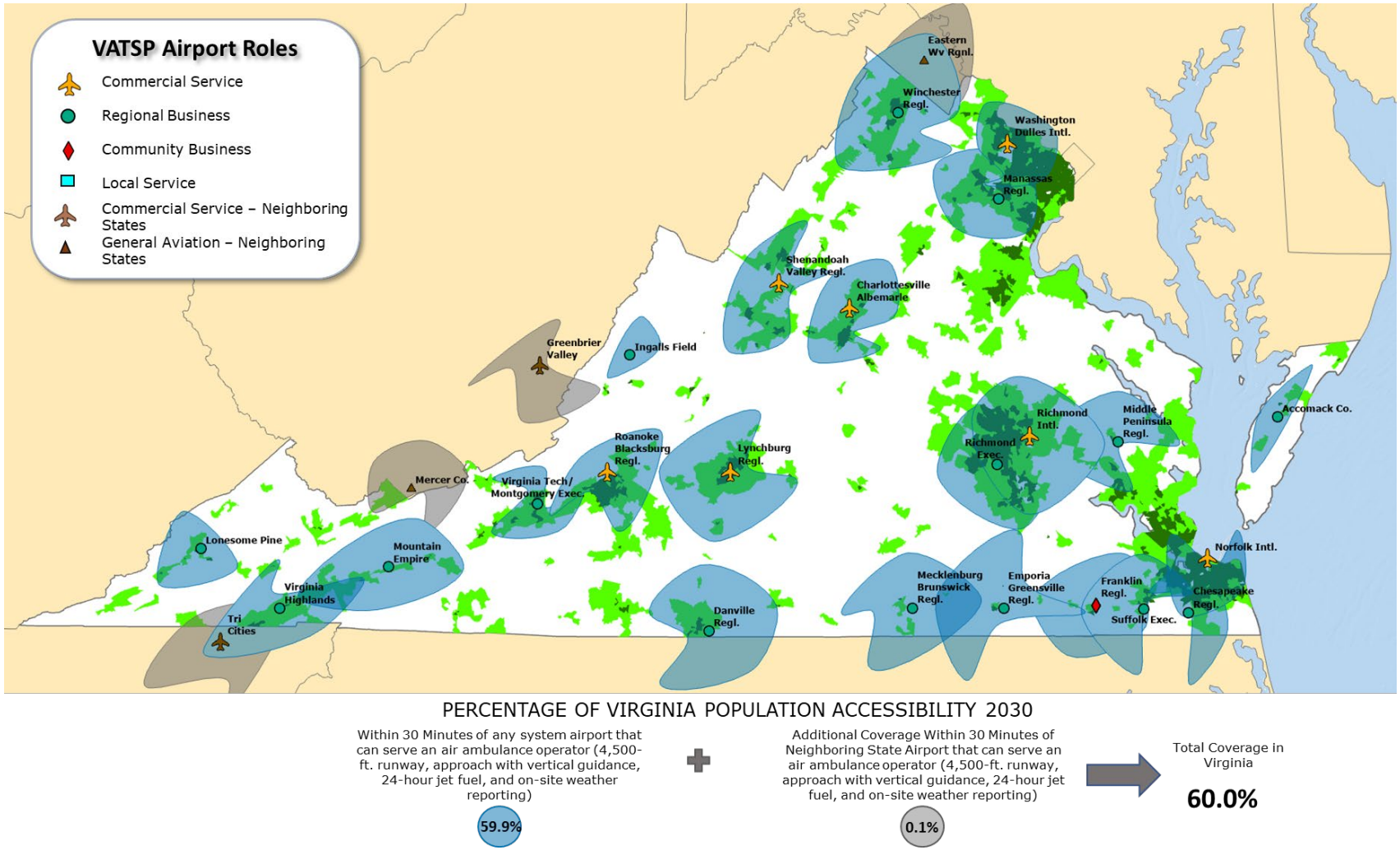
Another valuable aspect of the aviation system is its support of the healthcare industry through patient transport operations. **Figure 7-11** shows those system airports that have based air ambulance operators. Based on 30-minute drive times, those airports provide air ambulance access to nearly 41 percent of Virginia's 2030 projected population.



Source: Cignus, LLC.

Figure 7-11: Population Coverage by Airports with Based Air Ambulance Operators in 2030 (30 minutes)

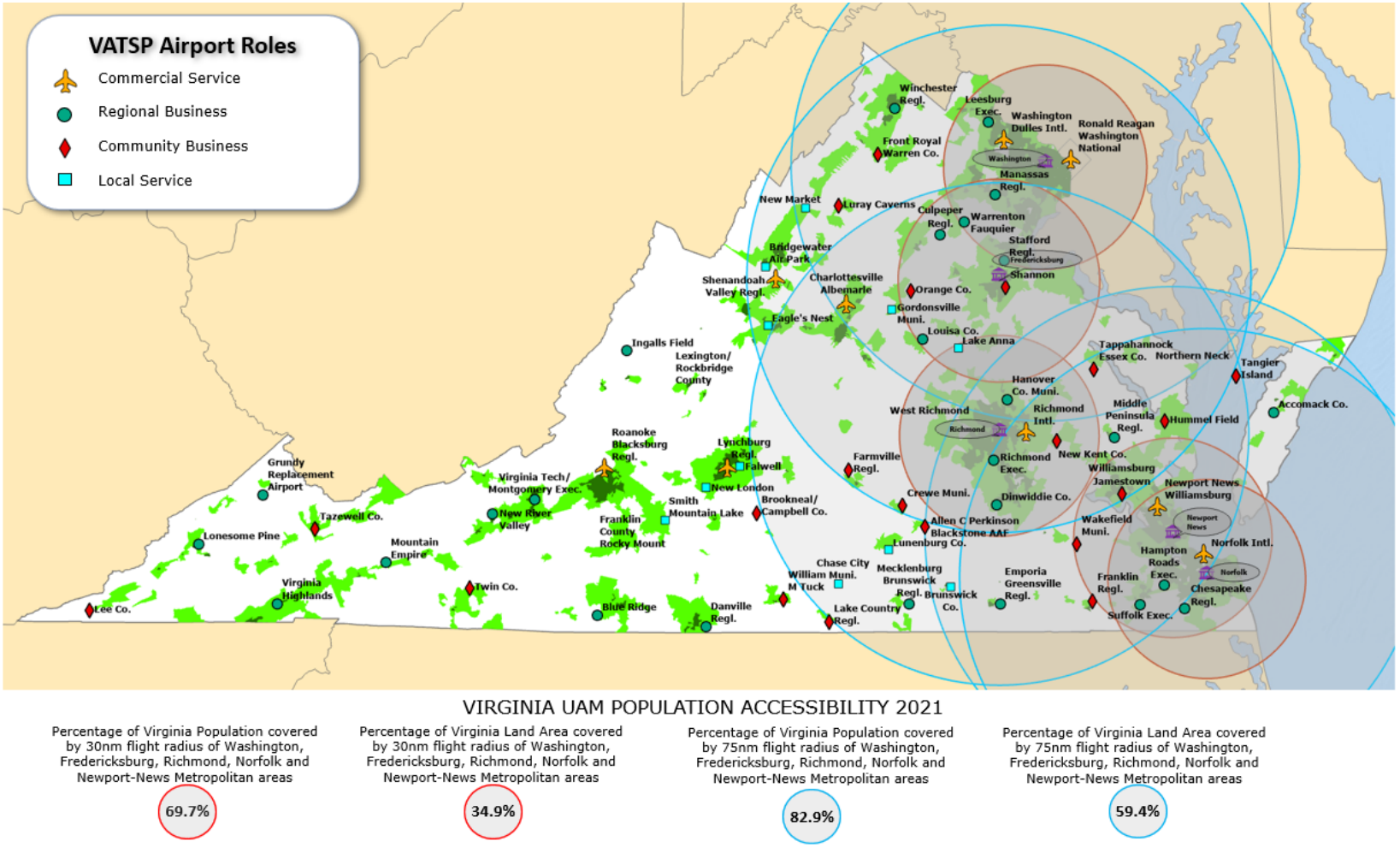
Air ambulance service can also take advantage of airports with adequate facilities. **Figure 7-12** examines the 2030 population coverage provided by airports capable of serving fixed-wing air ambulance aircraft. Based on typical air ambulance aircraft in use, these airports were defined as those with a runway of at least 4,500 feet, an approach with vertical guidance, jet fuel available 24 hours per day, and automated weather reporting. **Figure 7-12** shows that these airports are projected to provide air ambulance services to 55 percent of people in Virginia.



Source: Cignus, LLC.

Figure 7-12: Population Coverage by Airports that can Serve Air Ambulance Aircraft in 2030 (30 minutes)

As explained in the inventory chapter, early urban air mobility (UAM) technologies are expected in metropolitan areas, with the Washington, Fredericksburg, Richmond, Newport News, and Norfolk areas the most likely areas in Virginia. **Figure 7-13** shows both the expected 2030 population and land coverage resulting from UAM flight operations. Based on projected performance parameters for UAM aircraft, coverage is depicted with 30nm rings and 75nm rings around each urban center. With the more limited 30nm ring, 2030 population coverage is nearly 72 percent, and land coverage is approximately 35 percent. The larger 75nm ring expands 2030 population coverage to nearly 85 percent and land coverage to 59 percent.



Source: Cignus, LLC.

Figure 7-13: Population Coverage by Airports Expected to Serve Urban Air Mobility Operations in 2030

Flight Support Coverage

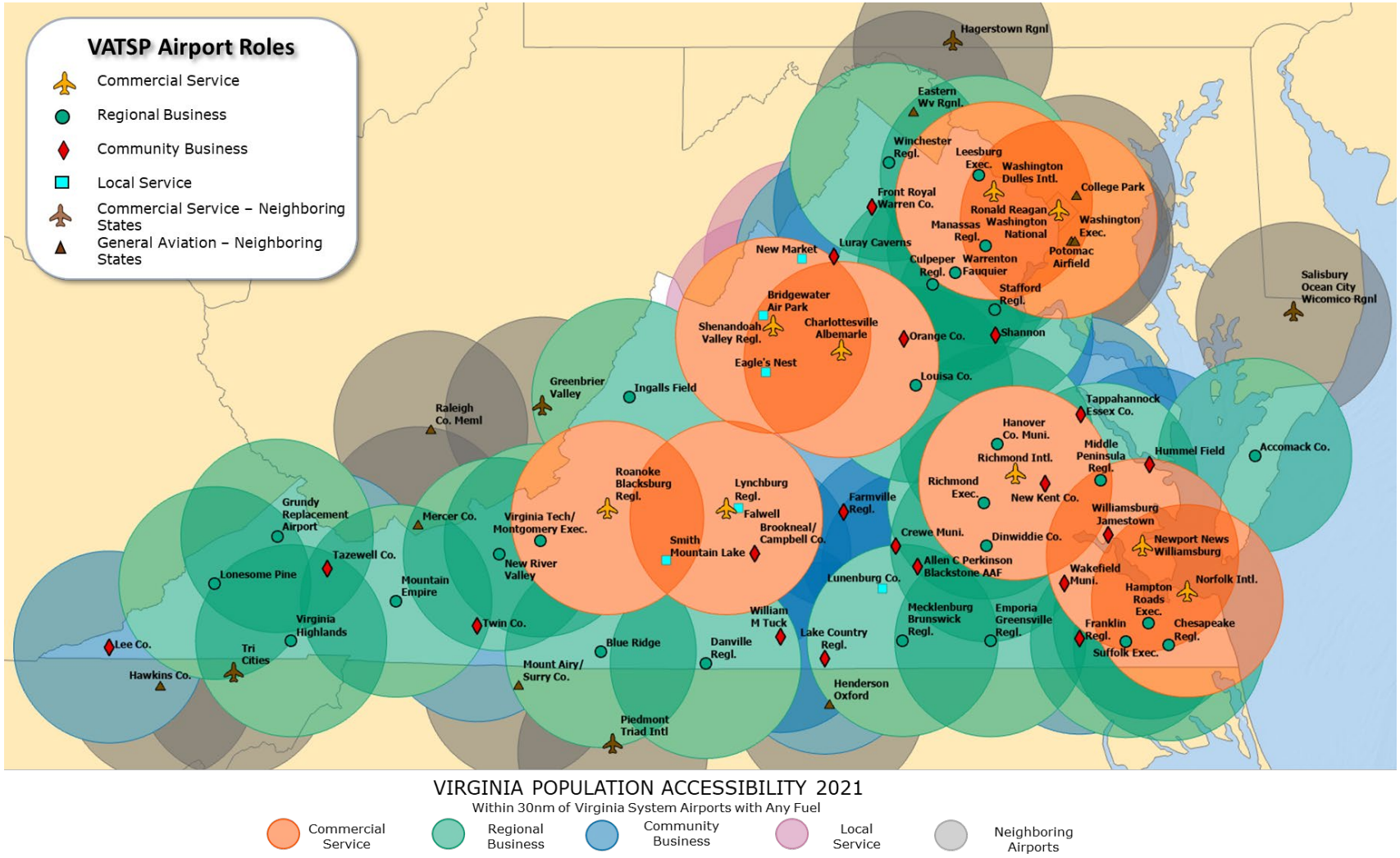
This set of geographic coverage maps examines the distribution of flight support facilities and services at the system airports. The extent of flight support services is depicted with 30nm rings around airports with the facility or service of interest. The flight support facilities and services assessed in this section are:

- Flight support coverage by airports with fuel (30nm flight radius)
- Flight support coverage by airports with jet fuel (30nm flight radius)
- Flight support coverage by airports with an instrument approach procedure (30nm flight radius)
- Flight support coverage by airports with an instrument approach procedure with vertical guidance (30nm flight radius)
- Flight support coverage by airports with automated weather reporting: 30nm flight radius

Given the well-developed state of the Virginia aviation system, it is not surprising that the coverage for flight support is extensive, with few opportunities for improvement.

The first example depicts the flight support coverage provided by airports with any type of aviation fuel. **Figure 7-14** shows that nearly the entire state of Virginia is covered. Analysis of the map indicates that only six Virginia system airports lack aviation fuel, and none of them would expand coverage by adding fuel availability. This is because these airports are located so close to airports with fuel that adding fuel availability to these airports would not increase coverage.

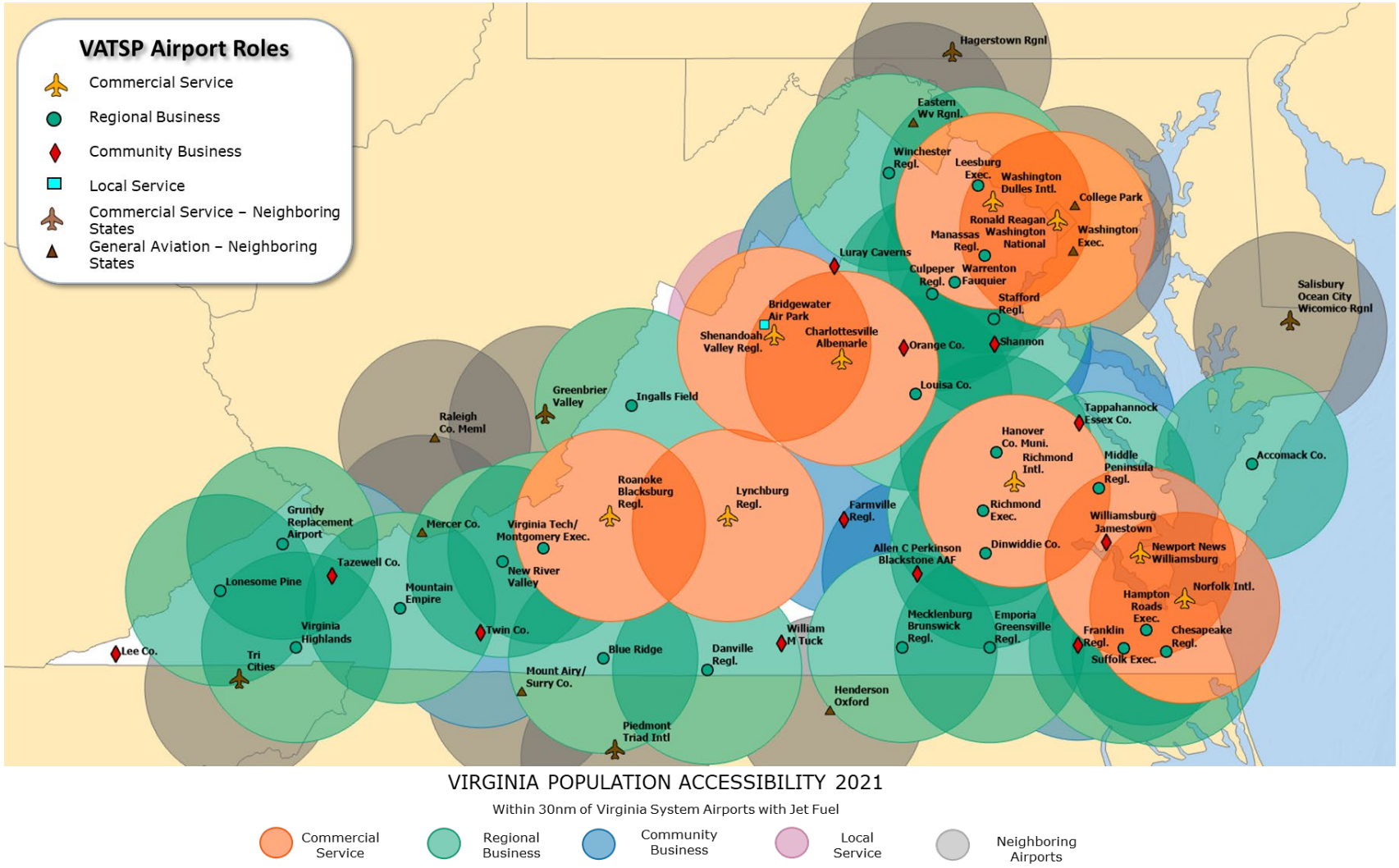
Source: Heather Ream.



Source: Cignus, LLC.

Figure 7-14: Flight Support Coverage by Airports with Fuel (30nm flight radius)

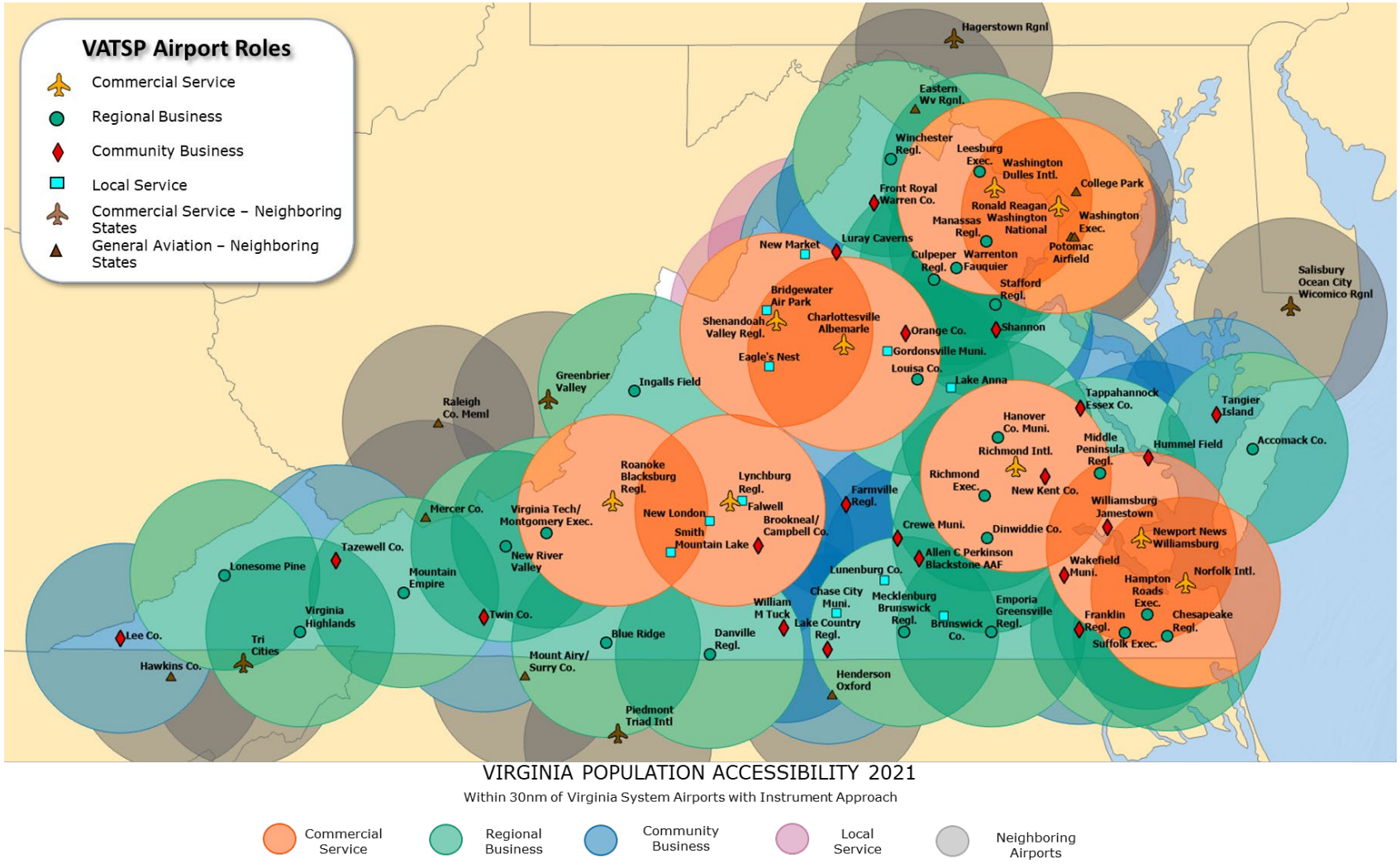
An analysis of flight support coverage by airports with jet fuel yields similar findings. Flight support coverage by these airports is nearly as extensive as the airports with any aviation fuel. However, there are two airports that, with the addition of jet fuel availability, would increase the coverage. These airports are Lee County Airport (0VG), and William M. Tuck Airport (W78). These airports are depicted in **Figure 7-15**, in addition to the airports providing jet fuel.



Source: Cignus, LLC.

Figure 7-15: Flight Support Coverage by Airports with Jet Fuel (30nm flight radius)

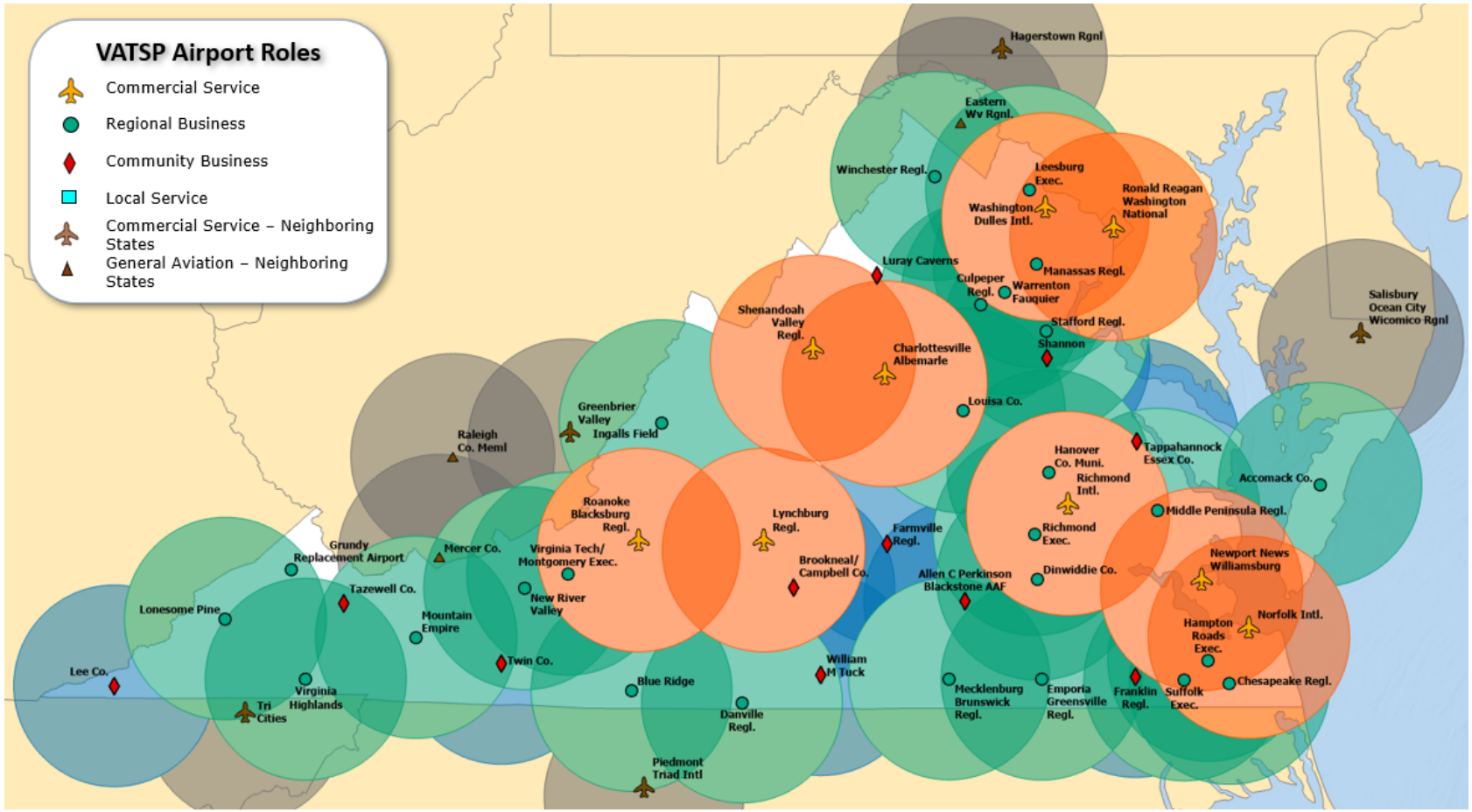
Figure 7-16 depicts the flight support coverage from system airports with an Instrument Approach Procedure (IAP). This coverage is quite extensive because every system airport has some type of IAP. This is further evidence of the extent to which the Virginia aviation system has been developed.



Source: Cignus, LLC.

Figure 7-16: Flight Support Coverage by Airports with an Instrument Approach Procedure (30nm flight radius)

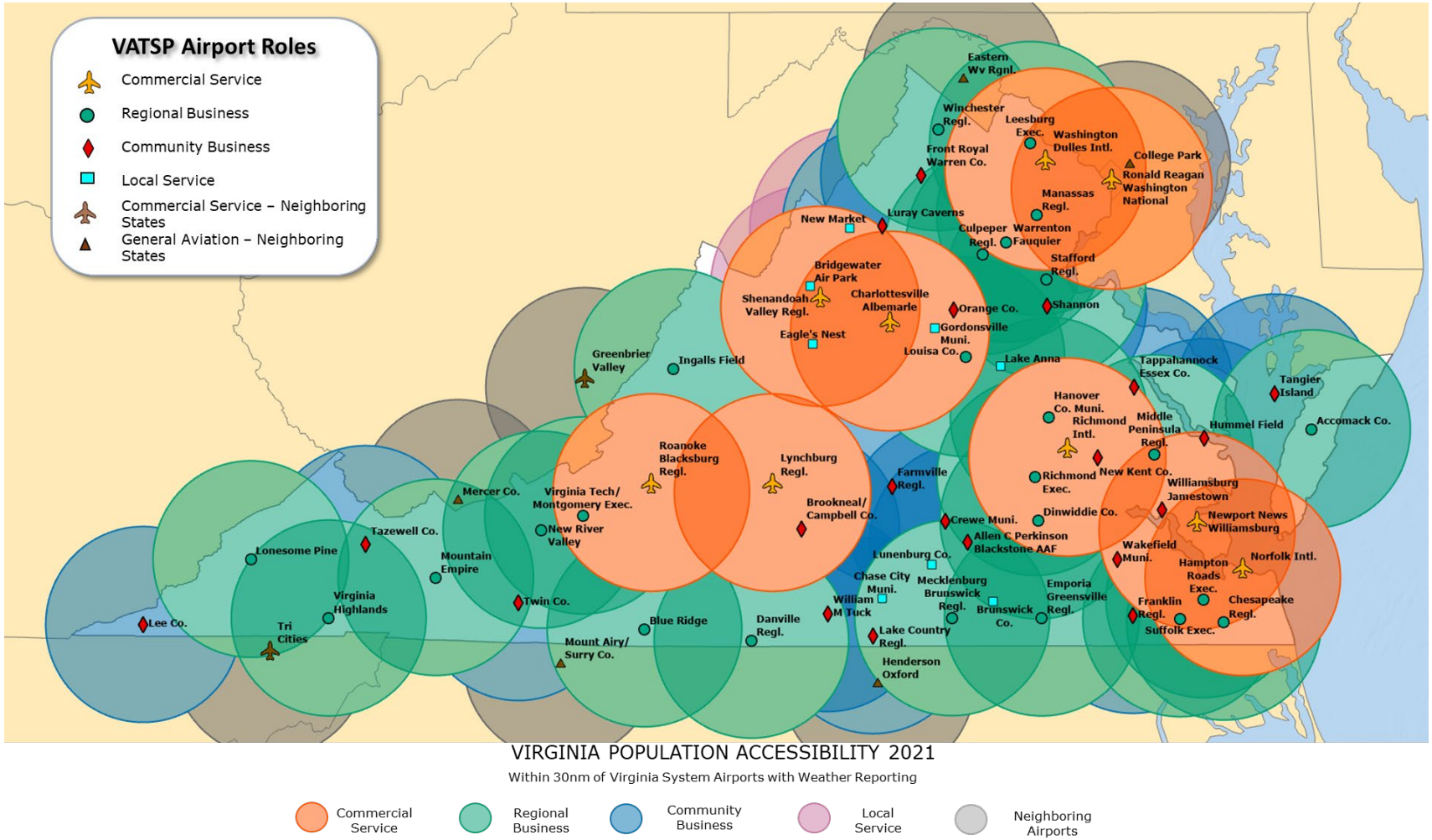
When looking at the flight support coverage from airports with an IAP with vertical guidance, it was clear that coverage was extensive as shown in **Figure 7-17**, but with some potential for improvement. Two airports, Grundy Replacement Airport (GDY) and Luray Caverns Airport (LUA), were identified as locations where adding vertical guidance capability to an existing IAP at the airport would increase the coverage.



Source: Cignus, LLC.

Figure 7-17: Flight Support Coverage by Airports with an Instrument Approach Procedure with Vertical Guidance (30nm flight radius)

Another example of how well developed the Virginia aviation system is can be seen in **Figure 7-18**, which shows flight support coverage from airports with automated weather reporting. Only four airports in the system (Falwell, Smith Mountain Lake, New London, and Grundy Replacement Airport) lack automated weather reporting. The other airports with automated weather reporting are sufficiently distributed so that adding automated weather reporting to any of the airports lacking it would not increase the coverage.



Source: Cignus, LLC.

Figure 7-18: Flight Support Coverage by Airports with Automated Weather Reporting (30nm flight radius)

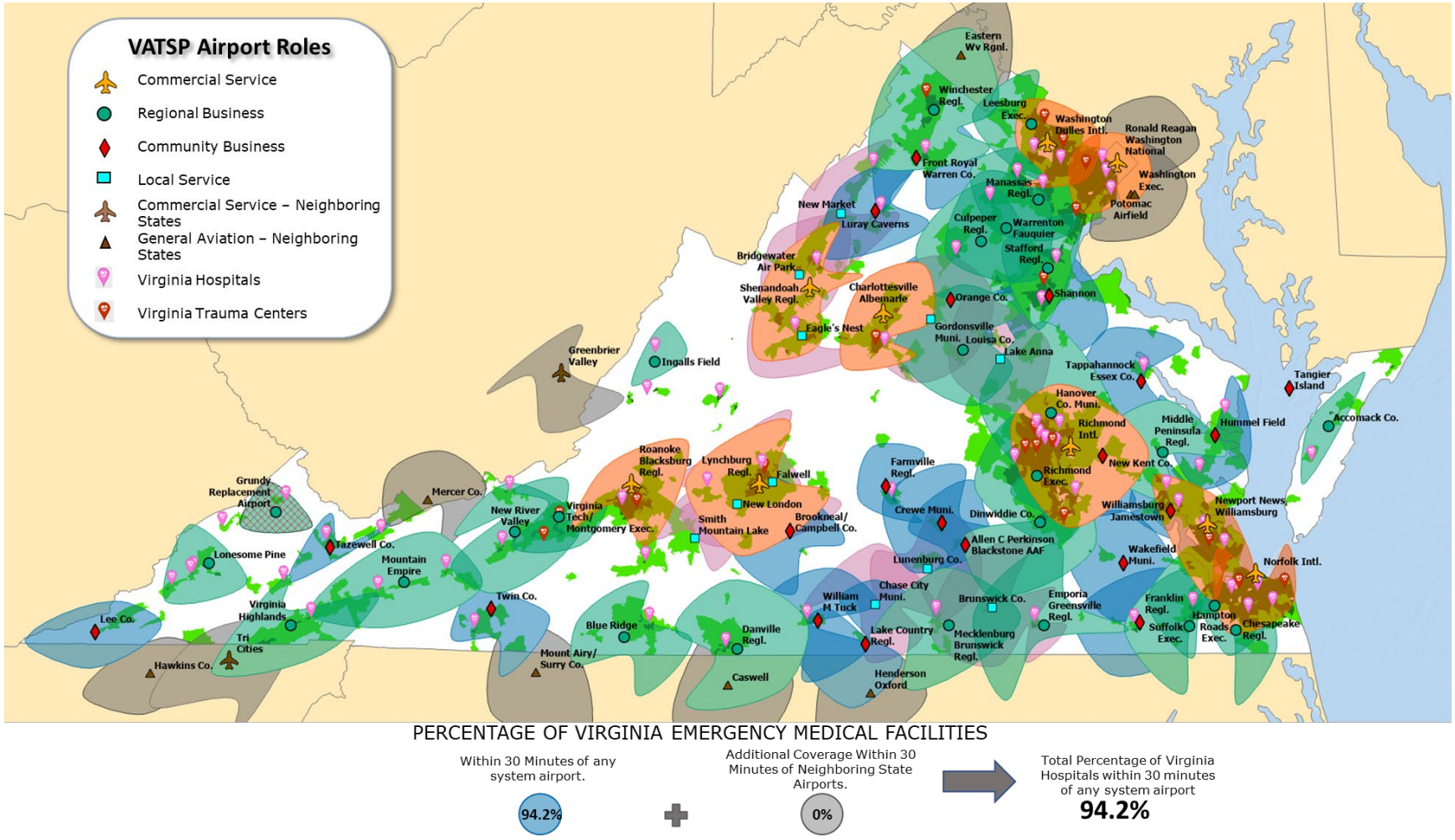
Other Coverage

This third section looks at coverage across the aviation system for unique aspects of the Virginia aviation system. These analyses examine:

- Trauma center coverage by airports within 30-minute drive time of a trauma center
- Air ambulance scene call coverage within the golden hour
- Land coverage by Automatic Dependent Surveillance-Broadcast (ADS-B)
- Special use airspace

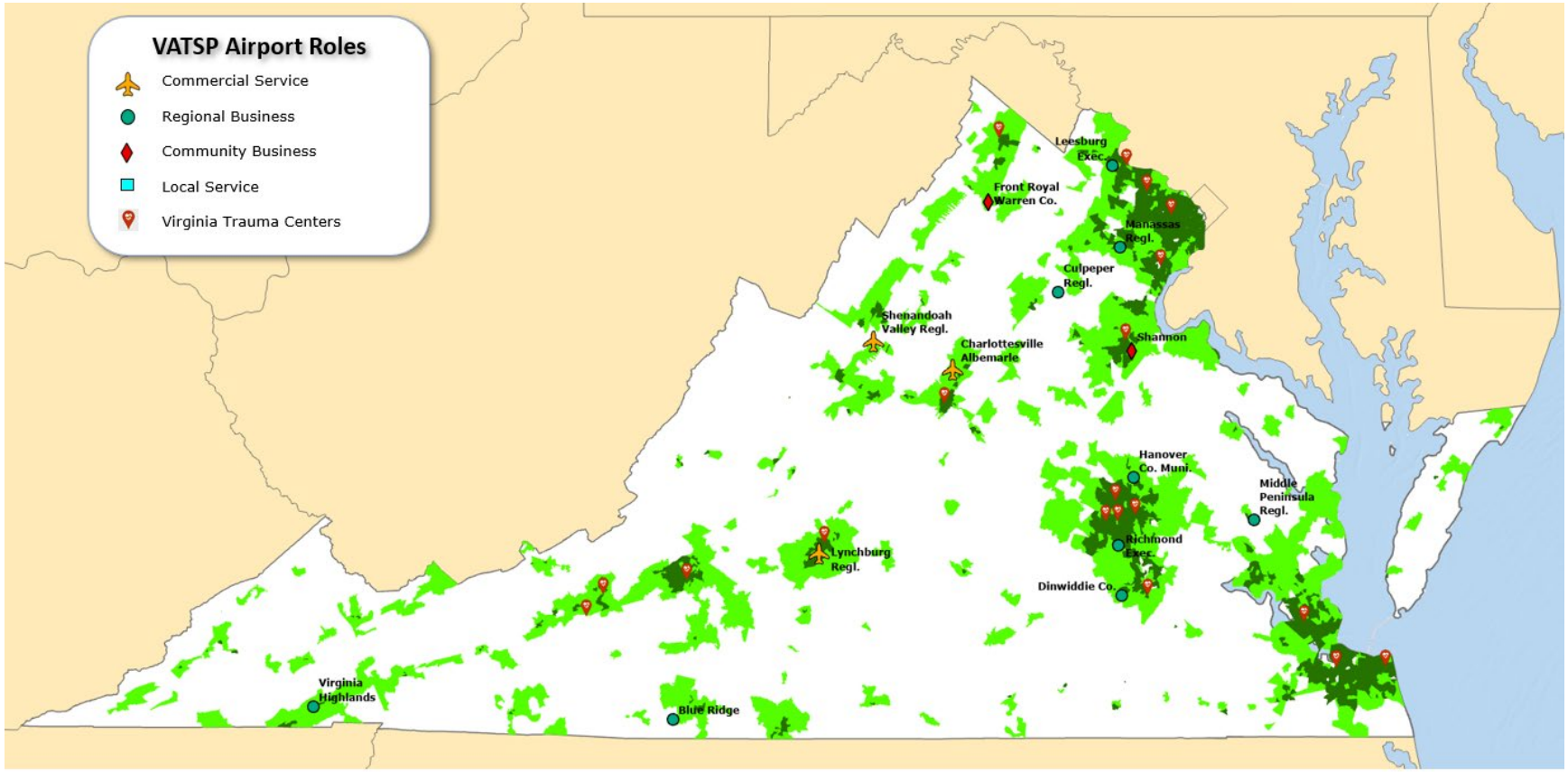
Source: Nancy Lewis.

Figure 7-19 illustrates the support that the Virginia aviation system provides the emergency medical services across Virginia. The map displays the hospitals and trauma centers found in Virginia and the 30-minute drive times of the system airports. Based on the analysis, more than 94 percent of Virginia's hospitals and trauma centers are within 30 minutes of a system airport. **Figure 7-20** displays the location of air ambulance bases and hospitals in Virginia**.**



Source: Cignus, LLC.

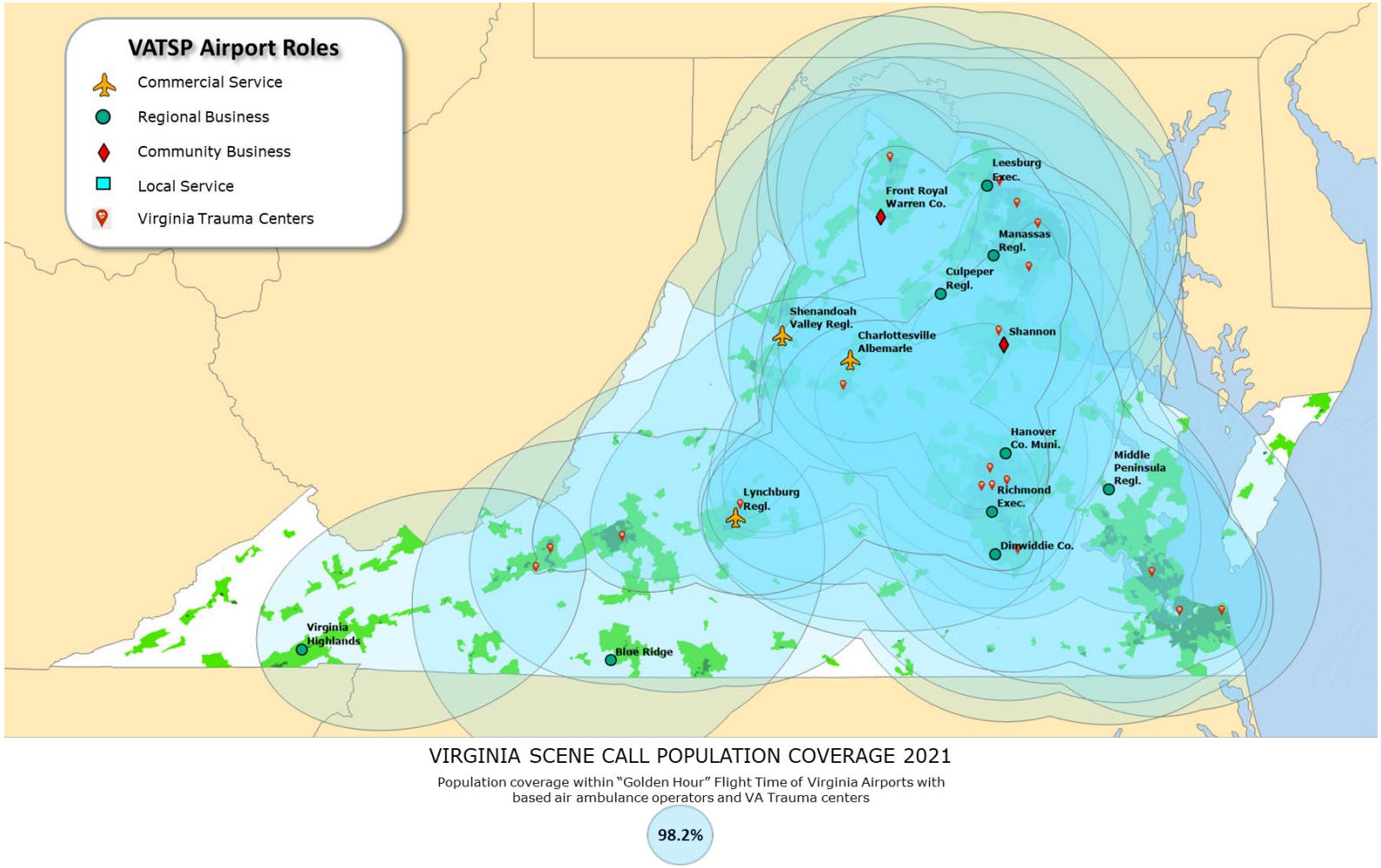
Figure 7-19: Trauma Center Coverage by Airports Within 30-minute Drive Time of a Trauma Center



Source: Cignus, LLC.

Figure 7-20: Air Ambulance Bases and Hospitals in Virginia

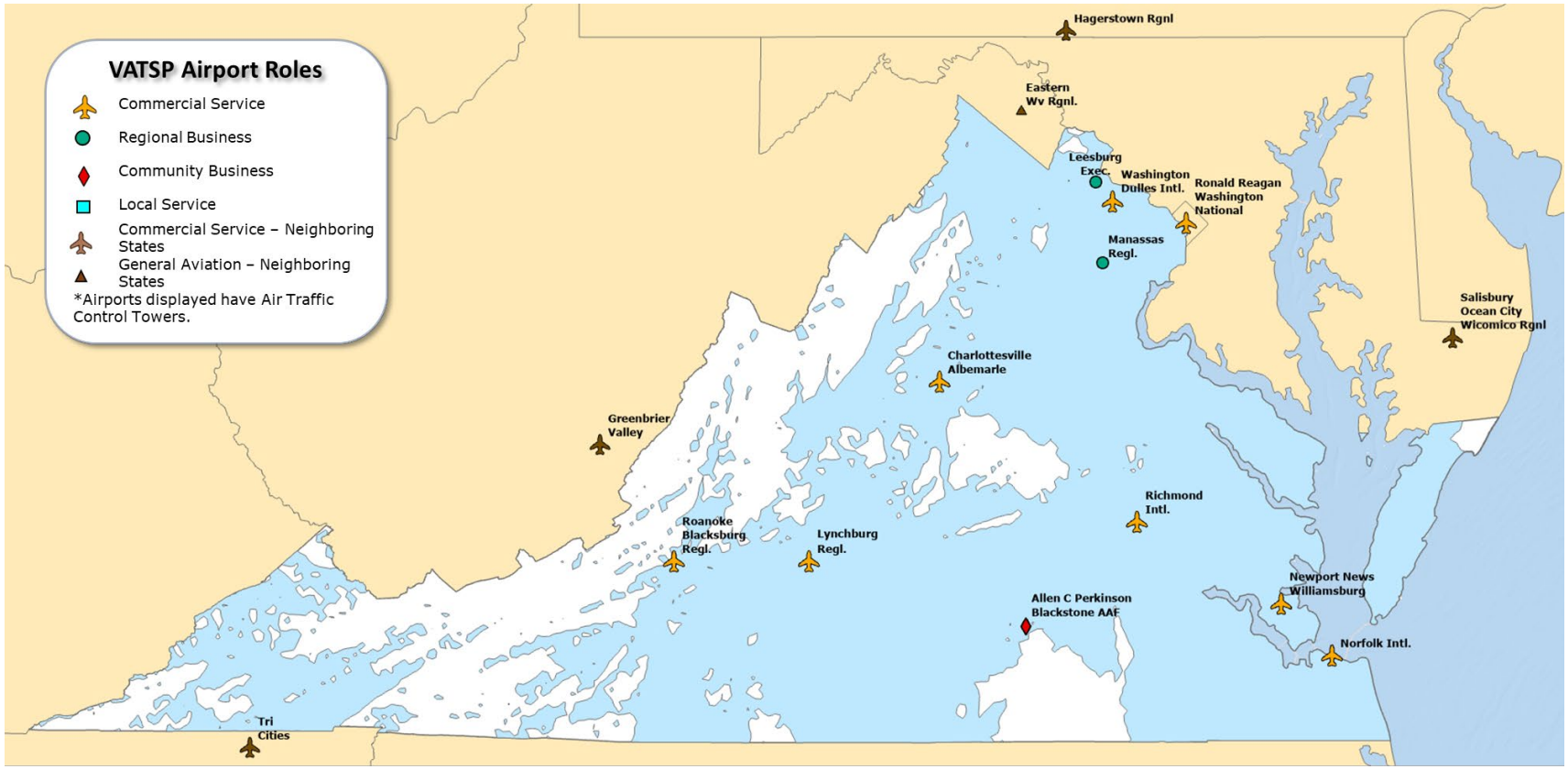
A core principle of emergency medical treatment is that patient outcomes are enhanced when medical specialists can provide their services as soon as possible, preferably within 60 minutes or less. This has become known as the golden hour. The concept is that critically ill or injured patients that are provided emergency room services within 60 minutes of the start of their emergency have increased chances of survival. **Figure 7-21** shows the golden hour coverage provided by air ambulance operators responding to scene calls across Virginia. The analysis assumed an aircraft average speed of 125 miles per hour and that the aircraft spent 10 minutes at the scene, leaving 50 minutes total time for the aircraft to travel from its base to the scene, and then on to the nearest hospital or trauma center.



Source: Cignus, LLC.

Figure 7-21: Air Ambulance Scene Call Coverage within the Golden Hour

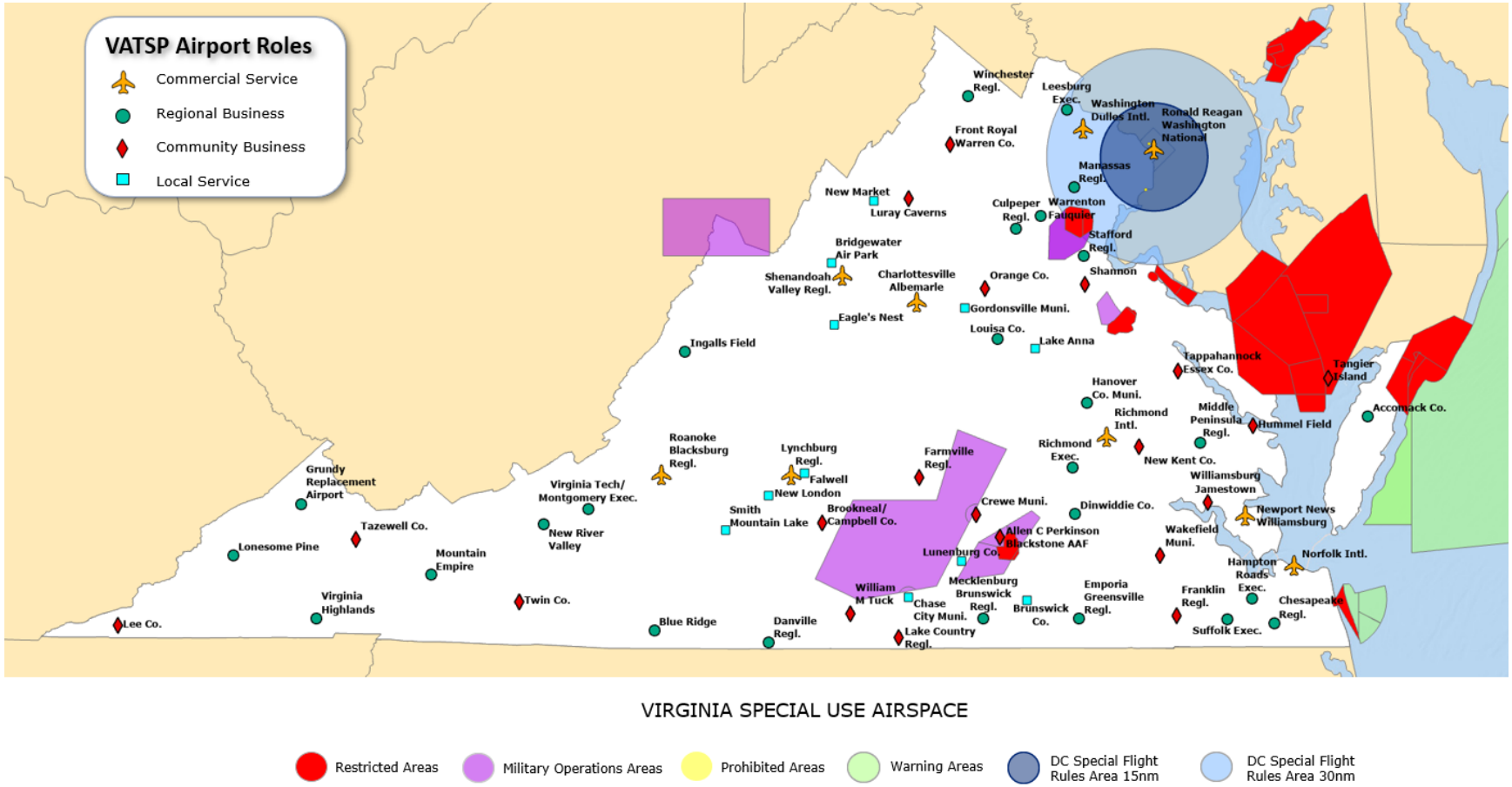
With the FAA mandating the use of ADS-B in 2020 as part of its effort to shift from a ground-based air traffic control system to a space-based system, the extent of ADS-B coverage across Virginia is an important aspect of the aviation system. **Figure 7-22** shows approximately 71 percent of Virginia is covered by ADS-B signal reception down to 500 feet above ground level. Unsurprisingly, the areas lacking ADS-B coverage at 500 feet are predominantly in the mountains. This map also depicts all of the airports in and around Virginia with air traffic control towers.



Source: Cignus, LLC.

Figure 7-22: Land Coverage by ADS-B

Figure 7-23 displays all of Virginia's system airports, along with the various classes of special use airspace. These areas have different rules for flight operations, depending upon their purpose. For example, the DC Special Flight Rules Area, created after the 9/11 terrorist attacks, requires air crews to undergo training and obtain security clearance before conducting the flight. Once in the airspace, specific flight rules must be followed. Areas with less restrictive special use airspace are the Military Operations Areas (MOA) found in parts of Virginia. Aviators are advised to avoid MOAs when they are active, but flight is not prohibited. These special use airspace areas could influence the development of future aviation facilities and operations and should be taken into account for any planned aviation related developments in their vicinity.



Source: Cignus, LLC.

Figure 7-23: Special Use Airspace in Virginia

Facility, Equipment, and Service Analysis by Airport Role

A number of performance measures based on the airport's facilities, equipment, and services (FE&S) were evaluated. This evaluation used targets established for each performance measure based on the airport's role. **Table 7-1** lists the performance measures and their respective targets for each airport role. Note that any airports without a recommended target still needs adequate justification for that improvement in order for it to be eligible for FAA funding.

Table 7-1: Targets for FE&S Performance Measures

Performance Measure	Airport Role			
	Commercial Service	Regional Business	Community Business	Local Service
Primary Runway Length	6,000 feet	5,000 feet	3,500 feet	2,000 feet
Primary Runway Width	150 feet	75 feet	50 feet	50 feet
Primary Runway Strength	Dual Wheel = 60,000	Single Wheel = 30,000	Single Wheel = 12,500	Preserve existing
Primary Runway Instrumentation (ALS, RW lights, VGSI)	MASLR, HIRLs, PAPI	REILS (or approach lights), MIRLs, PAPI	REILS (or approach lights), MIRLs, PAPI	Preserve existing
Taxiway System	Full parallel	Full parallel	Partial parallel	Stub
Automated Weather Reporting	ASOS or AWOS III on field, 24/7	ASOS or AWOS III on field, 24/7	ASOS or AWOS on field, 24/7	No target
Visual Guidance (rotating beacon, windcone)	Rotating beacon, lighted windcone	Rotating beacon, lighted windcone	Rotating beacon, lighted windcone	Rotating beacon, windcone
IAP Minimums on Primary Runway (ceiling and visibility in feet and statute miles, respectively)	200 and 1/2	250 and 1	500 and 1	1,100 and 3
Remote Towers	Any airport without ATCT	Any airport without ATCT and 3 or more based jets	N/A	N/A
Terminal Facilities	Per Master Plan	Based on DOAV terminal building objectives to represent the total terminal space needed	Based on DOAV terminal building objectives to represent the total terminal space needed	1,236 sq. ft. of public use space
Hangar Space	100% of based aircraft	100% of based aircraft	100% of based aircraft	Preserve existing
Maintenance Equipment	Snow removal equipment, mower, tractor, vehicle attachments, front end loader, truck, debris sweeper, other maintenance equipment as needed	Snow removal equipment, mower, tractor, vehicle attachments, front end loader, truck, debris sweeper	Mower, tractor, vehicle attachments, front end loader, truck, debris sweeper	Preserve existing
Airport Parking (non-revenue)	1 space per every 3 airport/tenant employees (assumes 3 shifts).	1 space per airport/tenant employee + 1.5 spaces per 50% of based aircraft	1 space per airport/tenant employee + 1.5 spaces per 50% of based aircraft	1 space per airport/tenant employee + 1.5 spaces per 50% of based aircraft
Airport Parking (revenue)	100 parking space per 100,000 enplanements	N/A	N/A	N/A
Pavement Maintenance	PCI ≥ 70	PCI ≥ 70	PCI ≥ 70	PCI ≥ 70
Utilities	Electricity, water, sewer, communications	Electricity, water, sewer, communications	Electricity, water, sewer, communications	Electricity, communications

Source: Mead & Hunt, Inc.

Primary Runway Length, Width, and Strength

This section describes in detail the results of this analysis, with a bar graph showing the percentage of airports meeting their targets, not meeting their targets, or not responding to the survey question. Additionally, a table lists the number of airports in each role that fall into each category. Each section concludes by listing the airports that do not meet the target and any issues the airport may have with achieving the target, if available.

The primary runways of each system airport were assessed for length, width, and weight bearing capacity, based upon the role assigned.

In evaluating the system airports, certain airports had primary runway extensions that were planned or in progress that were assumed to be completed. **Table 7-2** lists these airports and the primary runway length that was used in this analysis. These runway lengths were used in all other analyses in this study.

Table 7-2: Analyzed Primary Runway Length for Select Airports

ID	Airport	Analyzed Primary Runway Length (feet)
GDY	Grundy Replacement Airport	5,000
RMN	Stafford Regional	6,000
VBW	Bridgewater Air Park	4,034
VJI	Virginia Highlands	5,500
W75	Hummel Field	3,220

Source: Mead & Hunt, Inc.

Source: DOAV.

Primary Runway Length

Virginia's system airports generally have adequate runway length. More than 80 percent of system airports meet their runway length targets, as shown in **Figure 7-24**. Most of the airports that fall short are in the Community Business Airport role. **Table 7-3** lists the target for each airport role and the number of airports in that role that meet or do not meet their runway length targets.

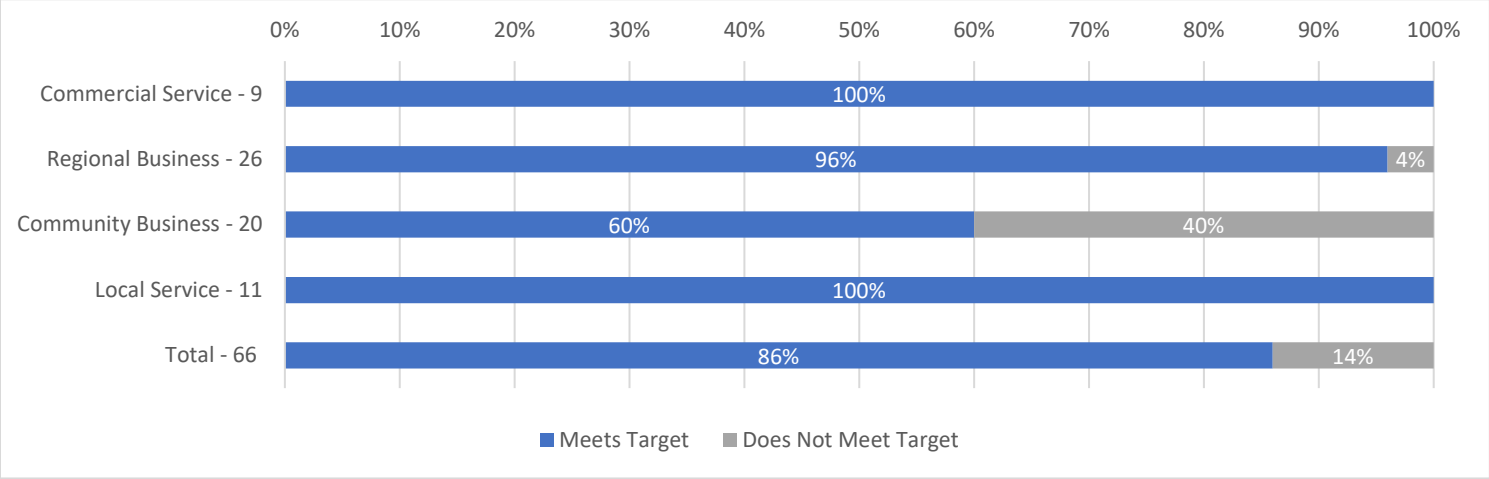


Figure 7-24: Percentage of Airports Meeting Runway Length Targets

Table 7-3: Airports Meeting Runway Length Targets

VATSP Role and Number of Airports	Runway Length Target (feet)	Airports Meeting Target	Airports Not Meeting Target
Commercial Service – 9	5,500	9	0
Regional Business – 26	5,000	25	1
Community Business – 20	3,500	12	8
Local Service – 11	2,000	11	0
Total – 66		57	9

Source: Mead & Hunt, Inc.

The airports that fall short of their primary runway length target are listed below, along with any constraints that may hinder a runway extension.

- Regional Business Airports
  - Louisa County/Freeman Field (LKU) – Terrain limitations
- Community Business Airports
  - Shannon (EZF) – Ownership and development constraints
  - Front Royal-Warren County (FRR) – Development constraints
  - Williamsburg-Jamestown (JGG) – Ownership and development constraints
  - Luray Caverns (LUA) – Future Master Plan Update to address
  - Orange County (OMH) – Terrain limitations and development constraints
  - Tangier Island (TGI) – Terrain limitations
  - Hummel Field (W75) – Development constraints
  - Crewe Municipal (W81) – Terrain limitations

Primary Runway Width

Nearly all of Virginia's airports meet their targets for primary runway width, as shown in **Figure 7-25**. At the time of this analysis, Hummel Field (W75) was in the process of widening its primary runway from 45 feet to 50 feet and was evaluated with the assumption that the project was complete. **Table 7-4** shows that only one Local Service Airport does not meet the primary runway width target.

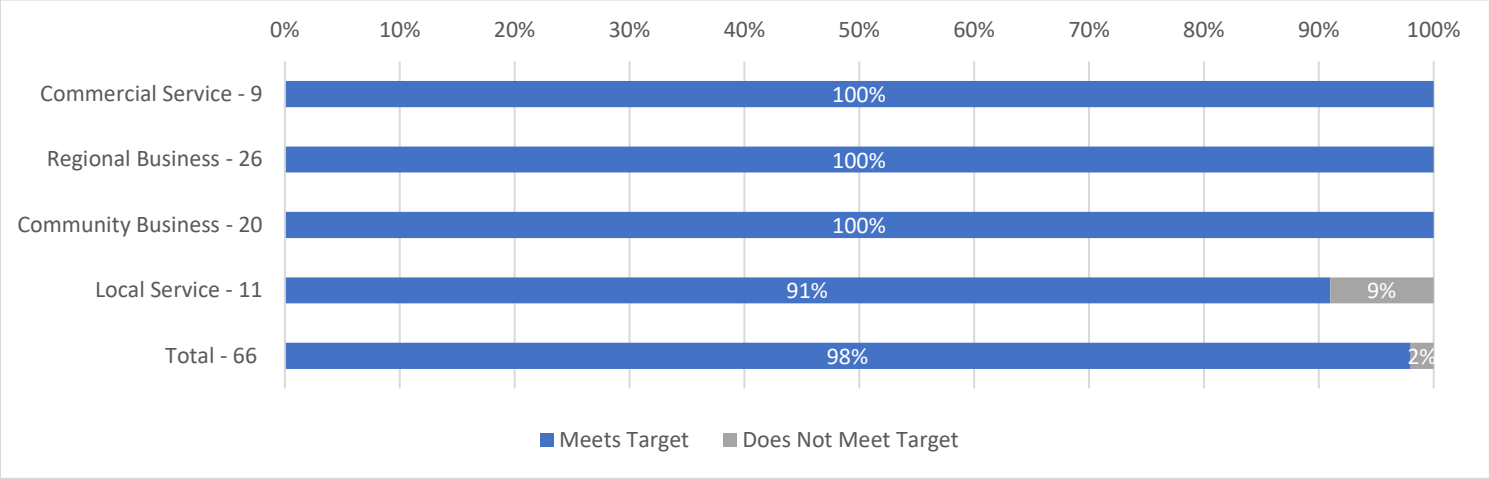


Figure 7-25: Percentage of Airports Meeting Runway Width Targets

Table 7-4: Airports Meeting Runway Width Targets

VATSP Role and Number of Airports	Runway Width Target (feet)	Airports Meeting Target	Airports Not Meeting Target
Commercial Service – 9	150	9	0
Regional Business – 26	75	26	0
Community Business – 20	50	20	0
Local Service – 11	50	10	1
Total – 66		65	1

Source: Mead & Hunt, Inc.

The Local Service Airport with insufficient primary runway width is 40 feet wide:

- Local Service Airports
  - New London (W90) – Development constraints

Primary Runway Strength

The strength rating of a runway is a recommended threshold of aircraft weight that should not be exceeded on a regular basis. As indicated in **Figure 7-26**, the Commercial Service Airports all meet their recommended runway strength target. About a third of the Regional Business and Community Business Airports lack the recommended target for runway strength. **Table 7-5** shows that eight Regional Business Airports and seven Community Business Airports fall short of their runway strength targets.

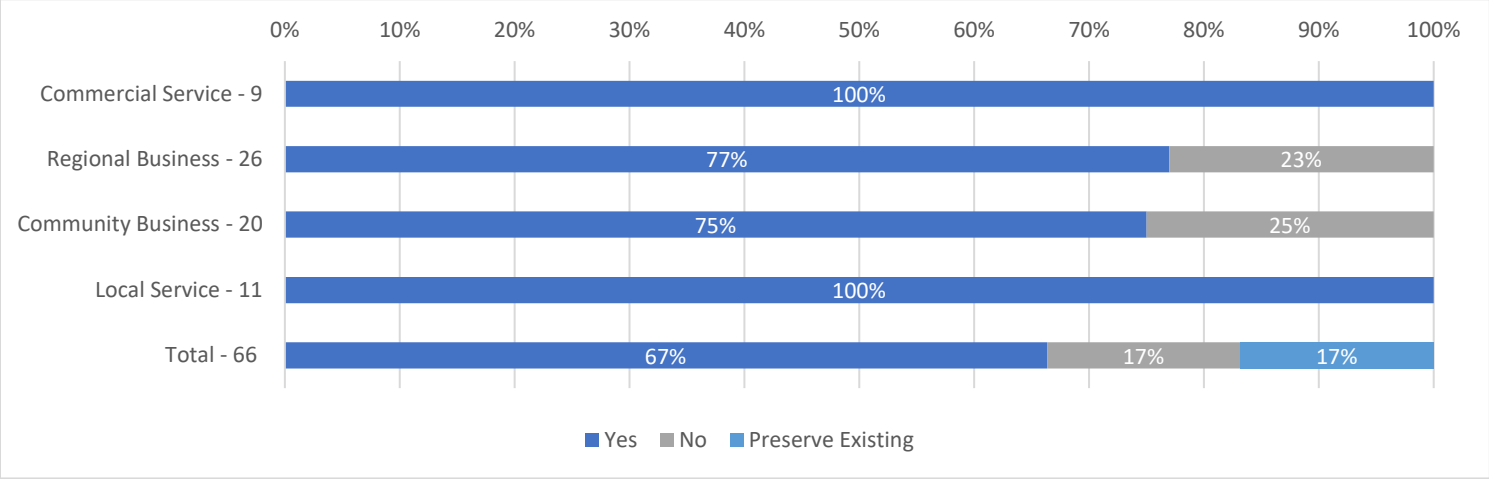


Figure 7-26: Percentage of Airports Meeting Runway Strength Targets

Table 7-5: Airports Meeting Runway Strength Targets

VATSP Role and Number of Airports	Airports Meeting Target	Airports Not Meeting Target	Preserve Existing
Commercial Service – 9	9	0	0
Regional Business – 26	20	6	0
Community Business – 20	16	4	0
Local Service – 11	0	0	11
Total – 66	45	10	11

Source: Mead & Hunt, Inc.

The airports that did not meet their primary runway strength targets are:

- Regional Business Airports
  - Louisa County/Freeman Field (LKU)
  - Mountain Empire (MKJ)
  - Accomack County (MFV)
  - Dinwiddie County (PTB)
  - Mecklenburg-Brunswick Regional (AVC)
  - Grundy Replacement Airport (GDY)
- Community Business Airports
  - Franklin Regional (FKN)
  - Orange County (OMH)
  - Crewe Municipal (W81)
  - Shannon (EZF)

Primary Runway Instrumentation

Primary runway instrumentation addresses the recommended approach lighting systems, runway edge lighting, and precision approach path indicators. **Figure 7-27** shows that more than two-thirds of the Virginia aviation system meets the respective targets for primary runway instrumentation. **Table 7-6** lists the airports by role that meet or do not meet their primary runway instrumentation targets. All of the Commercial Service Airports meet their targets, while all but one Regional Business Airport meets the targets. Only half of the Community Business Airports meet their target, with most lacking REILs or some type of approach lighting system on their primary runway.

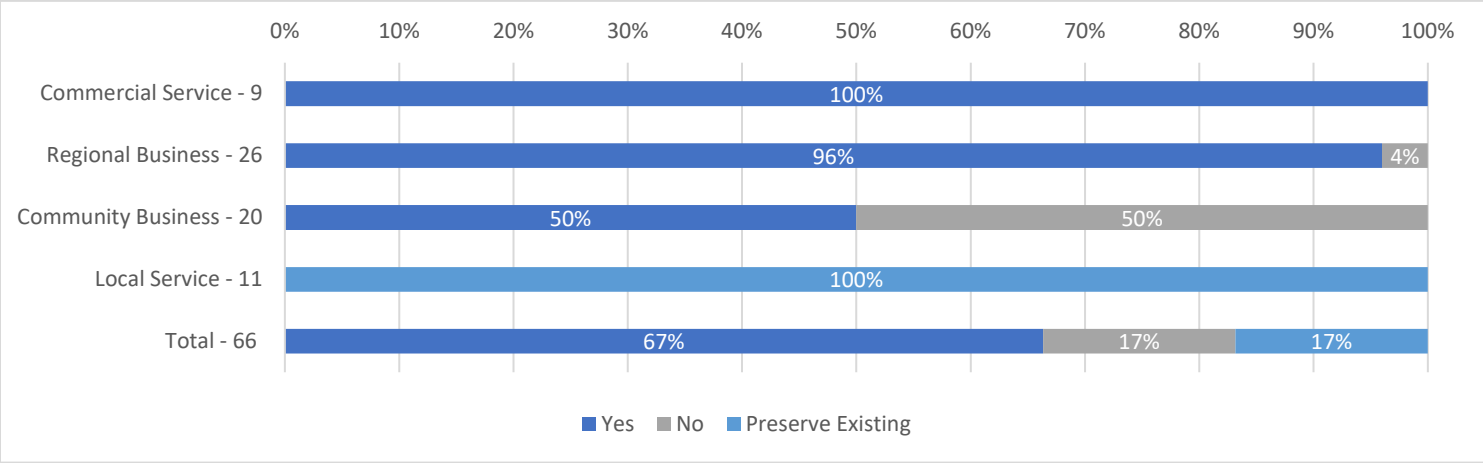


Figure 7-27: Percentage of Airports Meeting Primary Runway Instrumentation Targets

Table 7-6: Airports Meeting Primary Runway Instrumentation Targets

VATSP Role and Number of Airports	Airports Meeting Target	Airports Not Meeting Target	Preserve Existing
Commercial Service – 9	9	0	0
Regional Business – 26	25	1	0
Community Business – 20	10	10	0
Local Service – 11	0	0	11
Total – 66	44	11	11

Source: Mead & Hunt, Inc.

The airports that did not meet their primary runway instrumentation targets, and the components missing, are:

- Regional Business Airports
  - Grundy Replacement Airport (GDY) – Lacking PAPI
- Community Business Airports
  - Wakefield Municipal (AKQ) – Lacking REIL and PAPI
  - Allen C Perkinson Blackstone AAF (BKT) – Lacking REIL and PAPI
  - Shannon (EZF) – Lacking REIL
  - Franklin Regional (FKN) – Lacking REIL
  - Front Royal-Warren County (FRR) – Lacking REIL
  - Williamsburg-Jamestown (JGG) – Lacking PAPI
  - Tangier Island (TGI) – Lacking REIL, MIRL, and PAPI
  - Lake Country Regional (W63) – Lacking REIL and PAPI
  - Hummel Field (W75) – Lacking REIL
  - Crewe Municipal (W81) – Lacking REIL and PAPI

Taxiway System

The taxiway system for an airport's primary runway supports the operation of the runway. The type of taxiway system can contribute to safety and efficiency by minimizing the amount of time an aircraft spends on the runway, with busier airports generally benefiting from more extensive taxiway systems. **Figure 7-28** shows that 82 percent of system airports meet their taxiway system targets. Most of the airports not meeting their taxiway system target are in the Community Business role, as illustrated in **Table 7-7**. Overall, 12 airports are lacking the taxiway system recommended for their role.

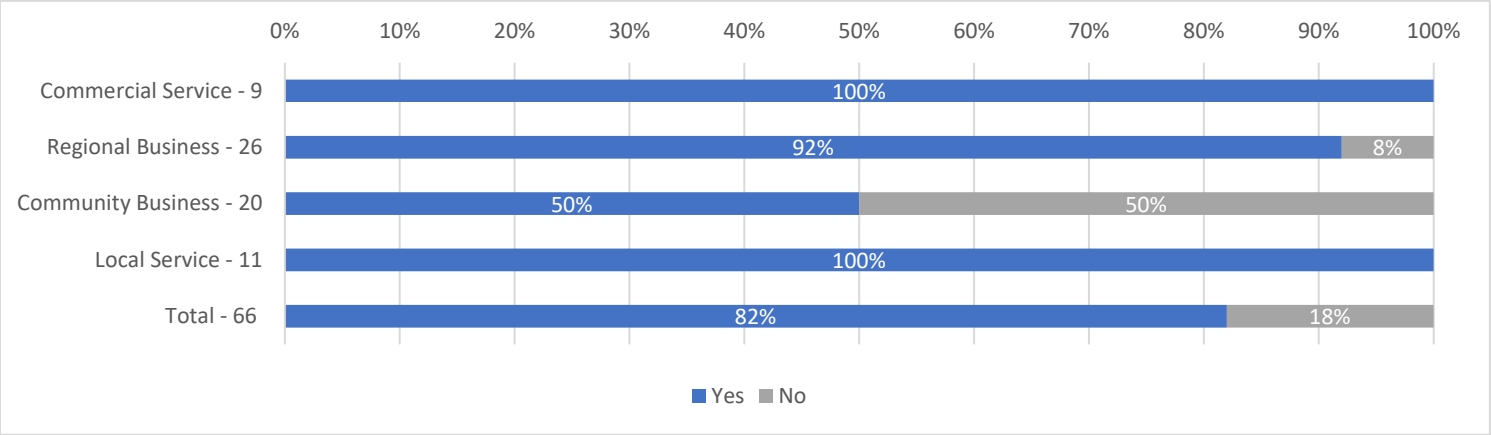


Figure 7-28: Percentage of Airports Meeting Taxiway Targets

Table 7-7: Airports Meeting Taxiway System Targets

VATSP Role and Number of Airports	Taxiway System Target	Airports Meeting Target	Airports Not Meeting Target
Commercial Service – 9	Full Parallel	9	0
Regional Business – 26	Full Parallel	24	2
Community Business –	Partial Parallel	10	10
Local Service – 11	Stub	11	0
Total – 66		54	12

Source: Mead & Hunt, Inc.

The airports not meeting their taxiway system targets, and any potential development limits, are:

- Regional Business Airports
  - Lonesome Pine (LNP) – Development constraints/terrain
  - Accomack County (MFV)
- Community Business Airports
  - Brookneal/Campbell County (0V4)
  - Wakefield Municipal (AKQ)
  - Allen C Perkinson Blackstone AAF (BKT)
  - Farmville Regional (FVX)
  - Tazewell County (JFZ)
  - Luray Caverns (LUA)
  - Tangier Island (TGI) – Development Constraints/Terrain
  - Lake Country Regional (W63) – Development Constraints/Terrain
  - Hummel Field (W75)
  - Crewe Municipal (W81) – Development Constraints/Terrain

Automated Weather Reporting

The analysis of the aviation system's automated weather reporting showed results in line with the geographic coverage by weather reporting. Virginia's aviation system has a substantial automated weather reporting network, with only 2 percent of system airports falling short of their target, as shown in **Figure 7-29**. **Table 7-8** shows that a single Regional Business Airport does not meet its automated weather reporting target. Even though there is no target for the Local Service Airports, this analysis found that only three of these airports lacked automated weather reporting, with all three of these airports owned by private entities.

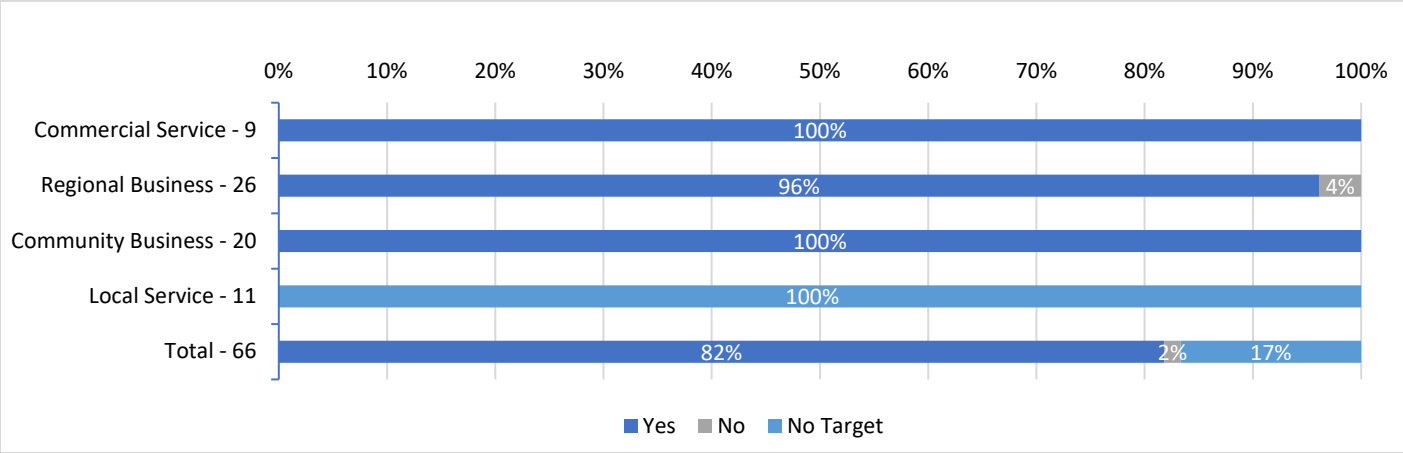


Figure 7-29: Percentage of Airports Meeting Automated Weather Reporting Targets

Table 7-8: Airports Meeting Automated Weather Reporting Targets

VATSP Role and Number of Airports	Airports Meeting Target	Airports Not Meeting Target	Airports without a Target
Commercial Service – 9	9	0	0
Regional Business – 26	25	1	0
Community Business – 20	20	0	0
Local Service – 11	0	0	11
Total – 66	54	1	11

Source: Mead & Hunt, Inc.

The airport that does not meet its automated weather reporting targets is:

- Regional Business Airports
  - Grundy Replacement Airport (GDY) – DOAV plans for GDY to have automated weather reporting when it opens.

Visual Guidance

The visual guidance analysis assessed each airport for its recommended visual aids, which consisted of rotating beacons and windcones. **Figure 7-30** shows that 88 percent of system airports meet their respective visual guidance targets. **Table 7-9** shows the eight airports that fall short of their targets. Half of these are Local Service Airports, with most of them lacking a rotating beacon. The remainder are split between Regional Business Airports and Community Business Airports, with each of them lacking lighted windcones.

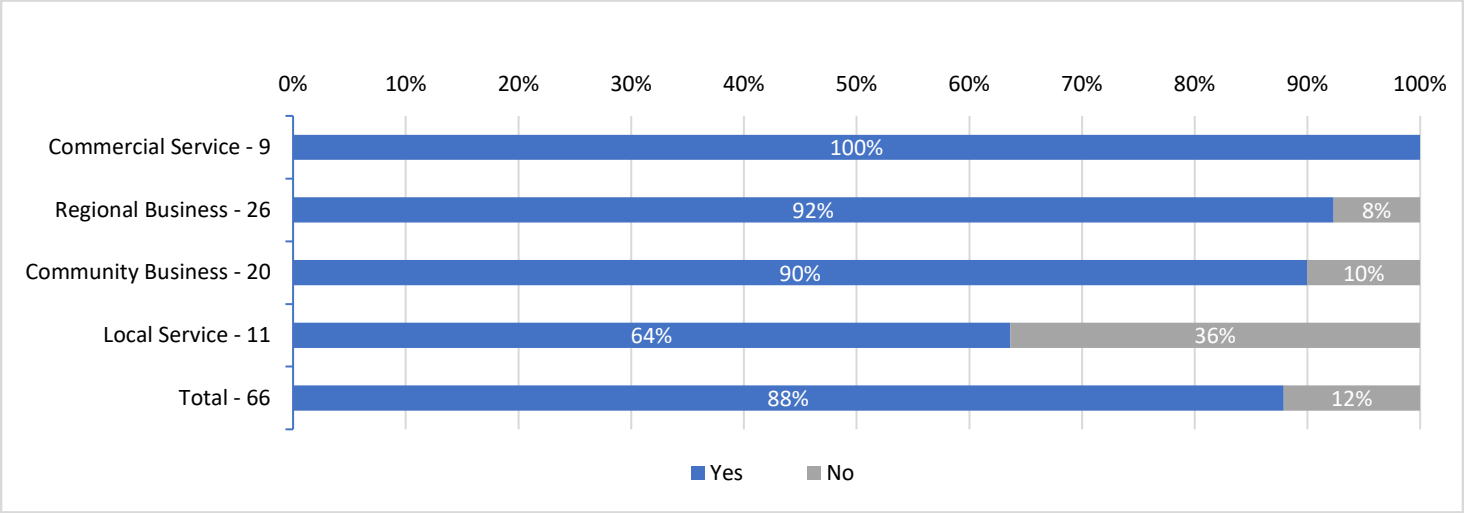


Figure 7-30: Percentage of Airports Meeting Visual Guidance Targets

Table 7-9: Airports Meeting Visual Guidance Targets

VATSP Role and Number of Airports	Airports Meeting Target	Airports Not Meeting Target
Commercial Service – 9	9	0
Regional Business – 26	24	2
Community Business – 20	18	2
Local Service – 11	7	4
Total – 66	58	8

Source: Mead & Hunt, Inc.

The airports that do not meet their visual guidance targets, and the facilities that are lacking, are listed below.

- Regional Business Airports
  - Grundy Replacement Airport (GDY) – Lacking lighted windcone
  - Leesburg Executive (JYO) – Lacking lighted windcone
- Community Business Airports
  - Lake Country Regional (W63) – Lacking lighted windcone
  - Tangier Island (TGI) – Lacking lighted windcone
- Local Service Airports
  - Chase City Municipal (CXE) – Lacking rotating beacon
  - Falwell (W24) – Lacking rotating beacon
  - Lake Anna (7W4) – Lacking windcone
  - New London (W90) – Lacking rotating beacon

Instrument Approach Minimums on Primary Runway

The development efforts of Virginia's airports and DOAV have resulted in an instrument approach procedure (IAP) at every system airport. Further refinement of this part of the Virginia aviation system is focused on the minimums of the best IAP at each airport. The minimums are the limits of two weather conditions, cloud ceiling and flight visibility, under which flight crews are able to use the IAP to successfully arrive at the airport during periods of poor weather. Each airport role has recommended targets for cloud ceiling and flight visibility on its best IAP.

Approximately three-quarters of Virginia's system airports have IAPs with minimums that meet the respective minimum targets for that airport. As shown in **Figure 7-31**, the Community Business Airports, followed by the Regional Business Airports, have the greatest shortfalls. **Table 7-10** tabulates the number of airports by role that have minimums that do not meet their targets. Most of these airports fall in the Community Business Airport role.

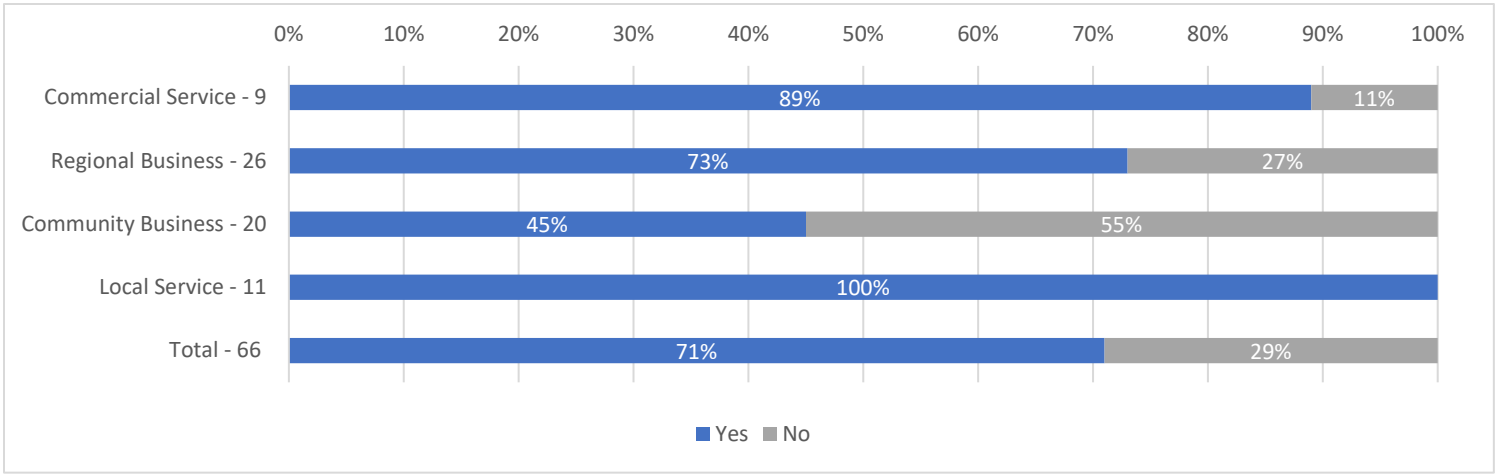


Figure 7-31: Percentage of Airports Meeting Instrument Approach Minimum Targets

Table 7-10: Airports Meeting Instrument Approach Procedure Targets

VATSP Role and Number of Airports	IAP Minimums Target	Airports Meeting Target	Airports Not Meeting Target
Commercial Service – 9	200 and ½	8	1
Regional Business – 26	250 and 1	19	7
Community Business – 20	500 and 1	9	11
Local Service – 11	1,100 and 3	11	0
Total – 66		47	19

Note: IAP minimums expressed for cloud ceiling (in feet above ground level) and flight visibility (in statute miles).
Source: Mead & Hunt, Inc.

The following airports have IAP minimums that do not meet their respective targets. For each airport, the minimum that does not meet its target is listed.

- Commercial Service Airports
  - Roanoke-Blacksburg Regional/Woodrum Field (ROA) – IAP ceiling above 200 feet and IAP visibility above ½ mile
- Regional Business Airports
  - Culpeper Regional (CJR) – IAP ceiling above 250 feet
  - Ingalls Field (HSP) – IAP ceiling above 250 feet
  - Lonesome Pine (LNP) – IAP ceiling above 250 feet
  - Mountain Empire (MKJ) – IAP ceiling above 250 feet and IAP visibility above one mile
  - Suffolk Executive (SFQ) – IAP ceiling above 250 feet
  - Virginia Tech/Montgomery Executive (BCB) – IAP ceiling above 250 feet
  - Grundy Replacement Airport (GDY) – DOAV plans for GDY to have an IAP ceiling of 250 feet and IAP visibility of one mile when the airport opens.
- Community Business Airports
  - Crewe Municipal (W81) – IAP ceiling above 500 feet
  - Front Royal-Warren County (FRR) – IAP ceiling above 500 feet and IAP visibility above one mile
  - Hummel Field (W75) – IAP ceiling above 500 feet and IAP visibility above one mile
  - Lake Country Regional (W63) – IAP ceiling above 500 feet
  - Luray Caverns (LUA) – IAP ceiling above 500 feet
  - Orange County (OMH) – IAP ceiling above 500 feet
  - Shannon (EZF) – IAP ceiling above 500 feet
  - Tangier Island (TGI) – IAP ceiling above 500 feet
  - Wakefield Municipal (AKQ) – IAP ceiling above 500 feet and IAP visibility above one mile
  - Williamsburg-Jamestown (JGG) – IAP ceiling above 500 feet and IAP visibility above one mile

Remote Towers

Virginia has led the way in the development of remote towers, with the remote tower operation at Leesburg Executive Airport (JYO) being one of two operating in the U.S. Remote towers, using technology, offer the ability to consolidate air traffic control operations while offering those services to locations where activity levels are unlikely to justify the construction and operation of a traditional airport traffic control tower (ATCT).

This analysis evaluated the Virginia aviation system for potential candidate airports that might benefit from a remote tower. This initial screening is the first step in a process of assessing whether an airport is suitable for a remote tower. It considered Commercial Service Airports without an ATCT, and Regional Business Airports without an ATCT and three or more based jets, as candidates for a remote tower. It also identified airports with federal contract towers as possible remote tower replacements.

Figure 7-32 indicates a third of the Commercial Service Airports and just under 20 percent of the Regional Business Airports meet the criteria for consideration of a remote tower.

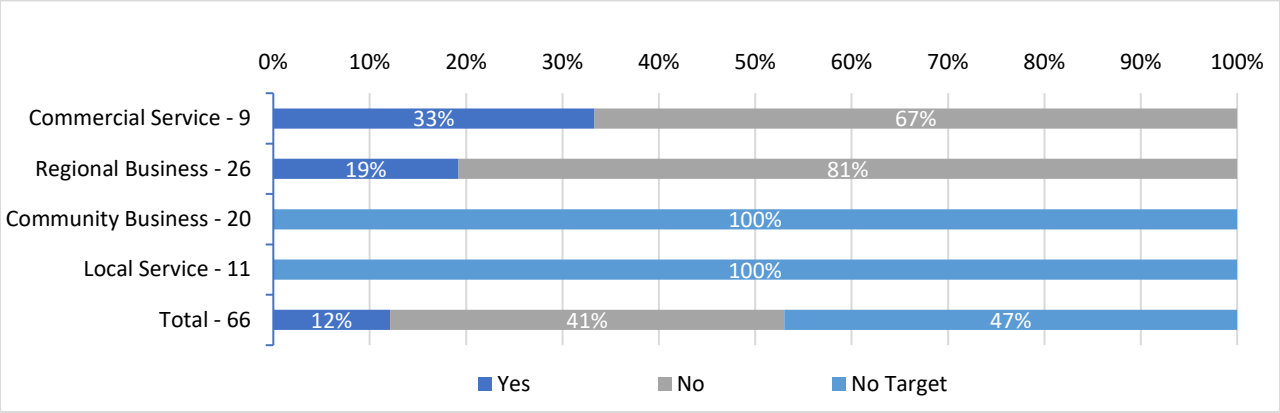


Figure 7-32: Percentage of Airports Considered for Remote Tower

As shown in **Table 7-11**, three of the Commercial Service Airports were identified as possible remote tower locations. Two of these airports host federal contract towers. Five Regional Business Airports were characterized as potential remote tower sites.

Table 7-11: Airports Considered for Remote Tower

VATSP Role and Number of Airports	Airports Considered for Remote Tower	Airports Not Considered for Remote Tower	Airports with No Target
Commercial Service – 9	3	6	0
Regional Business – 26	5	21	0
Community Business – 20	0	0	20
Local Service – 11	0	0	11
Total – 66	8	27	31

Source: Mead & Hunt, Inc.

The airports identified as meeting the criteria for consideration as remote tower sites are:

- Commercial Service
  - Charlottesville-Albemarle (CHO) – Federal contract tower
  - Lynchburg Regional/Preston Glenn Field (LYH) – Federal contract tower
  - Shenandoah Valley Regional (SHD)
- Regional Business Airports
  - Hampton Roads Executive (PVG)
  - Hanover County Municipal (OFP)
  - Richmond Executive-Chesterfield County (FCI)
  - Virginia Highlands (VJI)
  - Virginia Tech/Montgomery Executive (BCB)

Terminal Facilities

The targets for airport terminal facilities had a different basis for each airport role. Commercial Service Airports had a terminal facility target based on their existing master plan. Regional Business and Community Business Airports had a terminal facility target of a minimum square footage of space that was based on a DOAV model that accounted for various needs within the terminal (such as mechanical space and restrooms) plus a factor based on the aircraft operations at the airport. Local Service Airports were evaluated against a fixed terminal facility target of 1,236 square feet. **Figure 7-33** indicates that 85 percent of the system airports met their terminal facilities target. Airports that fell short of their terminal facilities targets are in the Regional Business and Community Business Airport roles, with most in the Community Business Airport role, as shown in **Table 7-12**

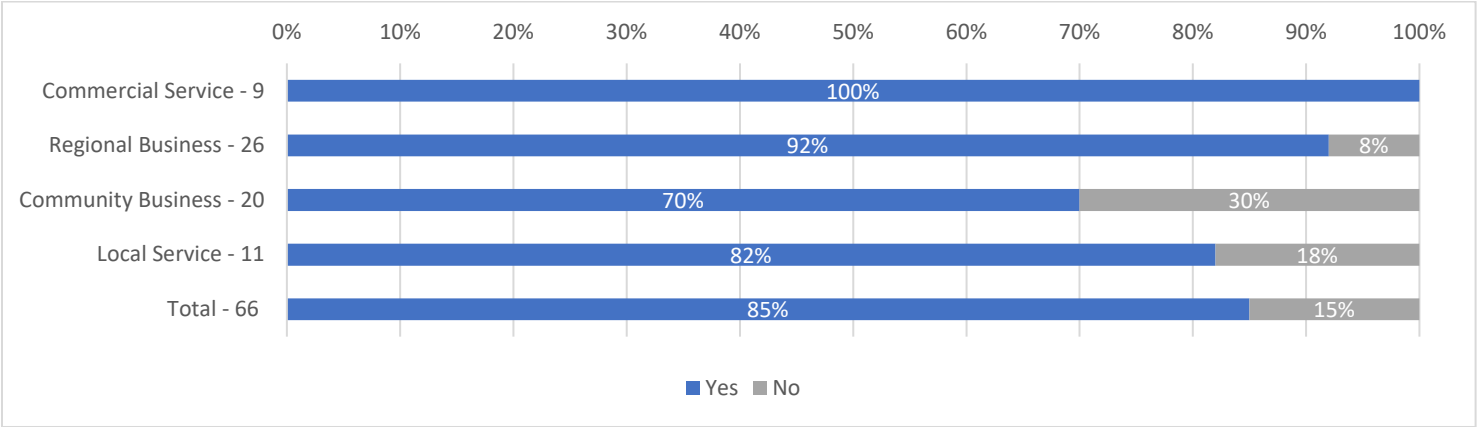


Figure 7-33: Percentage of Airports Meeting Terminal Facilities Targets

Table 7-12: Airports Meeting Terminal Facilities Targets

VATSP Role and Number of Airports	Airports Meeting Target	Airports Not Meeting Target
Commercial Service – 9	9	0
Regional Business – 26	24	2
Community Business – 20	14	6
Local Service – 11	9	2
Total – 66	56	10

Source: Mead & Hunt, Inc.

The airports not meeting their terminal facility targets and the amount of space their terminal lacks are:

- Regional Business Airports
  - Grundy Replacement Airport (GDY) – 797 square feet
  - Suffolk Executive (SFQ) – 126 square feet
- Community Business Airports
  - Brookneal/Campbell County (0V4) – 958 square feet
  - Lake Country Regional (W63) – 181 square feet
  - Luray Caverns (LUA) – 817 square feet
  - Tangier Island (TGI) – 1,609 square feet
  - Wakefield Municipal (AKQ) – 781 square feet
  - Williamsburg-Jamestown (JGG) – 2,839 square feet
- Local Service Airports
  - Gordonsville Municipal (GVE) – no terminal
  - Lake Anna (7W4) – no terminal

Hangar Space

The analysis of airports meeting their hangar space target indicated a significant demand for hangar space in Virginia. The analysis was based on each airport providing hangar space sufficient for its based aircraft, both in 2021 and its forecast based aircraft in 2044. As indicated in **Figure 7-34**, only 18 percent of system airports meet and are forecast to meet future hangar space demands. **Table 7-13** identifies which airport roles have the greatest number of airports that do not meet their hangar space targets. With 19 airports, the Regional Business Airports stand out as not meeting their hangar space target.

It should be noted that 13 airports, or nearly a quarter of the system airports, did not provide sufficient data to analyze the hangar space performance measure. It stands to reason that because of these non-responsive airports, the demand for hangar space is understated in this analysis.

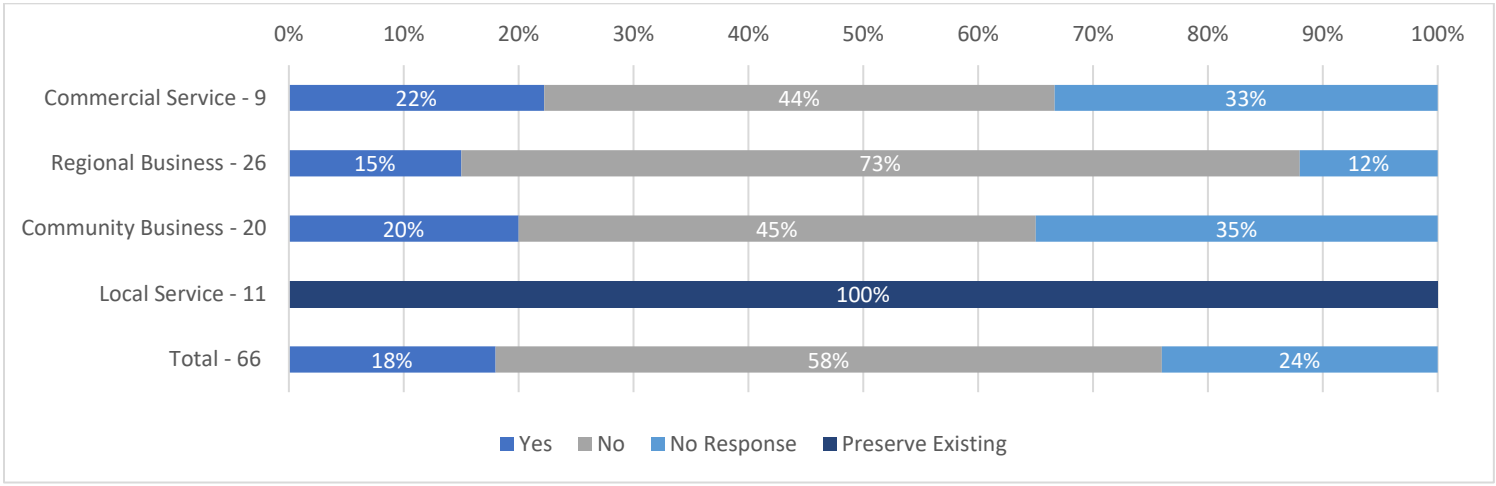


Figure 7-34: Percentage of Airports Meeting Hangar Space Targets

Table 7-13: Airports Meeting Hangar Space Targets

VATSP Role and Number of Airports	Airports Meeting Target	Airports Not Meeting Target	No Response	Preserve Existing
Commercial Service – 9	2	4	3	0
Regional Business – 26	4	19	3	0
Community Business – 20	4	9	7	0
Local Service – 11	0	0	0	11
Total – 66	10	32	13	11

Source: Mead & Hunt, Inc.

The airports that do not meet their hangar space target, and the number of aircraft spaces short of that target, are listed below. For airports with two numbers listed, the first number is the shortfall of aircraft spaces in 2021, and the second number is the projected shortfall in 2044, which is in addition to the 2021 shortfall.

- Commercial Service Airports
  - Charlottesville-Albemarle (CHO) – 0 aircraft spaces/17 aircraft spaces
  - Lynchburg Regional/Preston Glenn Field (LYH) – 69 aircraft spaces/23 aircraft spaces
  - Norfolk International (ORF) – 39 aircraft spaces/10 aircraft spaces
  - Roanoke-Blacksburg Regional/Woodrum Field (ROA) – 91 aircraft spaces
  - Shenandoah Valley Regional (SHD) – 31 aircraft spaces
- Regional Business Airports
  - Chesapeake Regional (CPK) – 27 aircraft spaces/48 aircraft spaces
  - Culpeper Regional (CJR) – 13 aircraft spaces/46 aircraft spaces
  - Danville Regional (DAN) – 9 aircraft spaces/4 aircraft spaces
  - Dinwiddie County (PTB) – 6 aircraft spaces
  - Emporia-Greensville Regional (EMV) – 0 aircraft spaces/1 aircraft space
  - Hanover County Municipal (OFP) – 49 aircraft spaces/25 aircraft spaces
  - Ingalls Field (HSP) – 1 aircraft space/2 aircraft spaces
  - Leesburg Executive (JYO) – 134 aircraft spaces/8 aircraft spaces
  - Lonesome Pine (LNP) – 15 aircraft spaces
  - Louisa County/Freeman Field (LKU) – 9 aircraft spaces/8 aircraft spaces
  - Manassas Regional/Harry P Davis Field (HEF) – 250 aircraft spaces/36 aircraft spaces
  - Mecklenburg-Brunswick Regional (AVC) – 0 aircraft spaces/11 aircraft spaces
  - Middle Peninsula Regional (FYJ) – 27 aircraft spaces/11 aircraft spaces
  - Mountain Empire (MKJ) – 13 aircraft spaces
  - New River Valley (PSK) – 15 aircraft spaces/9 aircraft spaces
  - Stafford Regional (RMN) – 19 aircraft spaces/27 aircraft spaces
  - Suffolk Executive (SFQ) – 6 aircraft spaces
  - Virginia Highlands (VJI) – 5 aircraft spaces/7 aircraft spaces
  - Virginia Tech/Montgomery Executive (BCB) – 23 aircraft spaces/4 aircraft spaces
  - Warrenton-Fauquier (HWY) – 11 aircraft spaces/11 aircraft spaces
  - Winchester Regional (OKV) – 44 aircraft spaces/10 aircraft spaces
- Community Business Airports
  - Front Royal-Warren County (FRR) – 7 aircraft spaces/9 aircraft spaces
  - Hummel Field (W75) – 19 aircraft spaces
  - Luray Caverns (LUA) – 3 aircraft spaces/9 aircraft spaces
  - New Kent County (W96) – 11 aircraft spaces/3 aircraft spaces
  - Orange County (OMH) – 13 aircraft spaces/14 aircraft spaces
  - Shannon (EZF) – 10 aircraft spaces
  - Tappahannock-Essex County (XSA) – 2 aircraft spaces/15 aircraft spaces
  - Tazewell County (JFZ) – 5 aircraft spaces/3 aircraft spaces
  - Wakefield Municipal (AKQ) – 2 aircraft spaces
  - Williamsburg-Jamestown (JGG) – 0 aircraft spaces/2 aircraft spaces
- Local Service Airports
  - Bridgewater Air Park (VBW) – 40 aircraft spaces
  - Eagle's Nest (W13) – 14 aircraft spaces/4 aircraft spaces
  - Falwell (W24) – 10 aircraft spaces/3 aircraft spaces
  - Gordonsville Municipal (GVE) – 3 aircraft spaces
  - Lake Anna (7W4) – 1 aircraft space/1 aircraft space
  - New Market (8W2) – 2 aircraft spaces/3 aircraft spaces

Maintenance Equipment

The maintenance equipment needed to support airport operations can be substantial. For this analysis, the following recommended targets were set for each airport role.

- Commercial Service Airports – Snow removal equipment, mower, tractor, vehicle attachments, front end loader, truck, debris sweeper, other maintenance equipment as needed
- Regional Business Airports – Snow removal equipment, mower, tractor, vehicle attachments, front end loader, truck, debris sweeper
- Community Business Airports – Mower, tractor, vehicle attachments, front end loader, truck, debris sweeper
- Local Service Airports – No target recommended

Figure 7-35 shows the percentage of airports that meet their recommended maintenance equipment targets. Nearly 90 percent of the Commercial Service Airports reported meeting their target. Less than 20 percent of the Regional Business and Community Business Airports reported meeting their targets. **Table 7-14** compiles the responses by airport role and number of airports.

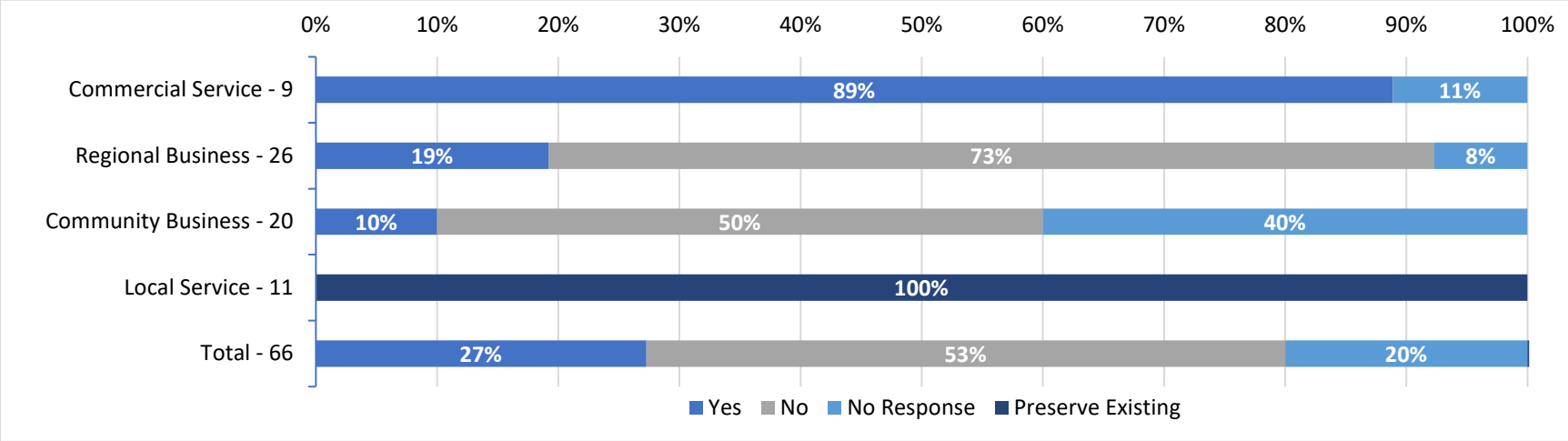


Figure 7-35: Percentage of Airports Meeting Maintenance Equipment Targets

Table 7-14: Airports Meeting Maintenance Equipment Targets

VATSP Role and Number of Airports	Airports Meeting Target	Airports Not Meeting Target	No Response	Preserve Existing
Commercial Service – 9	8	0	1	0
Regional Business – 26	5	19	2	0
Community Business – 20	2	10	8	0
Local Service – 11	0	0	0	11
Total – 66	15	29	11	11

Source: Mead & Hunt, Inc.

The airports that do not meet their maintenance equipment targets are listed below, along with what equipment they are lacking.

- Regional Business Airports
  - Accomack County (MFV) – vehicle attachments, front end loader, and debris sweeper
  - Blue Ridge (MTV) – debris sweeper
  - Culpeper Regional (CJR) – front end loader, truck, and debris sweeper
  - Danville Regional (DAN) – front end loader
  - Dinwiddie County (PTB) – vehicle attachments, truck, and debris sweeper
  - Emporia-Greensville Regional (EMV) – vehicle attachments, front end loader, and debris sweeper
  - Ingalls Field (HSP) – vehicle attachments, front end loader, and debris sweeper
  - Leesburg Executive (JYO) – debris sweeper
  - Lonesome Pine (LNP) – vehicle attachments, front end loader, and debris sweeper
  - Louisa County/Freeman Field (LKU) – snow removal equipment, vehicle attachments, front end loader, truck, and debris sweeper
  - Manassas Regional/Harry P Davis Field (HEF) – front end loader, and debris sweeper
  - Mecklenburg-Brunswick Regional (AVC) – snow removal equipment, vehicle attachments, front end loader, truck, and debris sweeper
  - Middle Peninsula Regional (FYJ) – debris sweeper
  - Mountain Empire (MKJ) – debris sweeper
  - New River Valley (PSK) – vehicle attachments, front end loader, and debris sweeper
  - Stafford Regional (RMN) – debris sweeper
  - Suffolk Executive (SFQ) – snow removal equipment, vehicle attachments, and debris sweeper
  - Virginia Tech/Montgomery Executive (BCB) – vehicle attachments, front end loader, and debris sweeper
  - Winchester Regional (OKV) – front end loader, and debris sweeper
- Community Business Airports
  - Allen C Perkinson Blackstone AAF (BKT) – front end loader and debris sweeper
  - Farmville Regional (FVX) – vehicle attachments, front end loader, and debris sweeper
  - Hummel Field (W75) – vehicle attachments, front end loader, and debris sweeper
  - Luray Caverns (LUA) – vehicle attachments and debris sweeper
  - Orange County (OMH) – vehicle attachments and debris sweeper
  - Shannon (EZF) – debris sweeper
  - Tangier Island (TGI) – front end loader
  - Tappahannock-Essex County (XSA) – tractor, vehicle attachments, and front end loader
  - Tazewell County (JFZ) – vehicle attachments and debris sweeper
  - Williamsburg-Jamestown (JGG) – vehicle attachments, front end loader, and debris sweeper

Airport Parking (non-revenue)

Non-revenue airport parking supports airport operations by providing parking spots for employees, airport users, and visitors. The recommended targets for non-revenue airport parking serve as guidelines for evaluating the parking available. The targets considered the employment as reported in the last statewide airport economic impact study and the number of based aircraft at the airport.

Figure 7-36 illustrates the degree to which more non-revenue airport parking is needed at Virginia's airports. Only 21 percent of Virginia's airports met their non-revenue airport parking target. **Table 7-15** shows the number of airports that meet, do not meet, or did not respond to this performance measure. Of note is that 18 out of the 26 Regional Business Airports lacked sufficient parking to meet their target.

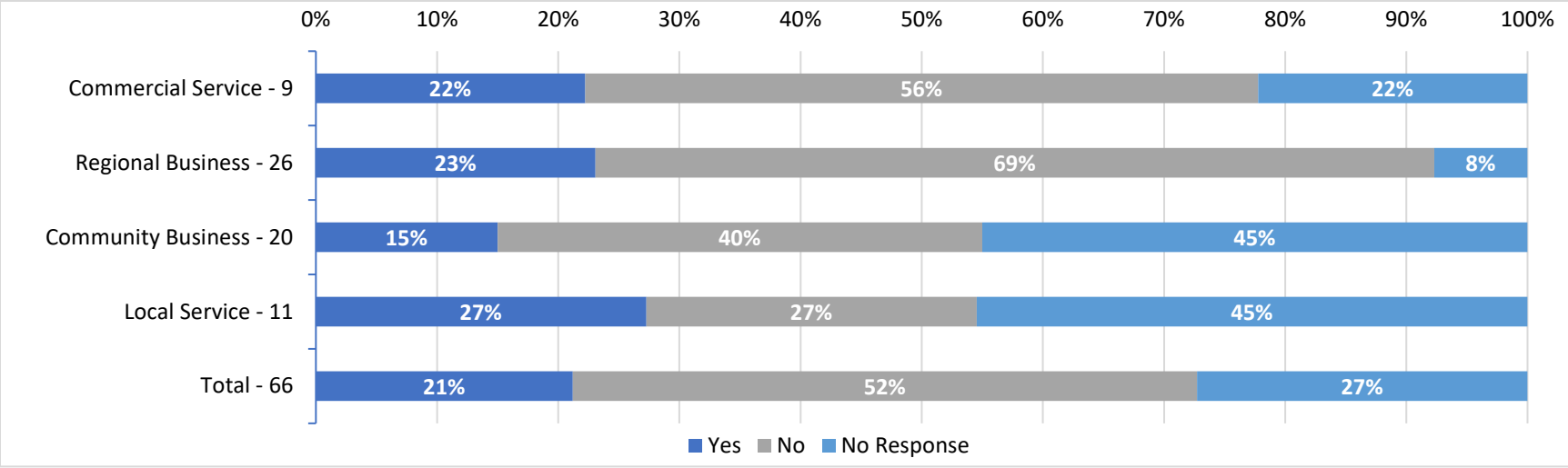


Figure 7-36: Percentage of Airports Meeting Non-Revenue Airport Parking Targets

Table 7-15: Airports Meeting Non-Revenue Airport Parking Targets

VATSP Role and Number of Airports	Airports Meeting Target	Airports Not Meeting Target	No Response
Commercial Service – 9	2	5	2
Regional Business – 26	6	18	2
Community Business – 20	3	8	9
Local Service – 11	3	3	5
Total – 66	14	34	18

Source: Mead & Hunt, Inc.

The airports that did not meet their auto parking targets are listed below, along with the number of parking spaces below their target.

- Commercial Service Airports
  - Charlottesville-Albemarle (CHO) – 93 parking spaces
  - Lynchburg Regional/Preston Glenn Field (LYH) – 185 parking spaces
  - Norfolk International (ORF) – 467 parking spaces
  - Richmond International (RIC) – 914 parking spaces
  - Ronald Reagan Washington National (DCA) – 1,640 parking spaces
- Regional Business Airports
  - Accomack County (MFV) – 22 parking spaces
  - Blue Ridge (MTV) – 48 parking spaces
  - Chesapeake Regional (CPK) – 127 parking spaces
  - Culpeper Regional (CJR) – 119 parking spaces
  - Dinwiddie County (PTB) – 43 parking spaces
  - Emporia-Greensville Regional (EMV) – 10 parking spaces
  - Hanover County Municipal (OFP) – 77 parking spaces
  - Leesburg Executive (JYO) – 278 parking spaces
  - Louisa County/Freeman Field (LKU) – 48 parking spaces
  - Manassas Regional/Harry P Davis Field (HEF) – 316 parking spaces
  - Middle Peninsula Regional (FYJ) – 42 parking spaces
  - New River Valley (PSK) – 34 parking spaces
  - Richmond Executive-Chesterfield County (FCI) – 60 parking spaces
  - Suffolk Executive (SFQ) – 74 parking spaces
  - Virginia Highlands (VJI) – 54 parking spaces
  - Virginia Tech/Montgomery Executive (BCB) – 5 parking spaces
  - Warrenton-Fauquier (HWY) – 52 parking spaces
  - Winchester Regional (OKV) – 127 parking spaces
- Community Business Airports
  - Allen C Perkinson Blackstone AAF (BKT) – 72 parking spaces
  - Front Royal-Warren County (FRR) – 59 parking spaces
  - Hummel Field (W75) – 26 parking spaces
  - Lake Country Regional (W63) – 1 parking space
  - New Kent County (W96) – 25 parking spaces
  - Orange County (OMH) – 82 parking spaces
  - Tappahannock-Essex County (XSA) – 3 parking spaces
  - Williamsburg-Jamestown (JGG) – 41 parking spaces
- Local Service Airports
  - Eagle's Nest (W13) – 22 parking spaces
  - Falwell (W24) – 16 parking spaces
  - Gordonsville Municipal (GVE) – 18 parking spaces

Airport Parking (revenue)

The analysis of revenue airport parking at Commercial Service Airports was based on enplanements at the airport. This analysis serves as a rough guideline as it does not distinguish between enplanements that are origin versus destination passengers versus connecting passengers. It also does not account for airports that have multimodal options for passengers.

As shown in **Figure 7-37**, more than half of the Commercial Service Airports fall short of their revenue airport parking targets. **Table 7-16** shows that five Commercial Service Airports did not meet their revenue airport parking targets. Included among these five airports is Ronald Reagan Washington National Airport (DCA), which has historically had connecting passengers, who have no need for parking, comprise about 10 percent of its enplanements. Additionally, passengers can travel to DCA on the Washington Metro, which also reduces the need for parking capacity. In short, it is likely that the target set is more than what is actually needed for DCA.

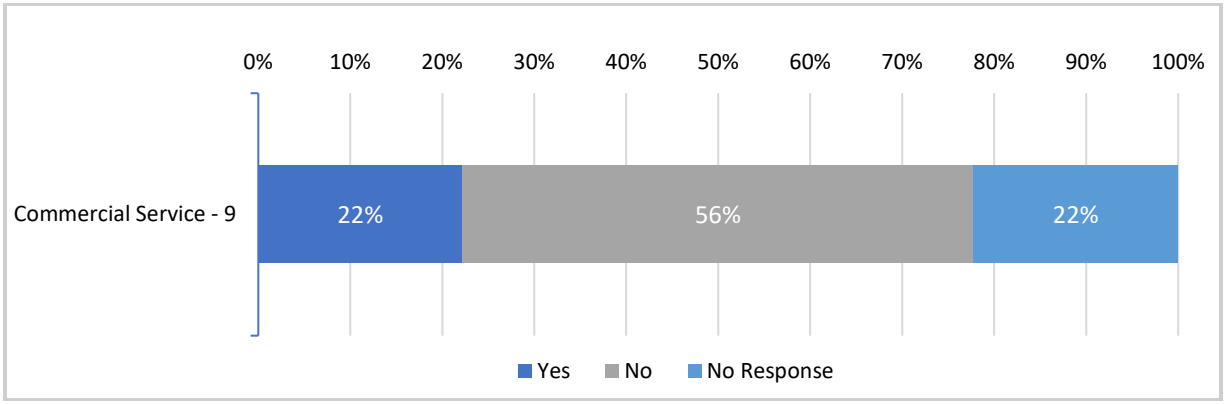


Figure 7-37: Percentage of Airports Meeting Revenue Airport Parking Targets

Table 7-16: Airports Meeting Revenue Parking Targets

VATSP Role and Number of Airports	Airports Meeting Target	Airports Not Meeting Target	No Response
Commercial Service – 9	2	5	2

Source: Mead & Hunt, Inc.

The Commercial Service Airports that did not meet their revenue airport parking targets are listed below, along with the number of parking spaces below their target.

- Charlottesville-Albemarle (CHO) – 232 parking spaces
- Lynchburg Regional/Preston Glenn Field (LYO) – 39 parking spaces
- Richmond International (RIC) – 389 parking spaces
- Ronald Reagan Washington National (DCA) – 2,976 parking spaces
- Shenandoah Valley Regional (SHD) – 17 parking spaces

Pavement Condition

The analysis of pavement condition consisted of a review of draft executive summary results from a statewide airport pavement management project that DOAV was conducting during the VATSP project. The data consisted of an average pavement condition index (PCI) for each airport's network of pavement. The index ranges from 0 to 100, with 100 indicating pavement in ideal condition. Each airport was assessed against a target PCI of 70. **Figure 7-38** shows that more than half of Virginia's airports are meeting this PCI target. As indicated in **Table 7-17**, there are 25 airports that do not meet the PCI target of 70. With continued deterioration of pavement over time, it is reasonable to conclude that the number of airports with PCI falling below 70 will increase, and that pavement maintenance costs are likely to be a significant expense for Virginia's airports.

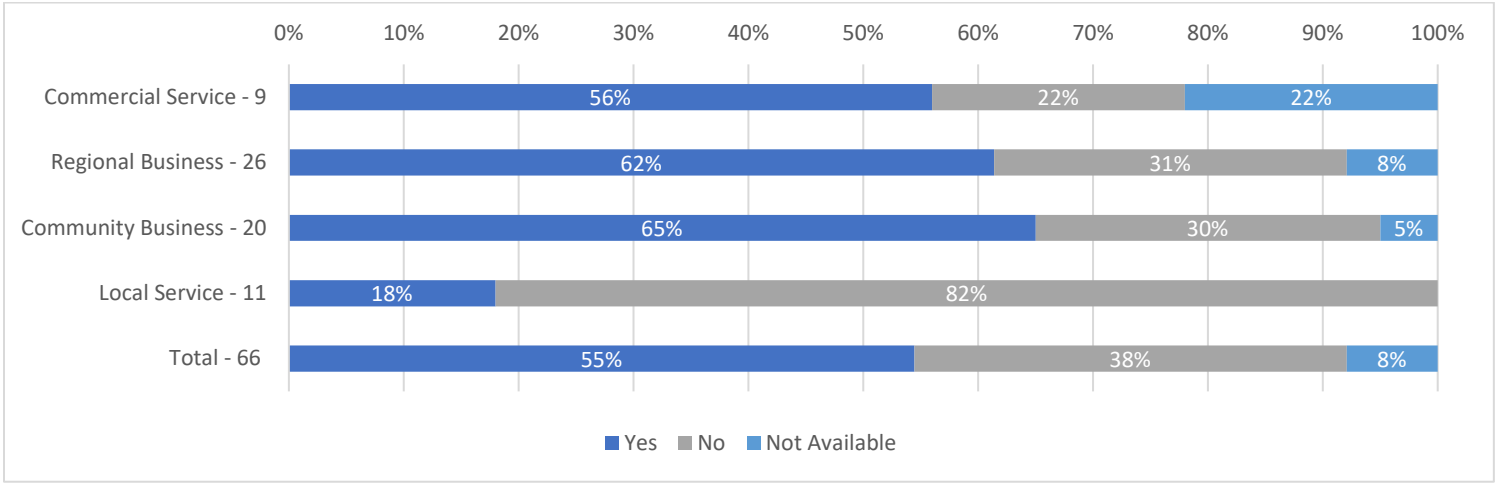


Figure 7-38: Percentage of Airports Meeting Pavement Condition Targets

Table 7-17: Airports Meeting Pavement Condition Targets

VATSP Role and Number of Airports	Airports Meeting Target	Airports Not Meeting Target	Data Not Available
Commercial Service – 9	5	2	2
Regional Business – 26	16	8	2
Community Business – 20	13	6	1
Local Service – 11	2	9	0
Total – 66	36	25	5

Source: Mead & Hunt, Inc.

The airports with an average PCI below 70 are:

- Commercial Service Airports
  - Newport News-Williamsburg (PHF)
  - Norfolk International (ORF)
- Regional Business Airports
  - Dinwiddie County (PTB)
  - Hanover County Municipal (OFP)
  - Ingalls Field (HSP)
  - Leesburg Executive (JYO)
  - Lonesome Pine (LNP)
  - Manassas Regional/Harry P Davis Field (HEF)
  - Richmond Executive-Chesterfield County (FCI)
  - Warrenton-Fauquier (HWY)
- Community Business Airports
  - Crewe Municipal (W81)
  - Franklin Regional (FKN)
  - Front Royal-Warren County (FRR)
  - Hummel Field (W75)
  - Tangier Island (TGI)
  - Wakefield Municipal (AKQ)
- Local Service Airports
  - Bridgewater Air Park (VBW)
  - Brunswick County (LVL)
  - Chase City Municipal (CXE)
  - Falwell (W24)
  - Gordonsville Municipal (GVE)
  - Lunenburg County (W31)
  - New London (W90)
  - New Market (8W2)
  - Smith Mountain Lake (W91)

Source: DOAV.

Utilities

The utilities assessed in this analysis consist of electric lightning in the GA terminal, public water, public sewer, and internet access. As indicated in **Figure 7-39**, approximately 32 percent of the aviation system falls short of this target. In most cases, the airport lacks access to either public water or sewer services. In the past, public pay phones have been a part of the utilities analysis. With the proliferation of cell phones, DOAV plans to shift the focus away from public pay phones to ensuring each airport has enhanced communications, either through accessible wi-fi connections, or reliable cell phone signals. **Table 7-18** indicates the number of airports in each role that do not meet their respective utility targets. Because of DOAV's focus shift away from public pay phones, the lack of a public pay phone is noted, but is not part of the utilities analysis. While the public phone criteria is a prime cause of airports not meeting their utility targets, a good number also lack public water and public sewer.

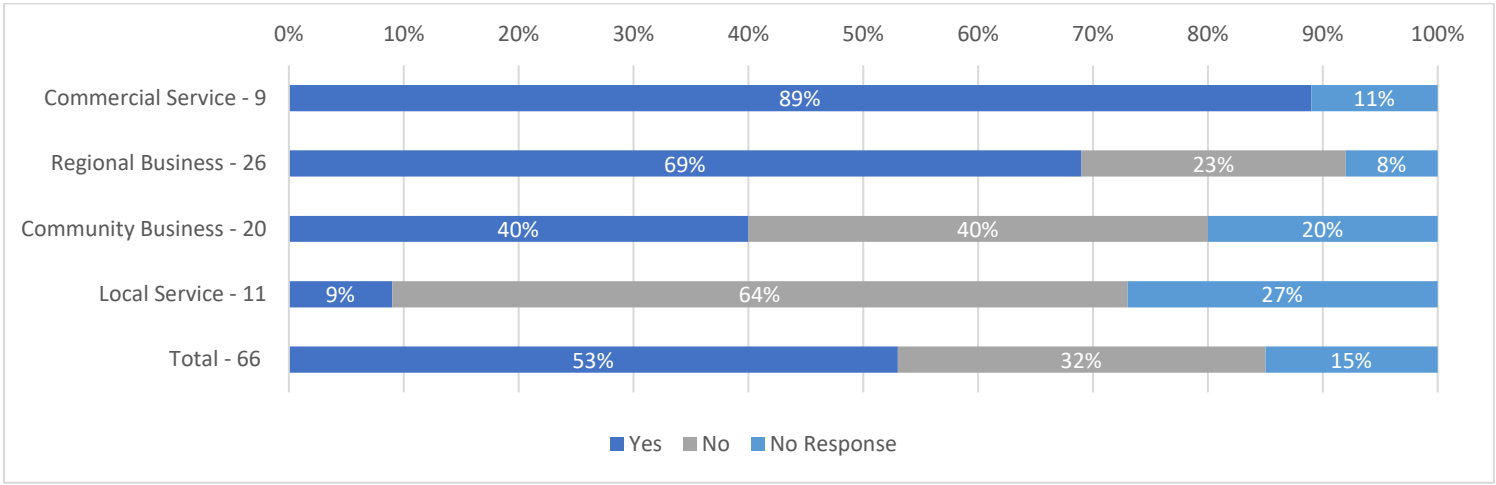


Figure 7-39: Percentage of Airports Meeting Utilities Targets

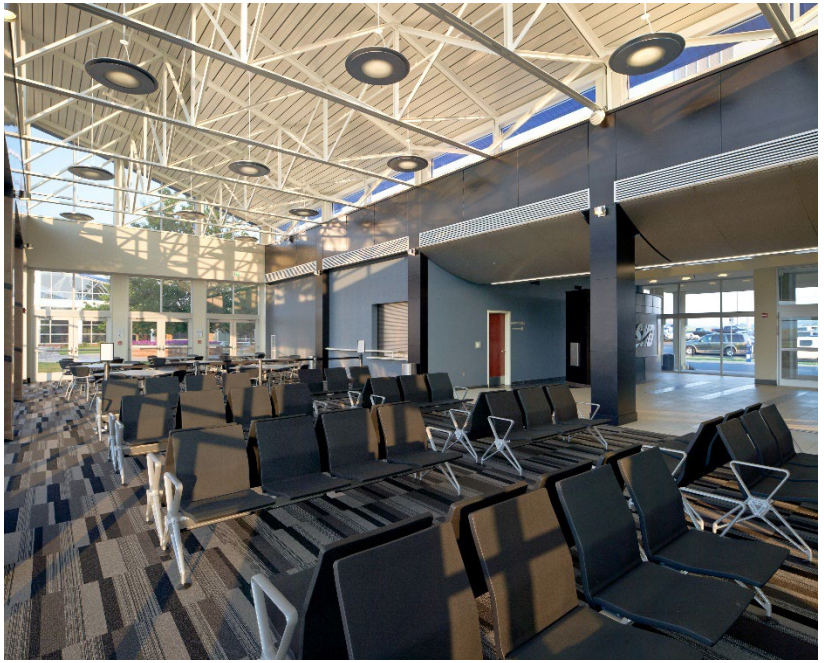
Table 7-18: Airports Meeting Utilities Targets

VATSP Role and Number of Airports	Airports Meeting Target	Airports Not Meeting Target	No Response
Commercial Service – 9	8	0	1
Regional Business – 26	17	7	2
Community Business – 20	6	10	4
Local Service – 11	3	5	3
Total – 66	34	22	10

Source: Mead & Hunt, Inc.

The airports that do not meet their utility targets, along with the specific utilities that they lack, are listed below.

- Commercial Service Airports
  - Charlottesville-Albemarle (CHO) – public phone
  - Ronald Reagan Washington National (DCA) – public phone
- Regional Business Airports
  - Accomack County (MFV) – public phone and internet access
  - Blue Ridge (MTV) – public phone and public sewer
  - Chesapeake Regional (CPK) – public water
  - Danville Regional (DAN) – public phone and public sewer
  - Emporia-Greensville Regional (EMV) – public phone, public water, and public sewer
  - Lonesome Pine (LNP) – public sewer
  - Mecklenburg-Brunswick Regional (AVC) – public phone and public sewer
  - Warrenton-Fauquier (HWY) – public phone
- Community Business Airports
  - Allen C Perkinson Blackstone AAF (BKT) – public water and public sewer
  - Brookneal/Campbell County (0V4) – public phone, public water, public sewer, and internet access
  - Farmville Regional (FVX) – public phone, public water, and public sewer
  - Front Royal-Warren County (FRR) – public phone, public water, and public sewer
  - Hummel Field (W75) – public phone, public water, and public sewer services
  - Lake Country Regional (W63) – public phone and internet access
  - Lee County (0VG) – public phone
  - New Kent County (W96) – public phone
  - Shannon (EZF) – public phone, public water, and public sewer
  - Tangier Island (TGI) – public phone, public water, public sewer services, public restroom, and internet access
  - Tappahannock-Essex County (XSA) – public phone, public water, and public sewer services
  - Tazewell County (JFZ) – public phone
  - Wakefield Municipal (AKQ) – internet access
- Local Service Airports
  - Bridgewater Air Park – public phone, public restroom, and internet access
  - Chase City Municipal – public phone and internet access
  - Gordonsville Municipal – public phone and public restroom
  - Lake Anna – public phone, public restroom, and internet access
  - New London – public phone and internet access
  - New Market – public phone



Source: Heather Ream.

Other Performance Measures

These performance measures are informational in nature – no targets are associated with these performance measures. Tracking these performance measures in future system plans may reveal trends that DOAV will want to monitor or possibly devote resources to influence the trend.

LED Lighting

Airports are increasingly making use of Light-Emitting Diode (LED) lighting in their facilities to lower utility and maintenance costs. This analysis looked at the number of airports using LED lights for their runway lighting, in their terminals, and for their automobile parking lots. A minority of Virginia's airports use LED lighting for their facilities. This may be an area for DOAV to investigate to see if encouraging additional LED use by airports could yield a better use of resources. Based on the numbers in **Table 7-19**, Regional Business Airports appear to have the greatest incentives to use LED lighting.

Table 7-19: Airports Using LED Lighting

VATSP Role and Number of Airports	Runway Edge Lights	Commercial Service Terminal Building	GA Terminal Building	Commercial Service Airport Parking	GA Airport Parking
Commercial Service – 9	3	4	2	5	2
Regional Business – 26	6	0	6	0	11
Community Business – 20	3	0	0	0	1
Local Service – 11	0	0	0	0	0
Total – 66	12	4	8	5	14

Source: Mead & Hunt, Inc.

Fuel Availability

The availability of fuel is a key service that airports provide. This analysis looked at two types of fuel available at Virginia's airports—jet fuel for turbine aircraft and avgas for piston aircraft. These are predominant fuels used in aviation. Other fuels, such as mogas, can be found at airports, but these make up a very small part of the fuel demand in aviation. **Table 7-20** lists how many airports provide each type of fuel. The analysis found that every airport that offered jet fuel also had avgas available, with the exception of Ronald Reagan Washington National Airport (DCA). Avgas is found at nearly 90 percent of the system airports, and, as was demonstrated in the Geographic Coverage section, is readily available throughout Virginia.

Table 7-20: Fuel Available at Airports

VATSP Role and Number of Airports	Jet Fuel Available	Avgas Available
Commercial Service – 9	9	8
Regional Business – 26	26	26
Community Business – 20	10	19
Local Service – 11	1	6
Total – 66	46	59

Source: Mead & Hunt, Inc.

Community Programs

Connecting with the community is often important to the functioning of an airport. This analysis looked at five community programs that airports in Virginia offer.

- Airport internships allow aviation students the chance to gain relevant work experience at an airport as well as develop contacts.
- Airport job shadowing provides aspiring aviation professionals the opportunity to follow an airport worker to experience what a typical work day is like.
- Air shows are a popular means of drawing crowds to the airport and demonstrating the facilities available at the airport to the local population.
- Flights for veterans typically provide free transportation and tours for military veterans to notable military memorials, such as the World War II Memorial in Washington, D.C.
- Airport career days offer the opportunity for community members to learn what kinds of jobs are available at their local airport.

Table 7-21 lists the number of airports that reported the use of these community programs. Air shows were the most common community program employed by airports, followed closely by internship programs. Flights for Veterans were the least used program, possibly because of Virginia's proximity to Washington D.C.

Table 7-21: Airports With Community Programs

VATSP Role and Number of Airports	Airport Internships	Airport Job Shadowing	Air Shows	Flights for Veterans	Airport Career Days
Commercial Service – 9	6	4	2	3	2
Regional Business – 26	6	5	7	4	8
Community Business – 20	1	1	4	1	1
Local Service – 11	1	1	2	2	1
Total – 66	14	11	15	10	12

Source: Mead & Hunt, Inc.

Economic Development

DOAV regards this evaluation as key to economic development. Airports were surveyed regarding the economic development potential in and around their airports. This took the form of three topics.

- Designated Economic Development Areas – Airports were asked to report whether there were known or designated economic development areas on their property.
- Development Areas in the Region – Airports were asked to report if they were aware of economic development areas in the region.
- Site Ready Areas on the Airport – Airport were asked to report if they had sites ready for immediate development on their property.

Table 7-22 summarizes the results of those questions and shows that a substantial number of airports answered in the affirmative. The Regional Business Airports in particular responded positively, with approximately 70 percent indicating that they had sites ready for development.

Table 7-22: Airports with Economic Development Opportunities

VATSP Role and Number of Airports	Designated Economic Development Areas	Development Areas in Region	Site Ready Areas on Airport
Commercial Service – 9	5	4	4
Regional Business – 26	19	21	18
Community Business – 20	5	5	2
Local Service – 11	0	1	1
Total – 66	29	31	25

Source: Mead & Hunt, Inc.

A potential follow-up assessment to this analysis is the degree to which airports work with the Virginia Economic Development Partnership, an organization formed in 1995 by the Virginia General Assembly to encourage, stimulate, and support development and expansion of Virginia's economy.

Community Communications

Staying in touch with the community is a proven strategy for successful airports. This can be accomplished through various means. This study examined two major avenues to achieve better community communications—participation by airport staff on community boards, and periodic communication with local agencies.

Table 7-23 lists the number of airports that have staff serving on a tourism board, an economic development board, and the local chamber of commerce. The numbers demonstrate that the Commercial Service and Regional Business Airports are the most involved groups of airports. Among the 31 Community Business and Local Service Airports, only five reported involvement with community boards.

Table 7-23: Airports with Airport Staff Engaged with Local Agencies

VATSP Role and Number of Airports	Airport Staff on Tourism Board	Airport Staff on Economic Development Board	Airport Staff on Chamber of Commerce
Commercial Service – 9	6	6	4
Regional Business – 26	3	10	8
Community Business – 20	1	1	2
Local Service – 11	0	0	3
Total – 66	10	17	17

Source: Mead & Hunt, Inc.

The other aspect assessed whether the airports had periodic communication with economic development representatives, local government officials, the local chamber of commerce, and with local media. The reported numbers, as shown in **Table 7-24**, indicated that Virginia's airports maintain solid lines of communication with these groups. For example, more than 80 percent of the system airports reported periodic communications with local government officials.

Table 7-24: Airports that Regularly Communicate with Local Agencies

VATSP Role and Number of Airports	Communicate with Economic Development Representatives	Communicate with Local Government Officials	Communicate with Chamber of Commerce	Communicate with Local Media
Commercial Service – 9	8	8	8	8
Regional Business – 26	23	25	17	20
Community Business – 20	12	14	7	11
Local Service – 11	2	6	2	4
Total – 66	45	53	34	43

Source: Mead & Hunt, Inc.

For airports that are interested in expanding their outreach capabilities, DOAV's Communications and Education staff are well suited for assisting airports in this area.

Airport Electrification

The development of electric aircraft has focused attention on the electrification of airports, both on the airside to serve electric aircraft, and on the landside to serve electric automobiles. This analysis asked which airports had, or were making plans for, charging stations for electric vertical take-off and landing (eVTOL) aircraft. The analysis also asked if any airports had undertaken a study of the impacts of eVTOL – either economic or operational – at their airport. Finally, data was gathered on the number of airports that had electric vehicle charging stations in their parking lots, with a distinction made between the parking for commercial airline services and GA parking.

Table 7-25: Airports with Electric Charging Facilities

VATSP Role and Number of Airports	Charging Stations Planned – eVTOL	Economic Impact Study of eVTOL	Charging Stations – Commercial Airport Parking	Charging Stations – GA Parking
Commercial Service – 9	5	1	2	1
Regional Business – 26	8	5	0	0
Community Business – 20	1	0	0	0
Local Service – 11	1	0	0	0
Total – 66	15	6	2	1

Source: Mead & Hunt, Inc.

Table 7-25 lists the number of airports that indicated they had undertaken some level of airport electrification. A number of airports are planning for the deployment of eVTOL aircraft, including a handful of those that have undertaken studies that examined potential impacts. There are a small number of airports with charging stations in their parking areas, with only one airport reporting the use of charging stations in a GA parking lot. One challenge airports face with parking lot charging stations is limiting the use of the charging station to just airport patrons, especially in cases where the airport is near an area with high vehicle traffic. Shenandoah Valley Regional Airport (SHD) addressed this issue by installing standard charging stations instead of fast charging stations. Not only did this save the airport money on equipment costs, but it also encouraged only airport passengers to use the charging stations since the standard charging station typically took a day or longer to charge a vehicle's batteries. This was more time than a passing user was willing to wait, but ideal for an airline passenger that would not be returning for a day or more.

Sustainability

There are several sustainable practices that airports across the country are undertaking in an effort to minimize their impact on the environment and make the most of the resources available. This analysis tabulated which airports reported using any of the following six sustainable practices.

- **Native Plants Used in Landscaping** involves using plants that are native to the region. This is advantageous because it can lower landscaping maintenance costs and improve the environment. Native plants have the benefit of being adapted to the local climate and soil conditions, which can translate into the plants living longer and requiring less frequent replacement. They are also more self-sufficient, which means less time spent caring for them. Native plants encourage native pollinators and can provide seeds for local animals. This supports the native biodiversity of the area.
- **Water Recycling**, also referred to as water reuse or water reclamation, consists of reclaiming water, treating it, and using it again. Recycled water may be used for agriculture, landscaping, manufacturing processes, human consumption, along with other uses, depending on the degree of treatment.
- **Construction Materials Recycled** refers to the use of discarded construction materials in alternative uses.
- **Geothermal Energy** refers to the use of heat from below the earth's surface to produce electricity or for climate control in structures.
- **Solar Farm Hosted** indicates that the airport has made land available for a solar farm.
- **Sustainable Aviation Fuel Available** means that the airport has some type of sustainable aviation fuel or biofuel available.

Table 7-26 shows the number of airports that reported using any of these sustainable practices. Nearly a third reported the use of native plants, and approximately 23 percent recycle construction materials. Two airports - Warrenton-Fauquier (HWY) and Falwell (W24) – reported the use of water recycling. Warrenton-Fauquier Airport (HWY) is an excellent case study in the use of sustainable practices. Its new terminal, opened in January 2020, incorporates solar panels and geothermal energy to be as environmentally friendly as possible.

Table 7-26: Sustainable Practices in Use at Airports

VATSP Role and Number of Airports	Native Plants Used in Landscaping	Water Recycling	Construction Materials Recycled	Geothermal Energy	Solar Farm Hosted	Sustainable Aviation Fuel Available
Commercial Service – 9	5	0	5	0	0	0
Regional Business – 26	10	1	7	1	1	0
Community Business – 20	2	0	1	0	0	0
Local Service – 11	3	1	2	0	0	0
Total – 66	20	2	15	1	1	0

Source: Mead & Hunt, Inc.

Summary

This chapter assessed the needs of the Virginia aviation system through several analyses that looked at the overall system as well as individual airports. It examined the anticipated geographic coverage of the aviation system by quantifying the percentage of forecasted 2030 population expected to fall within specified drive times from each airport. It also looked at geographic coverage provided by numerous flight support facilities and services. Airports that could increase the flight support coverage with new or enhanced facilities were identified.

Individual airports were evaluated based on their airport role and recommended FE&S targets. Any airports that did not meet their FE&S recommended targets were identified, and, where the information was available, any constraints to meeting that target were listed.

In addition to assessing the needs of the Virginia aviation system, this chapter also looked at how Virginia's airports were performing in areas such as community outreach, airport electrification, and sustainability. The performance measures for these analyses did not have recommended targets associated with them and were informational only.

The next part of the VATSP will include chapters that will take this needs assessment and develop recommendations for meeting these needs, considering factors such as DOAV priorities and available resources. Estimated costs will be developed along with a funding scenario and implementation plan.

Source: DOAV.

VIRGINIA AIR TRANSPORTATION SYSTEM PLAN

Part 3

Recommendations and Findings

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Technical Report Summary

This is the third of three parts that comprise the technical report of the Virginia Air Transportation System Plan (VATSP). Part 3 takes the analysis and findings of Part 2 and uses them to develop airport recommendations, estimated costs, and steps for implementing the changes recommended for the continued success of the Commonwealth's aviation system.

Part 3 contains the following chapters:

- Chapter 8: Recommended Aviation System
- Chapter 9: Costs and Funding
- Chapter 10: Implementation Plan

Chapter 8 – Recommended Aviation System provides potential improvements that were developed in response to the specific airport and system shortfalls identified in Part 2. These improvements are grouped by the process from which they were developed, looking at system coverage, facilities, equipment, and services, licensing and safety standards, and NAVAID maintenance and improvements. Improvements to address shortfalls are made for individual airports, with those airports facing development constraints noted.

Chapter 9 – Costs and Funding evaluates the financial side of the Virginia aviation system and its recommended improvements. It starts with a look at the various sources of capital funding available to the airports of Virginia. From there, it documents the funding levels of these sources, providing details as to how these funds are allocated between different types of airports. The chapter continues with an explanation of how costs were estimated for the recommended projects and summarizes those costs by airport role and by planning period. These cost estimates are then used as part of the funding analysis that starts by assessing what state and federal capital improvement funds Virginia's airports are expected to have available out to 2044. These funds are then compared to the estimated costs of the recommendations by year to determine an accumulated funding gap. Finally, the chapter looks at how Virginia stacks up against peer states in terms of airport funding and provides some information on non-traditional funding possibilities.

Chapter 10 – Implementation Plan provides some background and steps for planning for the implementation of the recommended improvements to the Virginia aviation system. It begins with an overview of the legislative framework that governs state administration of Virginia's airports. It then discusses the funding gap and possible approaches Virginia could consider to address that gap. These approaches range from potential new revenue sources to revisions in the ways that Virginia decides what projects are pursued in an environment with limited funding. The chapter concludes with a broad phased approach to implement the recommended improvements and steps to allow Virginia to track progress towards accomplishing its goals.

Source: John Jeniec.

Chapter 8: Recommended Aviation System

The Virginia Air Transportation System Plan (VATSP) conducted an extensive inventory of the Virginia aviation system and then tailored the analysis of that data to address specific needs identified by the Virginia Department of Aviation (DOAV). These analyses looked at the performance of the overall aviation system, subcomponents of the system, and individual system airports. From these analyses, specific system and airport shortfalls were identified and potential improvements were developed that could address those shortfalls. These improvements are explained in this chapter and grouped by the process from which they were developed, as listed under the section headings. There are four broad categories that were used to group the recommended system improvements into sections. These sections and their content are summarized below.

System Coverage

This section provides the recommendations that were developed based on the Commonwealth's existing system coverage, and discusses the following:

- Flight support coverage
- Recommended improved coverage in Southwest Virginia
- Proposed airports.

Facilities, equipment, and services

Improvements at Virginia system airports could enhance their ability to effectively fulfill their assigned roles. This section provides recommendations for facilities, equipment, and services that can be implemented at each airport based on their role, and is organized by the following types of improvement:

- Runway-Related Items
- Taxiway-Related Items
- Weather Reporting
- Navigational Aids/Improved Approach
- Remote Towers
- Terminal Improvements
- Hangar Improvements
- Maintenance Equipment
- Parking
- Utilities
- Average Airport Pavement Improvements

Licensing and safety standards

Various state and federal regulations influenced the recommendations included in this section, which are broken down into the following:

- Virginia Airport Licensing Standards
- Virginia Basic Airport Unit
- FAA Design Standards

Navigation Aids (NAVAID) maintenance and improvements

The inventory evaluated the NAVAIDs at each airport and the need to replace or upgrade aviation equipment. This section includes the recommendations for improving the NAVAID system based on this evaluation. The specific equipment types covered are:

- Weather Reporting
- Runway Lighting Improvements
- Approach Equipment Improvements
- Obstruction Removal.

The recommended improvements are explained in more detail for each category in the following sections. As these recommendations are based on a system-level analysis of Virginia's airports, these recommended improvements will need independent analysis at the individual airport level. Any airport improvement would need to be on an approved airport layout plan and have sufficient justification documented to be eligible for state or federal funding assistance. Inclusion in this system plan can aid in the justification argument but is generally insufficient on its own.

Source: DOAV.

System Coverage

The analysis of system coverage showed that Virginia has a well-developed, mature aviation system that provides extensive coverage to both flight operations and access to Virginia's population. As a result, only a handful of recommendations were developed from this analysis.

Flight Support Coverage

As prior analysis demonstrated, the flight support services[1] provided coverage across nearly all of Virginia. For example, all Virginia airports but a few offer some type of aviation fuel, so coverage by airports providing fuel is available across Virginia. It is only when parsing the analysis to look at flight support coverage by airports providing jet fuel that opportunities for expanding coverage are found. **Table 8-1** lists the airports – Lee County (0VG) and William M. Tuck (W78) – where jet fuel services are recommended to expand the flight support coverage, assuming demand for jet fuel is sufficient in these markets. This appears to be the case at Lee County, where the airport is in the process of adding a jet fuel farm, expected to be operational no later than 2023.

The analysis of coverage by airports with instrument approach procedures (IAP) was similar since every system airport has an IAP – further evidence of the deliberate development efforts of DOAV. Extending the analysis to airports with IAPs with vertical guidance resulted in one small area of Virginia lacking this flight support coverage. As shown in **Table 8-1**, it is recommended that the IAP at Luray Caverns (LUA) be improved to include vertical guidance.

Table 8-1: Recommended Flight Support Improvements

ID	Airport	Add Jet Fuel Farm	Improve IAP to Include Vertical Guidance
0VG	Lee County	Yes	-
W78	William M. Tuck	Yes	-
LUA	Luray Caverns	-	Yes

Source: Mead & Hunt.

[1] Flight support services consist of aviation fueling, instrument approaches, and automated weather reporting.

Improved Coverage in Southwest Virginia

When a more granular approach was used to analyze Virginia's aviation system coverage, it was found that certain regions could benefit from airport improvements that would increase access to the aviation system. Southwest Virginia was identified as a region that stood to gain from additional airport facilities. The recommended system highlights two enhanced airport facilities – the construction of Grundy Replacement Airport and a runway extension at Twin County Airport (HLX), as detailed in **Table 8-2**.

These two improvements would increase the access of southwest Virginia's population to airports with 5,000-foot runways. These two airports would also improve the ability of air ambulance operators to access this part of the state, since both airports would meet the criteria outlined in the analysis of airports capable of serving fixed-wing air ambulance operations (4,500-foot runway, an instrument approach with vertical guidance, automated weather reporting and jet fuel available 24 hours per day). While these airports would not meet the criteria established for serving business aircraft (falling short of the 5,500-foot runway criteria), these improvements would help address density altitude concerns in mountainous region by providing more airports with runways of at least 5,000 feet where feasible.

Table 8-2: Improvements to Enhance Southwest Virginia

ID	Airport	Recommended Improvement
GDY	Grundy Replacement Airport	• Planned runway of 5,100 feet • Planned IAP with vertical guidance and minimums of 200' and ¾ mile • Planned jet fuel and avgas available 24 hours/day • Planned AWOS*
HLX	Twin County Airport	• Extend runway to 5,000 feet

Note: Runway extensions recommended in the VATSP are for high level analysis and cannot be used for justification purposes during the master planning process.
*AWOS = Automated Weather Observing System
Source: Mead & Hunt.

Proposed airports

Even with the extensive coverage provided by the Virginia aviation system, there are ways to incrementally improve the system, especially when considering the coverage provided by subcomponents of the system. Three of the four new general aviation airports that were proposed in the 2016 system plan are included in this recommended plan. These airports aim, in part, to improve Virginia's population access by addressing shifting population density across the state. These airports are referred to as:

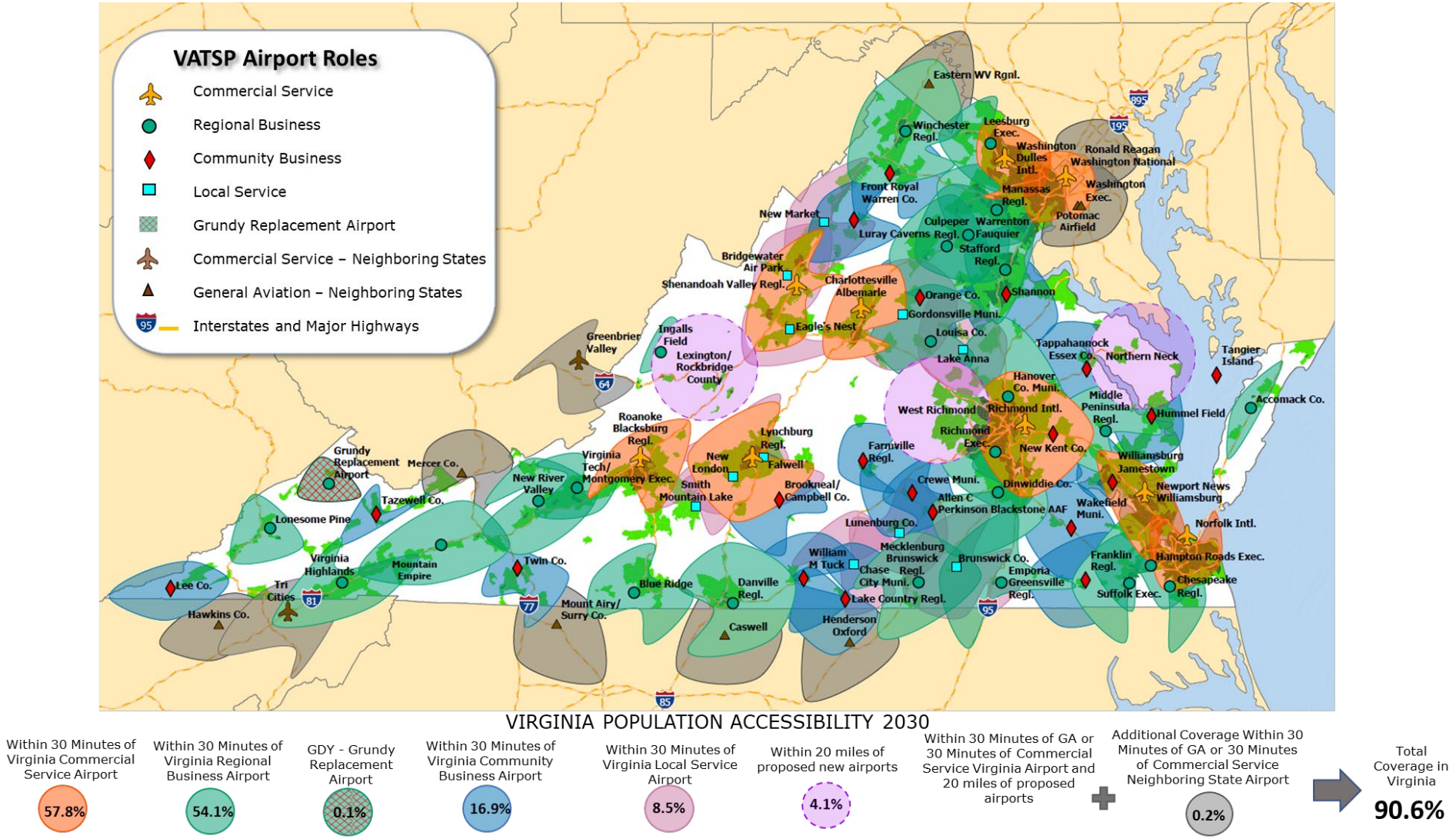
- Lexington/Rockbridge County
- West Richmond
- Northern Neck

Figure 8-1 shows the general location of the proposed airports and indicates that these airports could improve the percentage of Virginia's population that has 30-minute access to general aviation airports by 4 percent.

These airports would provide other benefits to the system beyond increased general accessibility. They would provide access for business aircraft to areas of Virginia with growing population centers with potential to develop into growing business centers. In addition, the locations of these proposed airports are such that they would provide back up for non-National Plan of Integrated Airport Systems (NPIAS) and privately-owned general aviation system airports. It is assumed that if new system airports are developed, they would come into the system as Regional Business Airports that are included in the NPIAS, making them eligible for Federal Aviation Administration (FAA) funding. Airports included in the NPIAS provide greater long-term stability for the system. Furthermore, as Regional Business Airports, these airports have the facilities that will improve access for business aircraft and for air ambulance aircraft, enhancing these services for the people of Virginia.

Under the current DOAV funding programs, inclusion in the NPIAS is imperative for a new airport to be fully developed. It is also important to note that local support is the driving factor for new airport development under the current programs.

Source: Andrew Crider.



Source: Cignus, LLC.

Figure 8-1: Virginia's Aviation System Population Coverage with Proposed New Airport Locations

Facilities, Equipment and Services

The analysis of the system airports based on their roles showed that numerous improvements could enhance the ability of these airports to effectively fulfill their roles. In the following section, the various facilities, equipment, and services that are recommended for each airport based on its role are explained and detailed in tables organized by the type of improvement. Based on a review by DOAV, some recommended improvements are denoted with an asterisk (*) to indicate that this particular improvement has considerable constraints to overcome and is less likely to be undertaken. These constraints include significant terrain challenges, limited community support, and fiscal restraints.

Runway Related Items

Table 8-3 lists those airports recommended for primary runway extensions and **Table 8-4** shows the airport recommended for a primary runway widening to allow it to function in its respective role more efficiently. Longer runways will permit the aircraft that operate at these airports to make better use of their full capabilities. It is notable that all but one runway extension (Luray Caverns) is constrained in some way. Only one airport – New London – is recommended for a wider runway.

Table 8-3: Recommended Primary Runway Extensions

ID	Airport	Existing Runway Length (ft.)	Recommended Runway Length (ft.)
LKU	Louisa County/Freeman Field	4,300	5,000*
W81	Crewe Municipal	3,300	3,500*
FRR	Front Royal-Warren County	3,008	3,500*
W75	Hummel Field	3,220	3,500*
LUA	Luray Caverns	3,126	3,500
OMH	Orange County	3,200	3,500*
EZF	Shannon	2,999	3,500*
TGI	Tangier Island	2,426	3,500*
JGG	Williamsburg-Jamestown	3,204	3,500*

Note: * Considerable constraints to improvement; Runway extensions recommended in the VATSP are for high level analysis and cannot be used for justification purposes during the master planning process.
Source: Mead & Hunt.

Table 8-4: Recommended Primary Runway Widenings

ID	Airport	Existing Runway Width (ft.)	Recommended Runway Width (ft.)
W90	New London	40	50*

Note: * Considerable constraints to improvement; Runway extensions recommended in the VATSP are for high level analysis and cannot be used for justification purposes during the master planning process.
Source: Mead & Hunt.

Table 8-5 shows the airports that are recommended for primary runway strengthening improvements. For those airports that do not indicate an existing runway strength, data was not available. It is recommended that the runway strengthening projects in **Table 8-5** be undertaken the next time that the runway is rehabilitated rather than as stand-alone projects. Recommended runway instrumentation improvements are listed in **Table 8-6**.

Table 8-5: Recommended Primary Runway Strengthening

ID	Airport	Existing Runway Strength (thousands of lbs.)	Recommended Runway Strength (thousands of lbs.)
MFV	Accomack County	SW 26.0	SW 30.0
PTB	Dinwiddie County	SW 25.0	SW 30.0
GDY	Grundy Replacement Airport	-	SW 30.0
LKU	Louisa County/Freeman Field	SW 12.5	SW 30.0
AVC	Mecklenburg-Brunswick Regional	SW 25.0	SW 30.0
MKJ	Mountain Empire	SW 20.0	SW 30.0
W81	Crewe Municipal	SW 12.0	SW 12.5
FKN	Franklin Regional	-	SW 12.5
OMH	Orange County	SW 12.0	SW 12.5
EZF	Shannon	-	SW 12.5

Notes: SW = Single wheel; - = Data not available
Source: Mead & Hunt.

Table 8-6: Recommended Instrumentation for Primary Runway

ID	Airport	Install Precision Approach Path Indicator	Install Runway End Identifier Lights	Install Medium Intensity Runway Lights
GDY	Grundy Replacement Airport	Yes	-	-
BKT	Allen C Perkinson Blackstone AAF	Yes	Yes	-
W81	Crewe Municipal	Yes	Yes	-
FKN	Franklin Regional	-	Yes	-
FRR	Front Royal-Warren County	Yes	Yes	-
W75	Hummel Field	Yes	Yes	-
W63	Lake Country Regional	Yes	Yes	-
EZF	Shannon	-	Yes*	-
TGI	Tangier Island	Yes*	Yes*	Yes*
AKQ	Wakefield Municipal	Yes	Yes	-
JGG	Williamsburg-Jamestown	Yes	Yes	-

Note: * Considerable constraints to improvement
Source: Mead & Hunt.

Taxiway Related Items

Projects are recommended at 12 airports for improvements to their taxiway systems, as shown in **Table 8-7**. Four of these airports are identified as having considerable constraints that could impact the feasibility of improving their taxiway systems.

Table 8-7: Recommended Taxiway System Improvements

ID	Airport	Recommended Taxiway System Improvement
MFV	Accomack County	Expand Partial Parallel to Full Parallel
LNP	Lonesome Pine	Expand Partial Parallel to Full Parallel*
BKT	Allen C Perkinson Blackstone AAF	Expand Stub Taxiway to Partial Parallel
0V4	Brookneal/Campbell County	Expand Stub Taxiway to Partial Parallel
W81	Crewe Municipal	Expand Stub Taxiway to Partial Parallel*
FVX	Farmville Regional	Expand Stub Taxiway to Partial Parallel
W75	Hummel Field	Expand Stub Taxiway to Partial Parallel
W63	Lake Country Regional	Expand Stub Taxiway to Partial Parallel*
LUA	Luray Caverns	Expand Stub Taxiway to Partial Parallel
TGI	Tangier Island	Expand Stub Taxiway to Partial Parallel*
JFZ	Tazewell County	Expand Stub Taxiway to Partial Parallel
AKQ	Wakefield Municipal	Expand Stub Taxiway to Partial Parallel

Note: * Considerable constraints to improvement
Source: Mead & Hunt.

Source: DOAV.

Weather Reporting

One more indication of the degree to which the aviation system has been well-developed by DOAV is that the only airport recommended for installing automated weather reporting equipment (AWOS) is the Grundy Replacement Airport, as shown in **Table 8-8**. Automated weather reporting equipment is common throughout the Virginia aviation system, which is why the replacement airport is the sole recommendation. Several Virginia airports will need AWOS upgrades or replacements as well over the next 20 years. These projects are noted later.

Table 8-8: Recommended Automated Weather Reporting Improvements

ID	Airport	Install AWOS
GDY	Grundy Replacement Airport	Yes

Source: Mead & Hunt.

Navigational Aids/Improved Approach

Table 8-9 lists the recommended visual guidance improvements for Virginia's system airports. Four airports need a rotating beacon, while four other airports would benefit from lighted windcones. Finally, Lake Anna has no wind indicator of any type and would be improved with the installation of a windcone.

Table 8-9: Recommended Visual Guidance Improvements

ID	Airport	Install Rotating Beacon	Install Lighted Windcone	Install Windcone
GDY	Grundy Replacement Airport	Yes	Yes	-
JYO	Leesburg Executive	-	Yes	-
W63	Lake Country Regional	-	Yes	-
TGI	Tangier Island	-	Yes*	-
CXE	Chase City Municipal	Yes	-	-
W24	Falwell	Yes	-	-
7W4	Lake Anna	-	-	Yes
W90	New London	Yes	-	-

* Considerable constraints to improvement
Source: Mead & Hunt.

Source: Mead & Hunt.

Since every Virginia system airport has an IAP, DOAV focused on improving the utility of the existing IAPs. **Table 8-10** lists the airports where an improvement to the IAP – either in terms of a lower cloud ceiling minimum, or lower flight visibility minimum – is recommended based on the airport's role.

Table 8-10: Recommended Instrument Approach Procedure Improvements

ID	Airport	Existing IAP Ceiling and Visibility	Recommended IAP Ceiling and Visibility
ROA	Roanoke-Blacksburg Regional/Woodrum Field	250 feet and 0.75 miles	Improve ceiling to 200 feet and visibility to 0.5 mile
CJR	Culpeper Regional	294 feet and 1 mile	Improve ceiling to 250 feet
HSP	Ingalls Field	300 feet and 0.875 miles	Improve ceiling to 250 feet
LNP	Lonesome Pine	278 feet and 1 mile	Improve ceiling to 250 feet
MKJ	Mountain Empire	577 feet and 2 miles	Improve ceiling to 250 feet and visibility to 1 mile
FRR	Front Royal-Warren County	1,116 feet and 1.25 miles	Improve ceiling to 500 feet and visibility to 1 mile
W75	Hummel Field	1,010 feet and 3 miles	Improve ceiling to 500 feet and visibility to 1 mile
LUA	Luray Caverns	557 feet and 1 mile	Improve ceiling to 500 feet
TGI	Tangier Island	555 feet and 1 mile	Improve ceiling to 500 feet
AKQ	Wakefield Municipal	1,010 feet and 3 miles	Improve ceiling to 500 feet and visibility to 1 mile
JGG	Williamsburg-Jamestown	1,011 feet and 3 miles	Improve ceiling to 500 feet and visibility to 1 mile

Source: Mead & Hunt.

The following airports did not meet their IAP target minimums but are not recommended for improvements to their IAP because they were within 20 feet of their target IAP ceiling. The marginal improvement in IAP ceiling was insufficient for justifying the effort needed to improve the IAP ceiling.

- Suffolk Executive (SFQ)
- Virginia Tech/Montgomery Executive (BCB)
- Lake Country Regional (W63)
- Orange County (OMH)

The controlling feature that limits an IAP's minimums can vary substantially. It may be an obstruction in the approach path, an obstruction on the way to the missed approach, a limit of the airport's facilities, or other factors. It is recommended that each airport identify what factor(s) is preventing improved IAP minimums, so airport management understands the effort necessary to improve its IAP.

Remote Towers

Virginia is home to one of only two remote towers currently in operation in the U.S. DOAV is interested in the prospects for expanding the use of this technology and the analysis identified two distinct opportunities. One opportunity is the replacement of federal contract towers (FCT), of which there are two in Virginia, as listed in **Table 8-11**. The other opportunity consists of non-towered airports with jet operations, also listed in **Table 8-11**. The airports listed in **Table 8-11** are for initial consideration. Further study is warranted to decide which, if any, of these airports could benefit from a remote tower.

Table 8-11: Recommended Remote Tower Consideration

ID	Airport	Possible Remote Tower Location	Possible Remote Tower Replacement of FCT
CHO	Charlottesville-Albemarle	-	Yes
LYH	Lynchburg Regional/Preston Glenn Field	-	Yes
SHD	Shenandoah Valley Regional	Yes	-
PVG	Hampton Roads Executive	Yes	-
OFP	Hanover County Municipal	Yes	-
FCI	Richmond Executive-Chesterfield County	Yes	-
VJI	Virginia Highlands	Yes	-
BCB	Virginia Tech/Montgomery Executive	Yes	-

Source: Mead & Hunt.

Terminal Improvements

Table 8-12 lists the recommended terminal facility expansions intended to meet DOAV targets for general aviation terminal size. Consideration should be given to undertaking these terminal expansions in conjunction with planned terminal refurbishments, especially for the smaller sized expansions.

Table 8-12: Recommended Terminal Improvements

ID	Airport	Recommended Terminal Improvements
GDY	Grundy Replacement Airport	Build new terminal
SFQ	Suffolk Executive	Expand terminal by 126 square feet*
0V4	Brookneal/Campbell County	Expand terminal by 958 square feet
W63	Lake Country Regional	Expand terminal by 181 square feet*
LUA	Luray Caverns	Expand terminal by 817 square feet
TGI	Tangier Island	Expand terminal by 1,609 square feet
AKQ	Wakefield Municipal	Expand terminal by 781 square feet
JGG	Williamsburg-Jamestown	Expand terminal by 2,839 square feet

Note: * Considerable constraints to improvement
Source: Mead & Hunt.

Hangar Improvements

Aircraft storage space was identified as one of the most needed infrastructure items in the Virginia aviation system. The analysis identified shortfalls in aircraft storage in 2022, as well as in 2044 based on forecasted based aircraft. **Table 8-13** provides the recommended increase in aircraft hangar space for airports that have or are expected to have a shortfall of aircraft storage space. These recommendations considered that there are economies of scale when investing in hangar space. Any need for hangar space for less than 10 aircraft was ignored.

Table 8-13: Recommended Hangar Space Improvements

ID	Airport	Recommended Hangar Improvements for 2022	Recommended Hangar Improvements for 2044
CHO	Charlottesville-Albemarle	-	Add hangar space for 17 additional aircraft
LYH	Lynchburg Regional/Preston Glenn Field	Add hangar space for 69 additional aircraft	Add hangar space for 23 additional aircraft
ORF	Norfolk International	Add hangar space for 39 additional aircraft	Add hangar space for 10 additional aircraft
ROA	Roanoke-Blacksburg Regional/Woodrum Field	Add hangar space for 91 additional aircraft	-
SHD	Shenandoah Valley Regional	Add hangar space for 31 additional aircraft	-
CPK	Chesapeake Regional	Add hangar space for 27 additional aircraft	Add hangar space for 48 additional aircraft
CJR	Culpeper Regional	Add hangar space for 13 additional aircraft	Add hangar space for 46 additional aircraft
OFP	Hanover County Municipal	Add hangar space for 49 additional aircraft	Add hangar space for 25 additional aircraft
JYO	Leesburg Executive	Add hangar space for 134 additional aircraft	-
LNP	Lonesome Pine	Add hangar space for 15 additional aircraft	-
HEF	Manassas Regional/Harry P Davis Field	Add hangar space for 250 additional aircraft	Add hangar space for 36 additional aircraft
AVC	Mecklenburg-Brunswick Regional	-	Add hangar space for 11 additional aircraft
FYJ	Middle Peninsula Regional	Add hangar space for 27 additional aircraft	Add hangar space for 11 additional aircraft
MKJ	Mountain Empire	Add hangar space for 13 additional aircraft	-
PSK	New River Valley	Add hangar space for 15 additional aircraft	-
RMN	Stafford Regional	Add hangar space for 19 additional aircraft	Add hangar space for 27 additional aircraft
BCB	Virginia Tech/Montgomery Executive	Add hangar space for 23 additional aircraft	-
HWY	Warrenton-Fauquier	Add hangar space for 11 additional aircraft	Add hangar space for 11 additional aircraft
OKV	Winchester Regional	Add hangar space for 44 additional aircraft	Add hangar space for 10 additional aircraft
W75	Hummel Field	Add hangar space for 19 additional aircraft	-
W96	New Kent County	Add hangar space for 11 additional aircraft	-
OMH	Orange County	Add hangar space for 13 additional aircraft	Add hangar space for 14 additional aircraft
EZF	Shannon	Add hangar space for 10 additional aircraft	-
XSA	Tappahannock-Essex County	-	Add hangar space for 15 additional aircraft
VBW	Bridgewater Air Park	Add hangar space for 40 additional aircraft	-
W13	Eagle's Nest	Add hangar space for 14 additional aircraft	-
W24	Falwell	Add hangar space for 10 additional aircraft	-

Source: Mead & Hunt.

Maintenance Equipment

Table 8-14 lists the recommended maintenance equipment for the airports shown.

Table 8-14: Recommended Maintenance Equipment Improvements

ID	Airport	Snow Removal Equipment	Debris Sweeper	Front End Loader	Truck	Tractor	Vehicle Attachments
MFV	Accomack County	-	Yes	Yes	-	-	Yes
MTV	Blue Ridge	-	Yes	-	-	-	-
CJR	Culpeper Regional	-	Yes	Yes	Yes	-	-
DAN	Danville Regional	-	-	Yes	-	-	-
PTB	Dinwiddie County	-	Yes	-	Yes	-	Yes
EMV	Emporia-Greensville Regional	-	Yes	Yes	-	-	Yes
HSP	Ingalls Field	-	Yes	Yes	-	-	Yes
JYO	Leesburg Executive	-	Yes	-	-	-	-
LNP	Lonesome Pine	-	Yes	Yes	-	-	Yes
LKU	Louisa County/Freeman Field	Yes	Yes	Yes	Yes	-	Yes
HEF	Manassas Regional/Harry P Davis Field	-	Yes	Yes	-	-	-
AVC	Mecklenburg-Brunswick Regional	Yes	Yes	Yes	Yes	-	Yes
FYJ	Middle Peninsula Regional	-	Yes	-	-	-	-
MKJ	Mountain Empire	-	Yes	-	-	-	-
PSK	New River Valley	-	Yes	Yes	-	-	Yes
RMN	Stafford Regional	-	Yes	-	-	-	-
SFQ	Suffolk Executive	Yes	Yes	-	-	-	Yes
BCB	Virginia Tech/Montgomery Executive	-	Yes	Yes	-	-	Yes
OKV	Winchester Regional	-	Yes	Yes	-	-	-
BKT	Allen C Perkinson Blackstone AAF	-	Yes	Yes	-	-	-
FVX	Farmville Regional	-	Yes	Yes	-	-	Yes
W75	Hummel Field	-	Yes	Yes	-	-	Yes
LUA	Luray Caverns	-	Yes	-	-	-	Yes
OMH	Orange County	-	Yes	-	-	-	Yes
EZF	Shannon	-	Yes	-	-	-	-
TGI	Tangier Island	-	-	Yes	-	-	-
XSA	Tappahannock-Essex County	-	-	Yes	-	Yes	Yes
JFZ	Tazewell County	-	Yes	-	-	-	Yes
JGG	Williamsburg-Jamestown	-	Yes	Yes	-	-	Yes

Source: Mead & Hunt.

Parking

The analysis for non-revenue parking identified more than two dozen airports that are recommended for additional parking. The greatest need was identified at Ronald Reagan Washington National Airport, where, due to space constraints as noted in **Table 8-15**, it will be challenging to meet the anticipated demand. Additionally, local planning efforts can better assess if the demand can be met through alternative means such as mass transit or other solutions that can lower the need for parking spaces.

Table 8-15: Recommended Non-Revenue Parking Improvements

ID	Airport	Recommended Additional Non-Revenue Parking Spaces
CHO	Charlottesville-Albemarle	Add 93 parking spaces
LYH	Lynchburg Regional/Preston Glenn Field	Add 185 parking spaces
ORF	Norfolk International	Add 467 parking spaces
RIC	Richmond International	Add 914 parking spaces
DCA	Ronald Reagan Washington National	Add 1,640 parking spaces*
MFV	Accomack County	Add 22 parking spaces
MTV	Blue Ridge	Add 48 parking spaces
CPK	Chesapeake Regional	Add 127 parking spaces
CJR	Culpeper Regional	Add 119 parking spaces
PTB	Dinwiddie County	Add 43 parking spaces
EMV	Emporia-Greensville Regional	Add 10 parking spaces
OFP	Hanover County Municipal	Add 77 parking spaces
JYO	Leesburg Executive	Add 278 parking spaces
LKU	Louisa County/Freeman Field	Add 48 parking spaces
HEF	Manassas Regional/Harry P Davis Field	Add 316 parking spaces
FYJ	Middle Peninsula Regional	Add 42 parking spaces
PSK	New River Valley	Add 34 parking spaces
FCI	Richmond Executive-Chesterfield County	Add 60 parking spaces
SFQ	Suffolk Executive	Add 74 parking spaces
VJI	Virginia Highlands	Add 54 parking spaces
HWY	Warrenton-Fauquier	Add 52 parking spaces
OKV	Winchester Regional	Add 127 parking spaces
BKT	Allen C Perkinson Blackstone AAF	Add 72 parking spaces
FRR	Front Royal-Warren County	Add 59 parking spaces
W75	Hummel Field	Add 26 parking spaces
W96	New Kent County	Add 25 parking spaces
OMH	Orange County	Add 82 parking spaces
JGG	Williamsburg-Jamestown	Add 41 parking spaces
W13	Eagle's Nest	Add 22 parking spaces
W24	Falwell	Add 16 parking spaces
GVE	Gordonsville Municipal	Add 18 parking spaces

Note: * Considerable constraints to improvement
Source: Mead & Hunt.

Source: Mead & Hunt.

Airport revenue parking needs at several of the commercial service airports were identified during the analysis portion of the study. **Table 8-16** lists those commercial service airports where additional revenue parking spaces are recommended. As parking tends to be an important revenue generator for commercial service airports, airport management typically focuses adequate attention on this need at the local level.

Table 8-16: Recommended Revenue Parking Improvements

ID	Airport	Recommended Additional Revenue Parking Spaces
CHO	Charlottesville-Albemarle	Add 232 parking spaces
LYH	Lynchburg Regional/Preston Glenn Field	Add 39 parking spaces
RIC	Richmond International	Add 389 parking spaces
DCA	Ronald Reagan Washington National	Add 2,976 parking spaces*
SHD	Shenandoah Valley Regional	Add 17 parking spaces

Note: * Considerable constraints to improvement
Source: Mead & Hunt.

Utilities

Recommended utility improvements are shown in **Table 8-17**. This includes two-way telecommunications, which can be met with a traditional public phone, or through cell phone coverage or web-enabled calls. Public water and public sewer recommendations were based on information provided by airports that responded to the study survey. Recommendations for airports that did not respond were not identified due to the lack of available data.

Table 8-17: Recommended Utility Improvements

ID	Airport	Two-Way Telecommunications	GA Terminal Public Restroom	GA Terminal Internet Access	Public Water	Public Sewer
MFV	Accomack County	Yes	-	Yes	-	-
MTV	Blue Ridge	-	-	-	Yes	Yes
CPK	Chesapeake Regional	-	-	-	Yes	-
DAN	Danville Regional	Yes	-	-	-	Yes
EMV	Emporia-Greensville Regional	Yes	-	-	Yes	Yes
LNP	Lonesome Pine	-	-	-	-	Yes
AVC	Mecklenburg-Brunswick Regional	Yes	-	-	-	Yes
HWY	Warrenton-Fauquier	Yes	-	-	-	-
BKT	Allen C Perkinson Blackstone AAF	-	-	-	Yes	Yes
0V4	Brookneal/Campbell County	Yes	-	Yes	Yes	Yes
FVX	Farmville Regional	Yes	-	Yes	Yes	Yes
FRR	Front Royal-Warren County	Yes	-	-	Yes	Yes
W75	Hummel Field	Yes	-	-	Yes	Yes

Table 8-17: Recommended Utility Improvements (continued)

ID	Airport	Two-Way Telecommunications	GA Terminal Public Restroom	GA Terminal Internet Access	Public Water	Public Sewer
W63	Lake Country Regional	Yes	-	Yes	-	-
0VG	Lee County	Yes	-	-	-	-
W96	New Kent County	Yes	-	-	-	-
EZF	Shannon	Yes	-	-	Yes	Yes
TGI	Tangier Island	Yes	-	Yes	Yes	Yes
XSA	Tappahannock-Essex County	Yes	-	-	Yes	Yes
JFZ	Tazewell County	Yes	-	-	-	-
AKQ	Wakefield Municipal	-	-	Yes	-	-
VBW	Bridgewater Air Park	Yes	Yes	Yes	-	-
CXE	Chase City Municipal	Yes	-	Yes	-	-
GVE	Gordonsville Municipal	Yes	Yes	-	-	-
7W4	Lake Anna	Yes	Yes	Yes	-	-
W90	New London	Yes	-	Yes	-	-
8W2	New Market	Yes	-	-	-	-

Source: Mead & Hunt.

Source: Heather Ream.

Average Airport Pavement Improvements

Earlier analysis established that many Virginia airports fell short of DOAV's target of maintaining an average airport pavement condition index (PCI) above 70. **Table 8-18** lists those airports where it is recommended that steps be taken to bring the airport's overall PCI above the 70 threshold.

Table 8-18: Recommended Pavement Improvements

ID	Airport	Recommended Pavement Improvements
PHF	Newport News-Williamsburg	Raise PCI to 70 or higher
ORF	Norfolk International	Raise PCI to 70 or higher
PTB	Dinwiddie County	Raise PCI to 70 or higher
OFP	Hanover County Municipal	Raise PCI to 70 or higher
HSP	Ingalls Field	Raise PCI to 70 or higher
JYO	Leesburg Executive	Raise PCI to 70 or higher
LNP	Lonesome Pine	Raise PCI to 70 or higher
HEF	Manassas Regional/Harry P Davis Field	Raise PCI to 70 or higher
FCI	Richmond Executive-Chesterfield County	Raise PCI to 70 or higher
HWY	Warrenton-Fauquier	Raise PCI to 70 or higher
W81	Crewe Municipal	Raise PCI to 70 or higher
FKN	Franklin Regional	Raise PCI to 70 or higher
FRR	Front Royal-Warren County	Raise PCI to 70 or higher
W75	Hummel Field	Raise PCI to 70 or higher
TGI	Tangier Island	Raise PCI to 70 or higher
AKQ	Wakefield Municipal	Raise PCI to 70 or higher
VBW	Bridgewater Air Park	Raise PCI to 70 or higher
LVL	Brunswick County	Raise PCI to 70 or higher
CXE	Chase City Municipal	Raise PCI to 70 or higher
W24	Falwell	Raise PCI to 70 or higher
GVE	Gordonsville Municipal	Raise PCI to 70 or higher
W31	Lunenburg County	Raise PCI to 70 or higher
W90	New London	Raise PCI to 70 or higher
8W2	New Market	Raise PCI to 70 or higher
W91	Smith Mountain Lake	Raise PCI to 70 or higher

Source: Mead & Hunt.

Licensing and Safety Standards

The recommendations stemming from licensing and safety standards are based on various state and federal regulations. The Code of Virginia § 5.1-7 *Licensing of airports and landing areas*, authorizes airport licensing standards, most of which are spelled out in the Virginia Administrative Code under 24VAC5-20-120 *Licenses*, 24VAC5-20-140 *Minimum requirements for licensing* and, 24VAC5-20-145 *Waiver of minimum requirements*.

Virginia Airport Licensing Standards

Virginia also establishes minimum facilities for new airports under its Basic Airport Unit definition established by the Virginia Aviation Board and detailed in the DOAV Airport Program Manual. In addition to these standards, the FAA also stipulates safety standards for airports through runway safety areas (RSA), runway object free areas (ROFA), and runway protection zones (RPZ). Based on reports from airports that responded to the study survey, the recommendations in the following tables were developed to enhance Virginia's airport adherence to these standards. **Table 8-19** shows the recommended improvements intended to meet Virginia's airport licensing standards.

Table 8-19: Recommended Improvements Based on Virginia Airport Licensing Standards

ID	Airport	Runway Width	Runway Safety Area (RSA)	Runway Object Free Area (ROFA)	FAR Part 77 Approach Surface Clear
MKJ	Mountain Empire	-	-	ROFA improvements	Mitigate Part 77 approach obstructions
SFQ	Suffolk Executive	-	-	-	Mitigate Part 77 approach obstructions
W75	Hummel Field	-	-	-	Mitigate Part 77 approach obstructions
W96	New Kent County	-	-	-	Mitigate Part 77 approach obstructions
EZF	Shannon	-	RSA improvements	ROFA improvements	-
VBW	Bridgewater Air Park	-	RSA improvements	ROFA improvements	Mitigate Part 77 approach obstructions
W13	Eagle's Nest	-	RSA improvements	ROFA improvements	Mitigate Part 77 approach obstructions
7W4	Lake Anna	-	RSA improvements	ROFA improvements	Mitigate Part 77 approach obstructions
W90	New London	Widen to 50'*	-	-	-

Note: * Considerable constraints to improvement
Source: Mead & Hunt.

Virginia Basic Airport Unit

Table 8-20 addresses the recommended improvements needed to meet Virginia's Basic Airport Unit. It should be noted that the Basic Airport Unit is applicable to new airports, not existing airports. Nevertheless, the Basic Airport Unit definition provides a baseline against which existing airport facilities can be measured to identify areas that DOAV urges existing airports to develop in an effort to meet Basic Airport Unit criteria. It is also important to point out that since the Basic Airport Unit established a public phone as part of its definition, cell phone use and coverage has expanded significantly. Because of this, the recommendation of "Improve communications" is intended to address this aspect of the Basic Airport Unit, either through cell phone coverage, internet communications, or other means of communication.

Table 8-20: Recommended Improvements to Meet Virginia Basic Airport Unit Standards

ID	Airport	Runway Lighting	Visual Navigation	GA Terminal Electric Lighting	GA Terminal Telecommunications	GA Terminal Public Restroom	Fuel Facility
MFV	Accomack County	-	-	-	Improve communications	-	-
DAN	Danville Regional	-	-	-	Improve communications	-	-
EMV	Emporia-Greensville Regional	-	-	-	Improve communications	-	-
GDY	Grundy Replacement Airport	-	Add rotating beacon	-	-	-	-
AVC	Mecklenburg-Brunswick Regional	-	-	-	Improve communications	-	-
HWY	Warrenton-Fauquier	-	-	-	Improve communications	-	-
0V4	Brookneal/Campbell County	-	-	-	Improve communications	-	-
FVX	Farmville Regional	-	-	-	Improve communications	-	-
FRR	Front Royal-Warren County	-	-	-	Improve communications	-	-
W75	Hummel Field	-	-	-	Improve communications	-	-
W63	Lake Country Regional	-	-	-	Improve communications	-	-
0VG	Lee County	-	-	-	Improve communications	-	-
W96	New Kent County	-	-	-	Improve communications	-	-
EZF	Shannon	-	-	-	Improve communications	-	-
TGI	Tangier Island	Add runway lights*	-	-	Improve communications	-	Add fuel facility*
XSA	Tappahannock-Essex County	-	-	-	Improve communications	-	-
JFZ	Tazewell County	-	-	-	Improve communications	-	-
AKQ	Wakefield Municipal	-	-	-	-	-	-
VBW	Bridgewater Air Park	-	-	-	Improve communications	Add restroom	-
LVL	Brunswick County	-	-	-	-	-	Add fuel facility*
CXE	Chase City Municipal	Add runway lights	Add rotating beacon	-	Improve communications	-	Add fuel facility*
W24	Falwell	-	Add rotating beacon	-	-	-	-
GVE	Gordonsville Municipal	-	-	-	Improve communications	Add restroom	Add fuel facility*
7W4	Lake Anna	-	-	-	Improve communications	Add restroom	Add fuel facility*
W90	New London	Add runway lights	Add rotating beacon	-	Improve communications	-	Add fuel facility*
8W2	New Market	-	-	-	Improve communications	-	-

Note: * Considerable constraints to improvement; The Basic Airport Unit standards apply to new airports but are being used as targets for existing airports for this analysis.
Source: Mead & Hunt.

FAA Design Standards

Table 8-21 addresses runway safety recommendations not covered by Virginia's licensing standards. These are primarily recommendations for airports to obtain greater control over their RPZs and ROFA through either purchase of land or easements over the land in question as recommended by the FAA and as reported by each airport in its survey.

Table 8-21: Recommended Improvements Based on other Safety Standards

ID	Airport	Runway Protection Zone Land Use	Runway Protection Zone (RPZ) Control	Runway Object Free Area (ROFA) Control
LYH	Lynchburg Regional/Preston Glenn Field	-	Improve RPZ control	-
ORF	Norfolk International	-	Improve RPZ control	-
SHD	Shenandoah Valley Regional	-	Improve RPZ control	-
JYO	Leesburg Executive	-	Improve RPZ control	-
MKJ	Mountain Empire	-	Improve RPZ control	Improve ROFA control
BKT	Allen C Perkinson Blackstone AAF	-	Improve RPZ control	-
0V4	Brookneal/Campbell County	-	Improve RPZ control	Improve ROFA control
FRR	Front Royal-Warren County	-	Improve RPZ control	-
W75	Hummel Field	Improve land use control	Improve RPZ control	-
EZF	Shannon	Improve land use control	Improve RPZ control	Improve ROFA control
TGI	Tangier Island	-	Improve RPZ control	-
VBW	Bridgewater Air Park	Improve land use control	-	-
W13	Eagle's Nest	Improve land use control	-	-
7W4	Lake Anna	Improve land use control	Improve RPZ control	-

Source: Mead & Hunt.

Navigational Aid (NAVAID) Maintenance and Improvements

The inventory of NAVAIDs evaluated the need to replace or upgrade various aviation equipment throughout the Virginia aviation system. The following tables list the recommended improvements to the NAVAID system based on that inventory. Tables group similar equipment.

Weather Reporting

Table 8-22 shows the recommended weather equipment improvements.

Table 8-22: Recommended Weather Equipment Improvements

ID	Airport	Automated Weather Reporting	Segmented Circle	Runway Visual Range (RVR) Equipment
CHO	Charlottesville-Albemarle	-	-	Install RVR (RW 03 and RW 21)
PHF	Newport News-Williamsburg	-	-	Install RVR (RW 07 and RW 25)
ORF	Norfolk International	-	-	Install RVR (RW 05 and RW 23)
RIC	Richmond International	-	-	Install RVR (RW 02)
ROA	Roanoke-Blacksburg Regional/Woodrum Field	-	-	Install RVR (RW 06 and RW 34)
SHD	Shenandoah Valley Regional	Upgrade AWOS	-	Install RVR (RW 05)
MFV	Accomack County	Upgrade AWOS	-	-
MTV	Blue Ridge	Replace AWOS	-	-
CPK	Chesapeake Regional	Upgrade AWOS	-	-
CJR	Culpeper Regional	Upgrade AWOS	-	-
DAN	Danville Regional	-	-	Install RVR (RW 02)
PTB	Dinwiddie County	Replace AWOS	-	-
EMV	Emporia-Greensville Regional	Upgrade AWOS	-	-
GDY	Grundy Replacement Airport	Install AWOS	-	-
PVG	Hampton Roads Executive	Replace AWOS	-	-
OFP	Hanover County Municipal	Upgrade ASOS	-	-
HSP	Ingalls Field	Replace AWOS	-	Install RVR (RW 25)
JYO	Leesburg Executive	Upgrade AWOS	-	-
LNP	Lonesome Pine	Replace AWOS	-	-
LKU	Louisa County/Freeman Field	Upgrade AWOS	Replace Segmented Circle	-
HEF	Manassas Regional/Harry P Davis Field	Replace AWOS	-	Install RVR (RW 16L)
AVC	Mecklenburg-Brunswick Regional	Upgrade AWOS	-	-
FYJ	Middle Peninsula Regional	Upgrade AWOS	-	-
MKJ	Mountain Empire	Replace AWOS	-	-
PSK	New River Valley	Replace AWOS	-	-

Table 8-22: Recommended Weather Equipment Improvements (continued)

ID	Airport	Automated Weather Reporting	Segmented Circle	Runway Visual Range (RVR) Equipment
FCI	Richmond Executive-Chesterfield County	Upgrade AWOS	-	-
RMN	Stafford Regional	Upgrade AWOS	-	-
SFQ	Suffolk Executive	Upgrade AWOS	-	-
VJI	Virginia Highlands	Replace AWOS	Replace Segmented Circle	-
BCB	Virginia Tech/Montgomery Executive	Upgrade AWOS	-	-
OKV	Winchester Regional	Replace AWOS	-	-
0V4	Brookneal/Campbell County	Replace AWOS	-	-
FVX	Farmville Regional	Upgrade AWOS	-	-
FKN	Franklin Regional	Upgrade AWOS	-	-
OMH	Orange County	Upgrade AWOS	-	-
EZF	Shannon	Upgrade AWOS	-	-
JFZ	Tazewell County	Replace AWOS	-	-
HLX	Twin County	Upgrade AWOS	-	-
JGG	Williamsburg-Jamestown	Upgrade AWOS	-	-
W91	Smith Mountain Lake	Install AWOS	-	-

Source: Mead & Hunt.

Runway Lighting Improvements

Recommended improvements to runway lighting are listed in **Table 8-23**.

Table 8-23: Recommended Runway Lighting Improvements

ID	Airport	Runway Edge Lights	Runway Centerline Lights	Touchdown Zone Lights
CHO	Charlottesville-Albemarle	-	Replace Centerline Lights (RW 03/21)	Install Touchdown Zone Lights (RW 03)
PHF	Newport News-Williamsburg	-	Install Centerline Lights (RW 07/25)	Install Touchdown Zone Lights (RW 07 and RW 25)
ORF	Norfolk International	-	-	Install Touchdown Zone Lights (RW 23)
RIC	Richmond International	-	-	Install Touchdown Zone Lights (RW 16)
ROA	Roanoke-Blacksburg Regional/Woodrum Field	-	Install Centerline Lights (RW 06/24 and RW 16/34)	Install Touchdown Zone Lights (RW 06, RW 24, and RW34)
PTB	Dinwiddie County	Replace MIRL (RW 05/23)	-	-
FRR	Front Royal-Warren County	Replace MIRL (RW 10/28)	-	-
GVE	Gordonsville Municipal	Replace MIRL (RW 05/23)	-	-
8W2	New Market	Replace Nonstandard Runway Edge Lights (RW 06/24)	-	-

Source: Mead & Hunt.

Runway Approach Lighting Improvements

Table 8-24 addresses the recommended improvements to runway approach lighting systems.

Table 8-24: Recommended Runway Approach Lighting Improvements

ID	Airport	Runway End Identifier Lights	Runway Approach Lights	Visual Approach Indicators
CHO	Charlottesville-Albemarle	-	Install MALSR (RW 21)	-
LYH	Lynchburg Regional/Preston Glenn Field	-	Install MALSR (RW 22)	Upgrade PAPI (RW 22)
PHF	Newport News-Williamsburg	Install REILs (RW 02)	Upgrade to ALSF-2 (RW 07) Install MALSR (RW 25)	Install PAPI (RW 07)
ORF	Norfolk International	-	Upgrade to ALSF-2 (RW 05)	-
RIC	Richmond International	-	Install MALSR (RW 02)	-
ROA	Roanoke-Blacksburg Regional/Woodrum Field	-	-	Upgrade PAPI (RW 06)
SHD	Shenandoah Valley Regional	-	Install MALSR (RW 23)	-
MFV	Accomack County	-	Install MALS (RW 03)	-
MTV	Blue Ridge	-	Upgrade to MALS (RW 05)	-
CPK	Chesapeake Regional	-	Install MALS (RW 23)	-
CJR	Culpeper Regional	-	Install MALS or MALSR (RW 04)	-
PTB	Dinwiddie County	Replace REILs (RW 05* and RW 23)	Upgrade to MALS (RW 05)*	-
PVG	Hampton Roads Executive	Install REILs (RW 02 and RW 20)	Install MALSR (RW 10) Install MALS (RW 28)	-
OFP	Hanover County Municipal	Replace REILs (RW 16)*	Install MALSR (RW 16)* Install MALS (RW 34)	Install PAPI (RW 34)
HSP	Ingalls Field	Install REILs (RW 07)	-	-
JYO	Leesburg Executive	-	Install MALSR (RW 17) Install MALS (RW 35)	-
LNP	Lonesome Pine	-	Install MALSR (RW 24)	-
AVC	Mecklenburg-Brunswick Regional	-	Install MALSR (RW 01)	-
FYJ	Middle Peninsula Regional	-	Install MALS (RW 10)	Install PAPI (RW 10 and RW 28)
FCI	Richmond Executive-Chesterfield County	-	Install MALSR (RW 15)	-
RMN	Stafford Regional	-	Upgrade to MALSR (RW 33)	-
SFQ	Suffolk Executive	-	Install MALS (RW 04)	-
VJI	Virginia Highlands	Install REILs (RW 06 and RW 24)	-	Install PAPI (RW 06 and RW 24)
BCB	Virginia Tech/Montgomery Executive	-	Install MALSR (RW 13)	Upgrade PAPI (RW 31)
0V4	Brookneal/Campbell County	-	-	-
FVX	Farmville Regional	Install REILs (RW 03)	-	-
FKN	Franklin Regional	Install REILs (RW 09 and RW 27)	-	-

Table 8-24: Recommended Runway Approach Lighting Improvements (continued)

ID	Airport	Runway End Identifier Lights	Runway Approach Lights	Visual Approach Indicators
FRR	Front Royal-Warren County	Install REILs (RW 10 and RW 28)	-	Install PAPI (RW 10 and RW 28)
W75	Hummel Field	-	-	Install PAPI (RW 01 and RW 19)
W63	Lake Country Regional	Install REILs (RW 04 and RW 22)	-	Install PAPI (RW 04 and RW 22)
LUA	Luray Caverns	-	-	Install PAPI (RW 04 and RW 22)
EZF	Shannon	Install REILs (RW 06 and RW 24)	-	Install PAPI (RW 06 and RW 24)
TGI	Tangier Island	Install REILs (RW 02 and RW 20)	-	Install PAPI (RW 02 and RW 20)
JFZ	Tazewell County	-	-	Replace PAPI (RW 07)
AKQ	Wakefield Municipal	Install REILs (RW 02 and RW 20)	-	Install PAPI (RW 02 and RW 20)
JGG	Williamsburg-Jamestown	-	-	Install PAPI (RW 13 and RW 31)
VBW	Bridgewater Air Park	Install REILs (RW 15 and RW 33)	-	Install PAPI (RW 15 and RW 33)
CXE	Chase City Municipal	Install REILs (RW 18 and RW 36)	-	Install PAPI (RW 18 and RW 36)
W91	Smith Mountain Lake	Repair REILs (RW 05)	-	Install PAPI (RW 05 and RW 23)

Notes: * REIL replacement recommended to take place in the short term, while installation of the more sophisticated approach lighting system (MALS or MALSR) recommended to take place in the long term.
Source: Mead & Hunt.

Approach Equipment Improvements

Table 8-25 lists recommended improvements for instrument approach equipment, namely, the glideslope antenna and related components, the localizer antenna and associated gear, and distance measuring equipment.

Table 8-25: Recommended Approach Equipment Improvements

ID	Airport	Glideslope	Localizer	Distance Measuring Equipment
CHO	Charlottesville-Albemarle	-	-	Replace ILS/DME (RW 03)
DCA	Ronald Reagan Washington National	-	-	Replace ILS/DME (RW 01)
IAD	Washington Dulles International	Replace Glideslope (RW 01C, RW 19C, and RW 12)	Replace Localizer (RW 01C, RW 19C, and RW 12)	Replace ILS/DME (RW 01R) Replace ILS/DME (19L)
OFP	Hanover County Municipal	Install Glideslope (16)	-	-
JYO	Leesburg Executive	-	Replace Localizer (RW 17)	Replace DME (RW 17)
LNP	Lonesome Pine	-	-	Replace DME (RW 24)
HEF	Manassas Regional/Harry P Davis Field	Replace Glideslope (16L)	Replace Localizer (RW 16L)	-
FCI	Richmond Executive-Chesterfield County	-	Replace Localizer (RW 33)	-
VJI	Virginia Highlands	-	Replace Localizer (RW 24)	-
0VG	Lee County	-	-	Install DME (RW 25)
XSA	Tappahannock-Essex County	-	-	Install DME (RW 28)

Source: Mead & Hunt.

Obstruction Removal

The NAVAID inventory compiled a list of airports with obstructions that could interfere with approaches to the airport's runways. More than 40 airports were identified as having obstruction issues. The next chapter will detail the methods used to estimate the costs of implementing the various recommendations listed by airport in this chapter, with the exception of obstruction removal. Due to the variability in obstruction removal improvements, this study will provide an estimated cost for obstruction removal for the entire system instead of airport by airport. The variability results from the numerous factors that need to be considered for obstruction removal. A partial listing of those factors includes:

- Area size of obstruction removal
- Number of obstructions to be addressed
- What imaginary surfaces are impacted by the obstructions
- How tall are the obstructions
- Whether the obstructions are on airport-owned land
- For obstructions not on airport-owned land, what level of property owner negotiation is needed
- Whether condemnation proceedings will be necessary
- Whether legal challenges will be part of the process.

This partial list makes it clear that more detailed information is needed for each airport to properly estimate obstruction clearing costs than what is obtained in a system plan. A rough order of magnitude cost estimate will be used to address obstructions at the system level for the Virginia airport system plan.

Source: Mead & Hunt.

Summary

DOAV has shepherded the Virginia aviation system to its present, well-developed position. Through prudent planning, including frequent system planning efforts, DOAV has tracked the growth of the aviation system and focused development in areas deemed important to the state. DOAV has focused its efforts on ways the aviation system can support business development, such as refining and improving IAP minimums to better serve business-class aircraft used by firms and air ambulance operators.

These subtle refinements, such as upgrading instrument approaches in a system where every airport already has an instrument approach, have resulted in the series of recommended improvements listed in this chapter. They were developed from several different analyses, including geographic coverage provided by the system, as well as subparts of the system. Other recommendations came out of the role that airports served in the system, along with recommendations from Virginia licensing and other safety standards. Finally, the inventory of NAVAIDs provided recommendations for the replacement or upgrade of numerous navigation equipment pilots use when flying around the system.

These recommended improvements include a replacement airport in the Grundy region, three proposed new airports, 10 runway extensions, and more than 100 other improvements. These recommendations will allow the Virginia aviation system to continue operating efficiently and focus on business development. The next chapter will estimate the cost of implementing these recommendations.

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Chapter 9: Costs and Funding

The aviation system improvements recommended in the previous chapter have an associated cost. This chapter contains the cost estimates of those improvements and evaluates the expected funding available. Based on the assumptions used, state and federal funding for Virginia's aviation system are estimated to fall short of its needs by $3.2 billion over the planning period.

The chapter consists of the following sections:

- Existing Sources of Funding
- Historical Funding of Virginia Airport Projects
- Development of Cost Estimates
- Summary of Costs
- Funding Analysis
- Gap Analysis
- Peer State Analysis
- Non-Traditional Funding Options
- Impacts on Future Funding

These sections review and compare the sources and levels of funding that Virginia's airports rely on for capital improvements. A description of the methods used to estimate the costs follows the analysis and comparison. The funding analysis describes the steps involved in estimating the expected available funds for the planning period based on the types of airport projects. Comparing the estimated costs to the expected available funds leaves a projected funding gap for the planning period. The chapter concludes with a comparison to Virginia's peer states and descriptions of potential alternative funding sources to address the projected funding gap.

Existing Sources of Funding

Airports generate revenues and receive funding through multiple sources. Typically, airports fund their operating expenses through a combination of aeronautical and non-aeronautical revenues. Aeronautical revenues link directly to airline or aircraft-related activity such as landing fees or facility use fees and rentals, while non-aeronautical revenues, such as in-terminal retail sales, parking fees, or real estate rentals, do not. Commercial service airports rely heavily on non-aeronautical revenues; however, some smaller airports (both commercial service and general aviation) need to be subsidized regularly (even without any capital expenditures) to cover operating costs. In 2020, the negative impacts were severe to both aeronautical and non-aeronautical revenues as the global aviation industry halted due to COVID-19. As a result, airports have relied on external funding sources (particularly federal ones) more heavily in 2020 and 2021 than in previous years.

This section of the Virginia Air Transportation System Plan (VATSP) outlines the external funding sources available to Virginia airports, their historical use, and how COVID-19 has impacted funding. **Table 9-1** illustrates the total amount of funding Virginia's airports received from FY 2015 to FY 2020 with an average of $198 million. State funding has remained relatively consistent ranging from 10 to 14 percent of the total. For a typical year, local funding (i.e., Passenger Facility Charges [PFCs]) is the most important source across all Virginia airports accounting for 50 percent or more of the total amount received. For general aviation airports where PFCs are not collected, the most important source is federal funding.

In FY 2020, federal funding accounted for 45 percent of Virginia's airport funding, an increase of 16 percent. Virginia's total funding went from $193 million in FY 2019 to $194 million in FY 2020 due to the Coronavirus Aid, Relief, and Economic Security (CARES) Act.

Table 9-1: Funding Distribution at All Virginia Airports, FY 2015-FY 2020

	2015	2016	2017	2018	2019	2020
Local	54.3%	49.7%	58.0%	54.9%	58.9%	41.7%
State	12.6%	12.0%	10.6%	14.3%	12.8%	13.5%
Federal	33.1%	38.3%	31.5%	30.9%	28.3%	44.7%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
Total Amount Received	**$189,149,000**	**$212,618,000**	**$187,582,000**	**$204,582,000**	**$193,471,000**	**$194,216,000**

Note: General aviation airports do not collect PFCs. State includes Commonwealth Aviation Fund (CAF) grants but not Aviation Special Fund. Federal includes Airport Improvement Program (AIP) and CARES Local Match and excludes CARES General funds.
Source: Federal Aviation Administration (FAA), Virginia Department of Aviation (DOAV), and individual airport reports.

Based on historical average annual funding, this section presents potential means to fund the airport facility development costs estimated later in this chapter. In addition, two funding scenarios reflect possible changes to available funding due to COVID-19 or other changes in federal or state policy. Potential funding gaps are identified, and methods for bridging these gaps are suggested and compared to approaches used by other states.

Typically, Virginia airports fund capital expenditures, at least in part, using external sources, including:

- Federal AIP grants
- CAF grants
- Commonwealth Aviation Special Fund grants
- Virginia Resources Authority (VRA) Virginia Airports Revolving Fund (VARF) Loan Program
- PFCs
- Local bonds

The emergence of COVID-19 in 2020 generated additional federal funding resources for U.S. airports:

- CARES Act of March 2020
- Coronavirus Response and Relief Supplemental Appropriation Act (CRRSAA) of December 2020
- American Rescue Plan Act (ARPA) of 2021

However, the supplementary federal funding because of COVID-19 will not be repeated in the future and cannot factor into funding plans. One recent federal legislation that can is the Bipartisan Infrastructure Law (BIL) of 2021 passed in November 2021, which sets out a five-year plan of infrastructure grants for airports. Each of the funding sources noted above specifies the eligible airports as shown in **Table 9-2**.

Table 9-2: Funding Program Eligibility Based on Airport Role

Program		Airport Role†				
		Air Carrier	Reliever	General Aviation (NPIAS*)	General Aviation (non-NPIAS)	General Aviation (non-NPIAS) Local Service
Federal	AIP Entitlement/Discretionary	X	X	X		
	CARES/CRRSA/ARPA**	X	X	X		
	BIL	X	X	X		
State	Entitlement	X				
	Discretionary	X	X	X	X	***
	Aviation Special Fund	X	X	X	X	***
Local	PFCs	X				
	Other	X	X	X	X	X

*National Plan of Integrated Airport Systems.
**These COVID-19 response acts apply to funding in FY 2020-2021 only.
***Local service general aviation airports are eligible only for safety and preservation projects under the State Discretionary Program and the Facilities and Equipment Program.
† The airport roles shown are given in terms based on the federal classification of airports and are described on page 3-2.
Source: DOAV Airport Program Manual, revised August 2021.

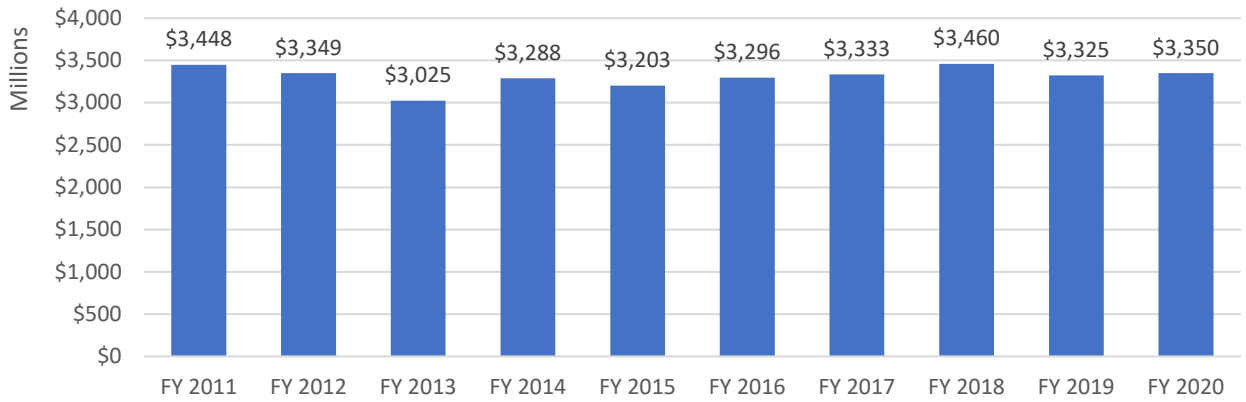
Federal Funding

Airport Improvement Program

The AIP established in 1982 is appropriated from the Airport and Airway Trust Fund (funded by excise taxes on aviation-related activities) and allocated by the FAA. The AIP consists of three different types of funds: entitlement, discretionary, and supplementary. Appropriated AIP funds are distributed into entitlement categories by formula, and the remaining funds are held in a discretionary account. Entitlement funds are distributed to airports that the FAA designates as primary according to the number of annual enplanements in the most recent calendar year. General aviation airports with more than 10,000 passengers also receive an annual entitlement. State apportionments are then available for other nonprimary airports with fewer annual passengers. Entitlement funds are reduced at airports collecting PFCs. For a full list of formulas for calculating annual entitlement distributions see **Table D-1** in **Appendix D**.

Before allocation of discretionary funds, the Small Airport Fund is calculated. It is not an official set-aside fund, but it ensures that 87.5 percent of entitlement funding for large and medium hub airports is used on smaller airports. The remainder of the annual AIP fund finances three set-aside accounts: Noise & Environmental, Military Airport Program (MAP), and Reliever (**Table D-2** in **Appendix D**). After these set-asides, the remaining funds are combined with unused entitlements from the previous fiscal year and are available as discretionary funds. **Table D-3** (**Appendix D**) shows the distribution of AIP funds according to year from FY 2015-FY 2018.[2] Slightly less than 75 percent of annual funds are typically entitlement with the remaining discretionary. The level of annual funding available for AIP grants has roughly remained the same (decline of 0.5 percent per annum) from FY 2011 to FY 2019, reaching $3.33 billion in FY 2019 (see **Figure 9-1***)*. In FY 2020, national AIP allocations were $3.35 billion; although airports began feeling the consequences of the COVID-19 pandemic in Spring of 2020, further legislation (e.g., CARES) created additional funding for US airports, not in the FY 2020 allocation.

[2] FY 2018 is the latest year available at the time of writing for this detailed distribution of AIP funds.



Note: Includes entitlement and discretionary grants. Excludes supplementary discretionary. Excludes CARES Local Match funds.
Source: FAA, https://www.faa.gov/airports/aip/grant_histories/#history.

Figure 9-1: Historical Allocations of AIP Grants, FY 2011 – FY 2020

In addition to the standard entitlement and discretionary funds, Congress began allocating additional funds to the AIP, which are called "supplemental discretionary funds," in FY 2018. In FY 2018, FY 2019, and FY 2020, Congress allocated additional funds of $1 billion, $500 million, and $400 million, respectively, on top of standard AIP funds. These supplemental funds are designated for two types of airports only:

1. nonprimary airports that are classified as Regional, Local, or Basic airports and are not located within a Metropolitan or Micropolitan Statistical Area
2. primary airports that are classified as Small or Non-hub airports

In addition, projects funded with supplemental discretionary funds are covered at a 100 percent rate (compared to the typical 90-95 percent). Project eligibility for supplementary discretionary funds follows the same guidelines as the standard discretionary funding policies. Terminal projects at larger airports do not qualify for standard AIP funding, but they are eligible for supplemental funds. In FY 2019, two Virginia airports received supplemental grants: Middle Peninsula Regional (FYJ) for an apron expansion and Farmville Regional (FVX) for an apron construction. Two more airports received supplemental grants in FY 2020: Dulles International (IAD) for a runway reconstruction and Virginia Highlands (VJI) for a runway extension.

On average, since FY 2011, Virginia airports have received $72 million[3] in AIP funding per year, with approximately 50 percent of this being entitlements (see **Table 9-3***)*. Over the last 10 years, FY 2012 was the highest level of total federal funding for Virginia airports at $97 million.

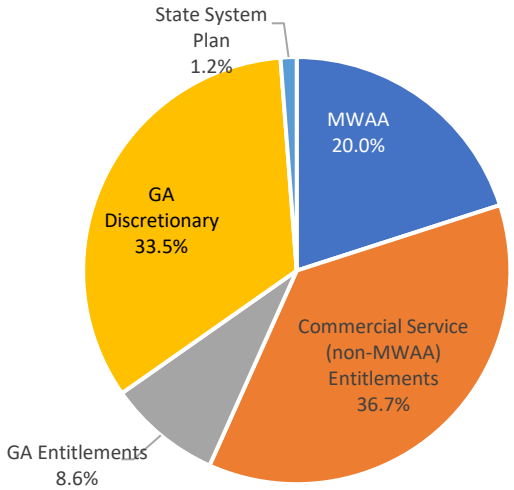
[3] FY 2020 is included in the average here as standard allocations for FY 2020 AIP were made prior to the pandemic.

Table 9-3: Virginia AIP Funding 2011-2020, USD

Fiscal Year	Entitlement	Discretionary	Supplemental Discretionary	Total
2011	$40,241,000	$22,412,000	$0	$62,654,000
2012	$40,343,000	$57,111,000	$0	$97,454,000
2013	$30,115,000	$41,738,000	$0	$71,853,000
2014	$49,671,000	$38,698,000	$0	$88,369,000
2015	$24,935,000	$37,690,000	$0	$62,625,000
2016	$34,787,000	$46,577,000	$0	$81,364,000
2017	$31,238,000	$27,792,000	$0	$59,030,000
2018	$29,046,000	$33,187,000	$897,000	$63,130,000
2019	$34,633,000	$19,690,000	$416,000	$54,739,000
2020	$43,844,000	$16,413,000	$17,846,000	$78,102,000
Total	**$358,853,000**	**$341,308,000**	**$19,160,000**	**$719,321,000**
Annual Average	**$35,885,000**	**$34,131,000**	**$1,916,000**	**$71,932,000**

Note: Fiscal Year shown refers to the year funds were awarded. Includes Metropolitan Washington Airports Authority (MWAA) airports but excludes AIP funds to the Metropolitan Washington Area and CARES funds.
Source: FAA Airport Improvement Program, FAA website, www.faa.gov/airports/aip/grant_histories.

In FY 2020, 20 percent of funds allocated to Virginia airports went to MWAA ($7.6 million in entitlements and $8.1 million in discretionary). The FAA allocated 36.7 percent to other commercial service airports, 42.1 percent to GA airports, and 1.2 percent for state system planning (**Figure 9-2**). Note that FY 2020 was a typical year for standard AIP funding as allocations were made prior to the pandemic.

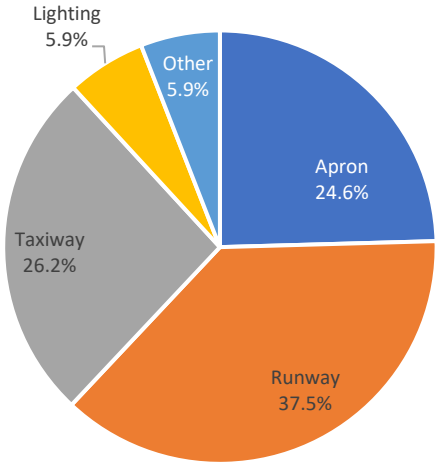


Note: No commercial service airports other than MWAA airports received Discretionary funds in FY 2020.
Source: FAA.

Figure 9-2: Virginia AIP Funding Breakdown by Area, FY 2020

In order to be eligible for an AIP grant, an airport must be in the NPIAS. Therefore, 47 of the 66 Virginia airports are eligible. To receive an AIP grant, an airport must add the project to its Capital Improvement Plan (CIP) and submit pre-planning documents to the FAA. AIP grants cover the majority share of the project cost, and the remainder must be covered by state or local funds. The level of AIP coverage differs by airport role with smaller airports receiving a larger share of projects covered. Large and medium hubs are eligible for 75 percent project coverage (80 percent for noise programs) while smaller hubs and GA airports are eligible for 90-95 percent project coverage.

Not all airport projects are eligible for AIP funding. Eligible projects include those that "enhanc[e] airport safety, capacity, security, and environmental concerns."[4] This does not include an airport's operating expenses, projects related to revenue-producing facilities, or projects related to airport operations. AIP funds can only be used for terminal building projects at smaller airports (non-hub primary, nonprimary commercial service, and reliever). Examples of eligible projects include runway construction/rehabilitation, airfield lighting, and environmental studies. In addition to meeting project eligibility requirements, projects must also conform to the FAA's standard grant assurances. In FY 2020, the largest category of projects at Virginia airports was runway-related (37.5 percent; rehabilitation, construction, or extension) as shown in **Figure 9-3**.



Note: Other includes removal of obstructions, land purchases, and equipment, among others.
Source: FAA.

Figure 9-3: AIP Funding at Virginia Airports by Area, FY 2020

[4] FAA website, *Overview: What is AIP?*, https://www.faa.gov/airports/aip/overview/

COVID-19 Relief Funding

To combat the financial strain on airports and airlines from COVID-19, the CARES Act (H.R. 748, Public Law 116-136) signed into law in March 2020 provided up to $10 billion in funds to eligible entities (such as airports) negatively impacted by the pandemic. The funds, appropriated from the U.S. Treasury's General Fund and allocated by the FAA, increased the share of 2020 capital projects funded by the AIP to 100 percent ("CARES Local Match"), removing the traditional local share component of AIP grants. This share increase amounted to five percent of the CARES allocations (see **Table 9-4**). In addition, the CARES Act provided new funds to NPIAS airports ("CARES General"), distributed by formulas shown in the table below. All commercial service airports received funds (74 percent of total grants) based on the number of enplanements in CY 2018, the amount of debt an airport had, and the amount of money the airport held in reserve. Primary commercial service airports with more than 10,000 annual passenger boardings received additional funds (20 percent) based on the number of enplanements. Lastly, GA airports received funds (one percent) based on their airport categories, such as National, Regional, Local, Basic, and Unclassified. These CARES General funds could be used to reimburse operating expenses, to pay down debt service, and (in some cases) to implement airport development projects.

Table 9-4: CARES Airport Grants (millions USD) by Allocation Category

Group No.	Group	Formula	Grants (millions USD)	Share
1	Increase of Federal Share (CARES Local Match)	• Increase to 100% the federal share of FY 2020 AIP and Supplemental grants	$500	5.0%
2	Commercial Service Airports	• 50% based on airport's percentage of total commercial service airport enplanements in CY 2018 • 25% based on percentage of debt service of total commercial service airport debt service in FY 2018 • 25% based on FY 2018 ratio of unrestricted reserves to its debt service	$7,400	74.0%
3	Primary Commercial Airports	• Based on statutory AIP primary apportionment formula with two exceptions ○ Removal of $26 million limit ○ No reduction for PFCs	$2,000	20.0%
4	General Aviation Airports	• Based on a share of the aggregate eligible development of each GA category • Evenly divided among eligible airports in the category, rounded up to nearest thousand dollars	$100	1.0%
	Total		**$10,000**	**100%**

Source: FAA, Coronavirus Aid, Relief, and Economic Security Act (CARES) Presentation, April 2020. Groups 2-4 are referred to as "CARES General."

Although no time limits were set on disbursing the funds, the FAA allocated CARES funds on an expedited basis, and the FAA urged airports to spend quickly (within four years or the funds could be reallocated). CARES funds could be used for "any purpose for which airport revenues may lawfully be used" and were not limited to eligible projects under the AIP rules. Funds could be used for airport operating expenses, paying down debt service, and/or airport development projects. In addition to standard AIP grant assurances,[5] projects under CARES grants at hub-designated airports must continue to employ 90 percent of staff[6] through December 31, 2020. Forty-seven Virginia airports received $8.9 million of CARES Local Match funds in FY 2020 as shown in **Table 9-5** below. An additional $309.8 million was available to cover operating expenses, debt financing, and airport development.

[5] Grant assurances do not apply to CARES funds used to cover airport operating expenses.
[6] Staff counts as of March 27, 2020.

Many airports cited the critical importance of the CARES funds in providing financial stability and reducing the pressure to lay off staff. MWAA used its CARES General funds to pay down debt service among other projects, while additional Virginia airports used the CARES General funds to supplement operating revenue to maintain service. It was believed that the CARES funding combined with other cost cutting measures would be sufficient to manage finances through 2020-2021. However, this outlook assumed a steady (or even robust) recovery of traffic (and all the associated revenues) through the end of 2020.

The expected traffic recovery did not occur, and the U.S. Government expanded its emergency funding to airports through subsequent legislation in FY 2021 including the Airport CRRSAA, which established the Airport Coronavirus Response Grant Program (ACRGP), and the ARPA. ACRGP funds are eligible to cover both operating expenditures and capital expenditures (as long as they relate to virus spread prevention). The ACRGP allocated an additional $2 billion to U.S. NPIAS airports to support concessions operating within those airports (by assisting with rent or meeting minimum annual guarantees). Funds were distributed across four groups: primary commercial service airports (including some cargo airports), non-primary commercial service airports and general aviation airports, airports participating in the FAA Contract Tower Program, and primary commercial service airports with concessions. In addition, CARES funds not allocated or returned earlier in FY 2020 were also allocated under the ACRGP.

The second FY 2021 act appropriated a further $8 billion for US airports, which the FAA allocated via the Airport Rescue Grants program. This program increased the federal share of FY 2021 AIP grants to 100 percent as well as allocated funds directly to primary and non-primary NPIAS airports based on annual enplanements. Similar to the ACRGP, ARPA funds are available for airport expenditures (operating and some capital) and concessions relief of rent and minimum annual guarantees. Virginia airports received $12.7 million in COVID Relief Local Match funds and $244 million in COVID Relief General funds in FY 2021.[7]

Table 9-5: CARES Funds Allocated to Virginia Airports by Program, FY 2020

Airport Role	Number of Airports	Funding	
		CARES Local Match	CARES General
Commercial Service	9	$6,208,000	$308,190,000
General Aviation	38	$2,587,000	$1,539,000
Non-Airport Specific	n/a	$106,000	$0
Subtotal VA	**47**	**$8,901,000**	**$309,729,000**
Total US	**3,000+**	**$556,300,000**	**$8,747,300,000**

Note: Includes MWAA airports.
Source: FAA.

Bipartisan Infrastructure Law, FY 2022

In FY 2022, Congress passed a substantial bill that will provide additional funding for airports. The BIL, signed on November 6, 2021, established three programs for airport funding:

1. The Airport Infrastructure Grant Program - $15 billion in grants over a five-year period
2. Air Traffic Facilities - $5 billion in federal contracts over a five-year period focused on sustainment and eventual replacement of existing Air Traffic Control facilities
3. Airport Terminal Facilities - $5 billion discretionary funds

[7] COVID Relief funds include both ACRGP and ARPA.

FY 2022 allocations to Virginia airports from the Airport Infrastructure Grant Program are shown in **Table 9-6** below. Virginia is expected to receive approximately $386 million over five years for its airports under this program.[8] Project eligibility guidelines will follow the current guidelines of the federal AIP program and state/local matching requirements will apply. Virginia Airports will also be eligible for the air traffic control and terminal facility funds.

Table 9-6: Virginia Allocation of Bipartisan Infrastructure Law, FY 2022

Airport Role	BIL Grants	
	Number of Airports	Funding
Commercial Service	9	$68,587,000
General Aviation	37*	$8,380,000
Subtotal VA	**46**	**$76,967,000**
Total US	**3,075**	**$2,889,896,000**

*Brookneal/Campbell County (an "Unclassified" GA airport) did not receive BIL funds. Note: Includes MWAA airports.
Source: FAA.

State

The goal of Virginia airport funding is to "allocate funding for airport improvements to: enhance safety; meet regulatory and policy obligations; maximize benefits to the public; and improve access to airports."[9] The Virginia Aviation Board (VAB) allocates available funds across Virginia's airports. State funding for Virginia projects is available from the CAF, which in turn is funded by 1.5 percent of the Commonwealth Transportation Fund. The CAF covers the Airport Capital Program, which funds capital expenditures. In addition to the CAF, Virginia issues grants from the Aviation Special Fund (sourced from tax levied on aviation fuel), which covers non-recurring maintenance, NAVAID communications equipment and installation, security measures, and airport promotion.

Commonwealth Aviation Fund (CAF)

The CAF finances capital expenditure projects via two types of funds: entitlement and discretionary. Similar to the federal program, CAF grants are allocated annually by formula according to airport type (formulas are shown in **Table D-4** in **Appendix D**). Specific consideration is given to MWAA airports. By law, MWAA receives $2 million annually, which is treated as an entitlement, from DOAV. MWAA is not eligible to receive discretionary funds from Virginia. Instead, MWAA relies on federal funds and the issuance of bonds to fund its capital projects.

At commercial service airports, entitlement funds can cover up to 100 percent of the portion not covered by the federal AIP (typically 10 percent of the entire project). If discretionary funds are also applied to the same project, state funds must be lower than 80 percent of the non-federal share. If an airport project is not selected for the AIP (i.e., not federally funded), then it is eligible for state funding coverage at 80 percent (with the remainder covered by local sources). "DOAV encourages sponsors to use other available federal, state, and local funding options, such as PFCs, before applying for state discretionary funds."[10] From 2011-2020, 46-59 percent of annual CAF allocations have been entitlement grants, with the remaining being discretionary (**Table 9-7**).[11] Historically, the commercial service airports' share of CAF funds has ranged from 57-85 percent.

[8] U.S. Department of Transportation. State-by-State Fact Sheets for Virginia and the District of Columbia.
[9] DOAV *Airport Program Manual*, revised August 2021, page 3-1.
[10] Ibid., page 5-3.
[11] This average includes FY 2020. Although the COVID-19 pandemic began in Spring of 2020, funding for FY 2020 was set in 2019.

Table 9-7: Historical Allocation of CAF Allocations, Based on Area

Fiscal Year	Commercial Service Entitlement Funds	Commercial Service Discretionary Funds	GA Discretionary Funds	Total CAF Funds
2011	$10,922,000	$5,258,000	$3,350,000	$19,530,000
2012	$12,005,000	$3,957,000	$5,568,000	$21,531,000
2013	$12,399,000	$3,247,000	$7,264,000	$22,910,000
2014	$12,154,000	$3,146,000	$5,214,000	$20,514,000
2015	$11,172,000	$8,930,000	$3,688,000	$23,790,000
2016	$14,900,000	$3,791,000	$6,854,000	$25,546,000
2017	$13,250,000	$1,789,000	$4,805,000	$19,845,000
2018	$13,499,000	$6,968,000	$8,704,000	$29,171,000
2019	$13,942,000	$0*	$10,738,000	$24,681,000
2020	$13,953,000	$3,636,000	$8,698,000	$26,287,000
Total	**$128,197,000**	**$40,723,000**	**$64,883,000**	**$233,804,000**
Avg. Annual	**$12,820,000**	**$4,072,000**	**$6,488,000**	**$23,380,000**
Compound Annual Growth Rate	**2.8%**	**-4.0%**	**11.2%**	**3.4%**

* No discretionary funds were allocated to commercial service airports in 2019.
Source: DOAV.

A larger group of Virginia airports is eligible for CAF grants than under the federal AIP. To be eligible, an airport must be licensed by DOAV, open to the public, and be included in the VATSP.[12] For example, 19 Virginia airports are not eligible under AIP funding but *are* eligible for state funding. Local service general aviation airports are eligible for CAF grants only for projects related to safety and preservation. As under the federal AIP, the CAF does not cover airport operating costs or revenue-producing facilities. Typical eligible projects include those funding planning and environmental studies; land acquisition; and design/construction of facilities including terminals. Virginia maintains a six-year listing of capital projects across all its airports called the Airport Capital Improvement Plan (ACIP), which serves as the list of near-term prioritized airport projects.

Aviation Special Fund

In addition to the CAF, DOAV allocates funds from the Aviation Special Fund within the following programs:

- Facilities and Equipment (F&E) Program
- Voluntary Security Program (program was in effect during the writing of this system plan, but has since been suspended)
- Maintenance Program
- Aviation and Airport Promotion Program

Each of these programs specifies the type of projects eligible and DOAV share of project costs (as shown in **Table 9-8** below). Like the CAF funds, the Aviation Special Fund cannot be used to cover airport operating expenses.

[12] Additionally, there are annual reporting requirements.

Table 9-8: Aviation Special Fund Program

Program	Eligible Airports	Eligible Projects	DOAV Share
Facilities & Equipment (F&E)	All (limited at local use airports)	• Communication, navigation, and information systems	• 100% for DOAV-owned and -maintained equipment • 80% for sponsor-owned and -maintained equipment (unless federally funded, then 8%)
Voluntary Security*	General Aviation, Public Use	• Security-related only	• 100% for security audits and plan development • 90% for design and installation
Maintenance	All	• Non-recurring or preventative maintenance	• 80-95% depending on project type; $100k maximum per airport per year
Aviation & Airport Promotion	Air Carrier/Commercial Service	• Advertising, education, public relations activities, data subscriptions, development of strategic and marketing plans	• 67% up to $35K for airports with greater than 25K enplanements • 50% up to $35K for airports with less than 25K enplanements
Aviation & Airport Promotion	General Aviation	• Advertising, education, public relations activities, data subscriptions, development of strategic and marketing plans	• 67% up to $10k for airports with more than 25 or more based aircraft • 50% up to $10K for airports with less than 25 based aircraft

Note: *The program was in effect during the writing of the system plan but has been suspended during the plan's finalization.
Source: DOAV Airport Program Manual, revised August 2021.

Other Sources of State Funding

The Virginia Department of Transportation manages the Airport Access Program, which finances the planning and construction of new or upgraded access roads located off of airport property.

Local

In addition to the local match required by federal and state (both CAF and Aviation Special Fund) grants, local sources of funding for Virginia airports include PFCs and bonds.

Passenger Facility Charge (PFC) Program

Started in 1992, the PFC program allows commercial service U.S. airports to collect a fee for each passenger using the airport. Although federally regulated, the PFC program is considered a local funding source. PFC funds can be used both for capital projects as well as servicing debt. The maximum PFC allowed to be collected has been capped at $4.50 since 2000; all Virginia airports currently charging PFCs collect at the $4.50 level. Over the last four fiscal years prior to the pandemic, the nine commercial service airports collected $441 million in PFC revenue (**Table 9-9**). As PFC revenue is directly related to passenger volumes, PFC revenue decreased by 29.1 percent in FY 2020 after increasing by 2.5 percent on average during the previous four years.

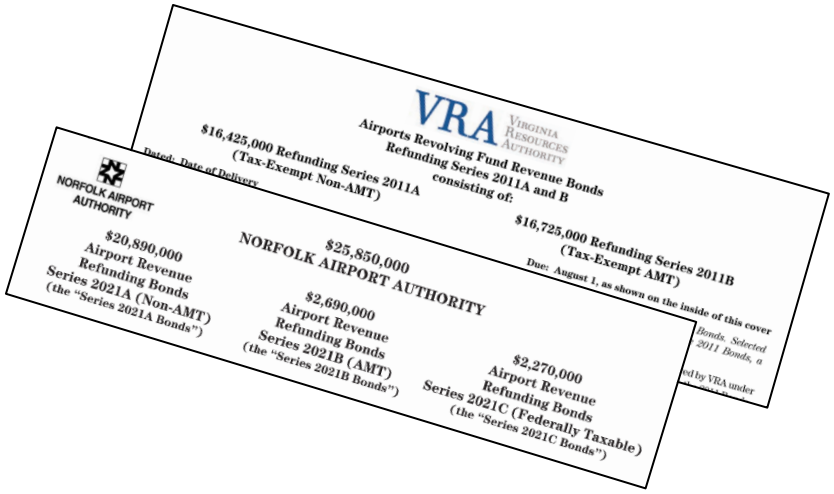
Table 9-9: Virginia Airports, PFCs Collected, FY 2016 – FY 2020

Airport	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	Total*
Charlottesville-Albemarle	$1,200,000	$1,330,000	$1,448,000	$1,582,000	$1,182,000	$6,742,000
Lynchburg Regional	$318,000	$321,000	$338,000	$360,000	$325,000	$1,662,000
MWAA Total	$88,796,000	$90,977,000	$93,316,000	$92,992,000	$65,035,000	$431,116,000
Newport News-Williamsburg	$821,000	$795,000	$824,000	$833,000	$782,000	$4,055,000
Norfolk International	$6,317,000	$6,581,000	$7,201,000	$7,935,000	$5,926,000	$33,959,000
Richmond International	$7,022,000	$7,518,000	$7,876,000	$8,941,000	$6,473,000	$37,830,000
Roanoke-Blacksburg Regional	$1,209,000	$1,185,000	$1,265,000	$1,409,000	$1,271,000	$6,340,000
Shenandoah Valley	$25,000	$0	$13,000	$0	$37,000	$74,000
Total	**$105,708,000**	**$108,707,000**	**$112,281,000**	**$114,051,000**	**$81,031,000**	**$521,779,000**

*Includes FY 2020.
Source: FAA.

Other Sources of Local Funding

In addition to PFCs, Virginia airports have other sources of funds to use for the local share of capital projects. Although mandated by *state* law, the Virginia Airports Revolving Fund (VARF) is available to cover the *local* share of federal/state funded projects or for projects not eligible for federal/state funding. Established in 2000, the VARF provides loans at below-market-rates to support capital improvement projects at public use airports. VARF applications made to the Virginia Resources Authority (VRA) are endorsed by the VAB and approved by the VRA. Finally, some airports in Virginia periodically issue bonds to cover airport capital needs. Seven of Virginia's nine commercial service airports have previously issued bonds (including airport revenue bonds and those backed by PFCs).[13]

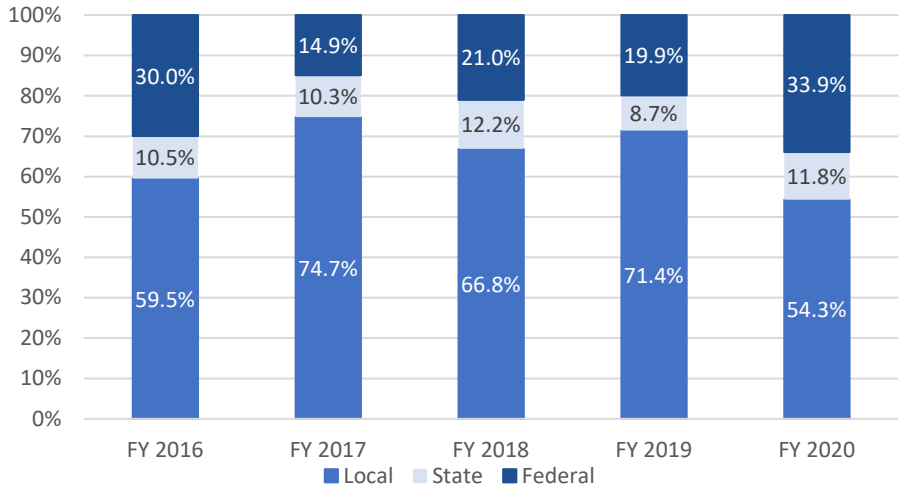


Source: Norfolk Airport Authority; Virginia Resources Authority.

[13] Excluding municipal general obligation bonds.

Historical Funding of Virginia Airport Projects

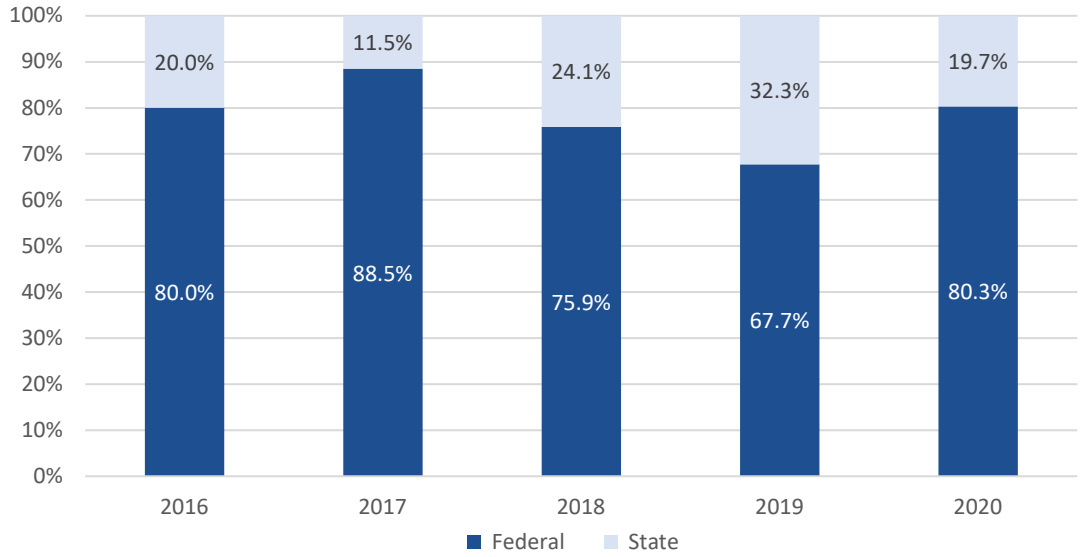
Historically, federal sources have accounted for 15-30 percent of annual funding at commercial service airports in Virginia (**Figure 9-4**); state sources accounted for 9-12 percent; and the remainder was funded by local sources. In FY 2019, the federal share accounted for 19.9 percent of total funding. Due to the addition of CARES funding in FY 2020, the federal share of total funding in FY 2020 increased to 33.9 percent. For a full list of funding distributions by commercial service airport, see **Table D-5** in **Appendix D**.



Note: Local includes PFCs but not bonds or other local sources. State includes CAF but not Aviation Special Funds. Federal includes AIP and CARES Local Match.
Source: FAA, DOAV, and individual airport reports.

Figure 9-4: Historical Funding Distribution for Virginia Commercial Service Airports

Without the ability to collect PFCs, funding for Virginia general aviation airports is split between federal and state sources (**Figure 9-5**). The federal funding share has ranged from 68-89 percent over the four fiscal years prior to the pandemic. In FY 2020, the federal share was 80.3 percent, which includes CARES Local Match funds.



Note: General aviation airports do not collect PFCs. State includes CAF but not Aviation Special Fund. Federal includes AIP and CARES Local Match.
Source: FAA, DOAV, and individual airport reports.

Figure 9-5: Historical Funding Distribution for Virginia General Aviation Airports

Development of Cost Estimates

This section establishes rough order of magnitude (ROM) cost estimates for infrastructure, facilities, and equipment needs for the 2022 to 2044 timeframe. The recommended system improvements described previously are part of these needs. To provide a full picture of the financial conditions DOAV faces over the planning period, the cost estimates of the recommended system improvements include other capital needs that consist of:

- Individual airport capital improvement projects from 2022 to 2027 not already included in the recommended system improvements. Estimates of similar projects expected from 2028 to 2044 were drawn from the list of airport capital improvement projects.
- Pavement maintenance projects from the *2020 Pavement Management Program Update*. This report provided estimates of pavement capital costs out to 2027. The study team extrapolated the pavement maintenance needs of the Virginia aviation system out to 2044 based on data from this report.
- Capital costs to maintain a minimum operating network of navigational aids (NAVAIDs).
- Entitlement money transferred annually from DOAV to the MWAA by agreement.
- Capital costs associated with bringing adequate electric power to select airports in anticipation of electric aircraft needs.
- Capital costs tied to fuel farm expansions in anticipation of unleaded and sustainable aviation fuels.
- Development of new airports.

This section describes how costs were developed, what data sources were used, and contains a detailed summary of costs for major project categories that will be required for the 22-year planning period.

Background

Cost estimates for infrastructure, facilities, and equipment needs of the system were determined using various cost information sources. This included similar projects built within the past three years or planned to be developed within the next five years at airports throughout the Commonwealth, relevant studies such as the *2020 Virginia Airport Pavement Management Program Update*, and costs data from a variety of industry data sources. Project costs were identified for the 66 Virginia system airports. The analysis identified more than 1,000 discrete projects throughout the planning period (2022-2044) according to the facility requirements analysis as part of the VATSP study. This includes capital projects for new infrastructure as well as funding for maintenance projects.

Project Classifications

Project classification occurred based on two categorization systems: Project Type and Facility Role. Project Type allocates the cost based on the expenditure and what will be accomplished or constructed.

Project types and their costs fell into these categories:

- The Aircraft Hangar category includes costs associated with construction of corporate hangars and T-hangars.
- The Airfield Pavement (Rehab or Reconstruction) category includes costs associated with preventative maintenance for runway and taxiway pavement areas.
- The Air Traffic Control Tower (ATCT) category includes costs associated with new and replacement towers.
- The Auto Parking category includes costs associated with construction of vehicle parking and roadways.
- The Aviation Fueling category includes costs associated with construction of aviation fueling storage and dispensing facilities.

Source: Mead & Hunt.

- The GA Terminal Improvements category includes costs associated with terminal construction/expansion and terminal maintenance for general aviation facilities.
- The General Capital Project category includes costs associated with equipment, entitlement funding to MWAA, and miscellaneous other projects that do not fit within other categories.
- The NAVAIDs category includes costs associated with NAVAIDs.
- The New Airports category represents new airports planned for construction.
- The Planning of Runway Protection Zones (RPZ), Runway Safety Areas (RSA), Runway Object Free Areas (ROFA), Land Use or other Improvements category includes costs associated with studies or projects such as master plans and airport layout plans, environmental entitlement projects, and projects related to acquiring land and/or clearing land areas located within protected surfaces such as the RSAs, ROFAs, or RPZs.
- The Remote Tower category includes costs associated with nontraditional ATCT enhancements.
- The Runway Construction (Extension or Widening) category includes costs associated with new runway pavement construction.
- The Taxiway Construction (Extension or Widening) category includes costs associated with new taxiway/taxilane pavement construction.
- The Vehicle Capital Cost category includes capital costs associated with acquisition of new maintenance vehicles.

Facility Role as a classification system allocates the cost based on the role played within the Commonwealth aviation system. These are the VATSP Airport Roles (i.e., Commercial Service, Community Business, Local Service, Regional Business) plus three additional categories. The three other categories are New Airports, Multiple Airports, and Minimum Operating Network. While these do not represent specific airports, classification into these roles remains necessary.

In cases where new airport construction was identified for the 22-year planning horizon, costs were categorized as New Airports. Three new airports are planned to enter service as Regional Business airports. Categorizing them as New Airports provides a useful separate category for DOAV officials to differentiate their implementation costs.

Multiple Airports categorizes projects that were not easily matched with a specific airport facility, or the recipient of the funds is not yet determined (e.g., unplanned maintenance budget). Therefore, Multiple Airports can represent projects within any VATSP airport role.

The Minimum Operating Network is a set of NAVAIDs necessary to support the lowest level of operability for aerial navigation within the Commonwealth airspace. Projects categorized as Minimum Operating Network serve the greater aviation system. Therefore, this separate category was used to capture all planned project costs.

Project Cost Data Sources

This section describes the methodology used to develop cost estimates. Project costs were prepared using several sources to ensure that the most accurate and appropriate budgetary numbers are considered in this study.

Capital cost estimate and data points from the VATSP NAVAIDs Assessment were the primary source to obtain the project cost for NAVAID infrastructure improvements. Considerations included cost of the equipment, allowances for design and construction/installation testing, and calibration costs, where appropriate.

The 2016 VATSP study was used to formulate the project costs associated with potential new airports. Considerations included planning/environmental studies, airfield pavement, NAVAIDs, landside access facilities, and a general aviation terminal facility.

The DOAV Statewide CIP was the basis of many of the projects identified in the facility requirements. The CIP lists extend through the 2028 fiscal year, so a pro forma extension of the CIP costs was prepared. This methodology included extrapolating the costs listed in the current CIP through the end of the planning period (2044) and proportionally allocating the costs to Project Type and Facility Role, where possible.

The DOAV Statewide Pavement Management and Maintenance Plan (PMMP) that was completed in 2020 was the primary source to estimate the cost of airfield maintenance projects. The PMMP included costs through fiscal year 2027, which led to the preparation of a pro forma extension of the pavement maintenance costs. This methodology is similar

to that completed for the CIP. It included extrapolating the costs listed in the current PMMP through the end of the planning period (2044) and proportionally allocating the costs to Facility Role. Where possible, the analysis accounted for expected duration of pavements considering the type of rehabilitation performed in the previous investment period.

Another primary source for cost data is the historic DOAV construction project bid tabs collected from projects bid in 2018 and 2019. This project data provided a "real-world" estimate of construction costs and associated project soft cost for varying projects bid across the Commonwealth. The data was used to identify planning-level unit costs that could apply to the study list of projects to determine future project cost. Where possible, the unit costs extracted from the construction project bid tabs were identified based on airport use (e.g., commercial service vs. general aviation airport) to ensure the applied unit costs best represented the project at hand.

Additional project cost sources included DOAV staff for general budgetary allowances. For example, DOAV identified ongoing funding for unplanned maintenance projects and DOAV entitlements for MWAA, which historically received $2 million annually from DOAV. Thus, the same amount was included as a future budgetary need.

A cost escalation factor was applied after all of the project cost estimates (in 2022 dollars), as described in the next section.

Cost Escalation

Projects Costs were escalated to the year of implementation. Escalation rates were established based on information available from industry sources such as Means Construction Costs, Turner Construction, and Construction Analytics data for Virginia. **Table 9-10** below shows the various escalation rates used for estimates.

Table 9-10: Escalation Rates

Period	Total Growth Rate
2022 to 2023	6.50%
2022 to 2024	13.40%
2022 to 2025	17.50%
2022 to 2026	18.50%
2022 to 2027	21.70%
2022 to 2028	24.99%
2022 to 2029	28.36%
2022 to 2030	31.83%
2022 to 2035	47.94%
2022 to 2040	67.38%
2022 to 2044	84.75%

Note: The recent volatility of inflation called for year-by-year projections out to 2030. Beyond 2030, when inflation is expected to return to more stable behavior, projections cover up to five-year periods.
Source: Means, Turner, Edzarenski.

Source: Jason Davis.

Summary of Costs

ROM cost estimates are for the projects set to be implemented at Commonwealth airports through 2044. ROM costs for the various projects are determined considering the time period when the projects are expected to occur within the planning period. Project ROM costs were estimated based on the cost of the project in 2022 dollars escalated to the year they occur.

Table 9-11 shows the ROM cost estimates for the 2022 Fiscal Year. Projects associated with Regional Business Airports represent the highest dollar value with costs for the Commercial Service Airports category ranked second. The Airfield Pavement (Rehab or Reconstruction) Project Type represents the largest dollar value when comparing Facility Roles to the other Project Types – representing more than half of the total budget for each Facility Role. This Project Type drives the total cost associated with Regional Business Airports and Commercial Service Airports, accounting for approximately 80 percent of the projected costs for the initial fiscal year of this planning study.

Table 9-11: Rough Order of Magnitude Project Cost Estimates – 2022, Facility Roles Broken out by Project Type

Project Type	Commercial Service	Regional Business	Community Business	Local Service	New Airports	Multiple Airports	Min. Operating Network
Aircraft Hangar	$0	$15,041,000	$770,000	$34,000	$0	$0	$0
Airfield Pavement (Rehab or Reconstruction)	$57,297,000	$65,090,000	$26,412,000	$15,728,000	$0	$0	$0
ATCT	$0	$0	$0	$0	$0	$0	$0
Auto Parking	$1,921,000	$3,495,000	$0	$0	$0	$0	$0
Aviation Fueling	$0	$0	$0	$0	$0	$0	$0
Terminal Improvements	$10,451,000	$1,752,000	$100,000	$233,000	$0	$0	$0
General Capital Project	$6,821,000	$1,845,000	$470,000	$0	$0	$5,313,000	$0
NAVAIDs	$435,000	$436,000	$900,000	$85,000	$0	$0	$0
New Airport	$0	$0	$0	$0	$0	$0	$0
Planning – (RPZ, RSA, ROFA, Land Use or other Improvements)	$3,456,000	$7,962,000	$1,484,000	$199,000	$0	$0	$0
Remote Tower	$0	$0	$0	$0	$0	$0	$0
Runway Construction (Extension or Widening)	$0	$0	$0	$0	$0	$0	$0
Taxiway Construction (Extension or Widening)	$20,455,000	$12,920,000	$0	$128,000	$0	$0	$0
Vehicle Capital Cost	$1,352,000	$0	$0	$0	$0	$0	$0
Totals	**$102,188,000**	**$108,541,000**	**$30,136,000**	**$16,407,000**	**$0**	**$5,313,000**	**$0**

Source: RS&H.

Table 9-12 presents the project costs for the 2023-2027 timeframe. Projects associated with Commercial Service Airports represent the highest dollar value with costs for the Regional Business Airports ranked second. Similar to the 2022 Fiscal Year, the Airfield Pavement (Rehab or Reconstruction) Project Type represents the largest dollar value across both of these Facility Roles compared to the other Project Types – representing more than one-third of the total budget for each Facility Role. The total cost associated with Commercial Service Airports and Regional Business Airports accounts for approximately 90 percent of the projected costs for the initial fiscal year of this planning study.

Table 9-12: Rough Order of Magnitude Project Cost Estimates – 2023-2027

Project Type	Commercial Service	Regional Business	Community Business	Local Service	New Airports	Multiple Airports	Min. Operating Network
Aircraft Hangar	$0	$8,889,000	$3,291,000	$682,000	$0	$0	$0
Airfield Pavement (Rehab or Reconstruction)	$199,043,000	$173,019,000	$24,163,000	$5,723,000	$0	$0	$0
ATCT	$0	$609,000	$0	$0	$0	$0	$0
Auto Parking	$55,036,000	$9,781,000	$1,214,000	$49,000	$0	$0	$0
Aviation Fueling	$0	$0	$0	$0	$0	$731,000	$0
Terminal Improvements	$85,017,000	$14,925,000	$5,207,000	$610,000	$0	$0	$0
General Capital Project	$84,532,000	$4,851,000	$2,819,000	$481,000	$0	$15,000,000	$0
NAVAIDs	$6,793,000	$6,865,000	$3,218,000	$73,000	$0	$0	$7,459,000
New Airport	$0	$0	$0	$0	$0	$0	$0
Planning – (RPZ, RSA, ROFA, Land Use or other Improvements)	$8,126,000	$37,645,000	$7,970,000	$197,000	$0	$0	$0
Remote Tower	$0	$0	$0	$0	$0	$0	$0
Runway Construction (Extension or Widening)	$0	$21,223,000	$3,195,000	$0	$0	$0	$0
Taxiway Construction (Extension or Widening)	$112,864,000	$108,143,000	$8,391,000	$675,000	$0	$0	$0
Vehicle Capital Cost	$9,967,000	$0	$0	$0	$0	$0	$0
Totals	**$561,378,000**	**$385,950,000**	**$59,468,000**	**$8,490,000**	**$0**	**$15,731,000**	**$7,459,000**

Source: RS&H.

Table 9-13 describes the project costs for the 2028-2032 timeframe. Within this timeframe, approximately $1.29 billion is allocated to the Multiple Airports Facility Role. New construction and anticipated preventative maintenance for airfield facilities at various airports across the Commonwealth drive these costs. The budget for the Multiple Airports category represents approximately 60 percent of the total budget for this period. Costs associated with Commercial Service Airports and Regional Business Airports Facility Roles each total approximately $400 million. Automobile parking costs account for the greatest share (approximately 56 percent) for Commercial Service Airports, while aircraft hangars account for the greatest share (approximately 26 percent) for Regional Business Airports.

Table 9-13: Rough Order of Magnitude Project Cost Estimates – 2028-2032

Project Type	Commercial Service	Regional Business	Community Business	Local Service	New Airports	Multiple Airports	Min. Operating Network
Aircraft Hangar	$34,317,000	$102,872,000	$7,711,000	$9,782,000	$0	$51,663,000	$0
Airfield Pavement (Rehab or Reconstruction)	$0	$0	$0	$0	$0	$337,323,000	$0
ATCT	$6,905,000	$10,000,000	$0	$0	$0	$0	$0
Auto Parking	$222,096,000	$73,055,000	$12,472,000	$2,231,000	$0	$42,595,000	$0
Aviation Fueling	$0	$0	$1,838,000	$3,063,000	$0	$3,948,000	$0
Terminal Improvements	$4,320,000	$6,980,000	$6,783,000	$2,955,000	$0	$154,575,000	$0
General Capital Project	$2,167,000	$33,739,000	$1,488,000	$0	$0	$110,723,000	$0
NAVAIDs	$33,000,000	$43,607,000	$5,451,000	$3,147,000	$0	$35,724,000	$4,645,000
New Airport	$0	$0	$0	$0	$0	$0	$0
Planning – (RPZ, RSA, ROFA, Land Use or other Improvements)	$18,301,000	$13,052,000	$16,838,000	$14,025,000	$0	$79,830,000	$0
Remote Tower	$2,748,000	$14,290,000	$0	$0	$0	$0	$0
Runway Construction (Extension or Widening)	$0	$44,917,000	$17,895,000	$5,545,000	$0	$0	$0
Taxiway Construction (Extension or Widening)	$71,426,000	$37,154,000	$57,878,000	$0	$0	$457,542,000	$0
Vehicle Capital Cost	$0	$18,629,000	$5,826,000	$0	$0	$13,740,000	$0
Totals	**$395,280,000**	**$398,295,000**	**$134,180,000**	**$40,748,000**	**$0**	**$1,287,663,000**	**$4,645,000**

Source: RS&H.

Table 9-14 describes the project costs for the 2033-2044 timeframe. This timeframe includes approximately $2 billion allocated to the Multiple Airports category. New construction and anticipated preventative maintenance for airfield facilities at various airport across the Commonwealth drive these costs. The costs to support the construction of the four new airports drives the New Airports category to the second ranked budgetary requirement for this period.

Table 9-14: Rough Order of Magnitude Project Cost Estimates – 2033-2044

Project Type	Commercial Service	Regional Business	Community Business	Local Service	New Airports	Multiple Airports	Min. Operating Network
Aircraft Hangar	$10,249,000	$49,196,000	$2,870,000	$0	$0	$81,353,000	$0
Airfield Pavement (Rehab or Reconstruction)	$0	$0	$0	$0	$0	$510,700,000	$0
ATCT	$0	$0	$0	$0	$0	$0	$0
Auto Parking	$0	$0	$0	$0	$0	$67,065,000	$0
Aviation Fueling	$0	$0	$0	$0	$0	$8,040,000	$0
Terminal Improvements	$0	$0	$0	$0	$0	$243,382,000	$0
General Capital Project	$0	$38,680,000	$0	$0	$0	$167,365,000	$0
NAVAIDs	$0	$2,113,000	$0	$0	$0	$56,314,000	$2,481,000
New Airports	$0	$0	$0	$0	$247,721,000	$0	$0
Planning – (RPZ, RSA, ROFA, Land Use or other Improvements)	$0	$0	$0	$0	$0	$125,913,000	$0
Remote Tower	$0	$0	$0	$0	$0	$0	$0
Runway Construction (Extension or Widening)	$0	$0	$0	$0	$0	$0	$0
Taxiway Construction (Extension or Widening)	$0	$0	$0	$0	$0	$719,656,000	$0
Vehicle Capital Cost	$0	$0	$0	$0	$0	$21,688,000	$0
Totals	**$10,249,000**	**$89,989,000**	**$2,870,000**	**$0**	**$247,721,000**	**$2,001,476,000**	**$2,481,000**

Source: RS&H.

Table 9-15 provides a summary of the project costs for the entire planning period.

Table 9-15: Rough Order of Magnitude Cost Estimate Summary

Airport Role	2022 Costs	2023-2027 Costs	2028-2032 Costs	2033-2044 Costs
Commercial Service	$102,188,000	$561,378,000	$395,280,000	$10,249,000
Regional Business	$108,541,000	$385,950,000	$398,295,000	$89,989,000
Community Business	$30,136,000	$59,468,000	$134,180,000	$2,870,000
Local Service	$16,407,000	$8,490,000	$40,748,000	$0
New Airports	$0	$0	$0	$247,721,000
Multiple Airports	$5,313,000	$15,731,000	$1,287,663,000	$2,001,476,000
Minimum Operating Network	$0	$7,459,000	$4,645,000	$2,481,000
Total	$262,585,000	$1,038,476,000	$2,260,811,000	$2,354,786,000
Grand Total	**$5,916,658,000**			

Source: RS&H.

Source: Keith Holt.

Funding Analysis

As discussed earlier in chapter 9, the funding sources available to finance airport projects costs are federal grants, Commonwealth grants, and local revenues. **Table 9-16** shows the funding allocations. Federal grants are available to NPIAS airports, while non-NPIAS airports are eligible for only state and local funding. Federal grants cover 90 percent of most projects eligible for federal funding, with state funding covering 8 percent, and the local funding share at 2 percent. For projects where federal funding is not available, the state often covers 80 percent of the project costs with local funding covering the remaining 20 percent.[14]

Table 9-16: Virginia Airport Capital Plan Funding (Federal and State Capital Improvement Programs)

Project Category	NPIAS Funding Allocations			non-NPIAS Funding Allocations	
	Federal	State	Local	State	Local
Airside	90%	8%	2%	80%	20%
Facilities Service and Equipment	90%	8%	2%	80%	20%
Landside	90%	8%	2%	80%	20%
Terminal*	59%	5%	36%	52%	48%
New Airport	90%	8%	2%	80%	20%
Planning	90%	8%	2%	80%	20%
Security	90%	8%	2%	100%	0%
F&E**	79%	19%	2%	84%	16%
Maintenance	0%	80%	20%	80%	20%
Other	0%	100%	0%	100%	0%

* Percentage of federal and state participation for terminal projects is not standard. Percentages shown reflect an assumption that 65% of a terminal building is public use space.
** Funding for F&E projects depends on ownership (FAA, DOAV, or Sponsor).
Note: There are multiple exceptions to the funding allocations shown above. Other includes the annual MWAA entitlement and Minimum Operating Costs.
Source: FAA, DOAV, VATSP Analysis.

The costs of individual projects at each airport were combined to determine the total cost of recommended projects at each airport. Funding eligibility was applied to each project as outlined in **Table 9-16** above. The airport project costs and the funding source eligibility were further summed by airport role and by project type. These costs are unconstrained and have not been reviewed or prioritized with respect to the ultimate objectives and initiatives resulting from the system plan. **Table 9-17** below includes the summary costs by role and project type for existing airports. Notable findings include:

- Development costs totaled $5.92 billion over the forecast period, with $1.25 billion allocated to the state funding source.
- The nine commercial service airports in the Virginia system, including MWAA airports, account for $2.651 billion in project costs over the forecast period, or an average of $295 million per airport. Regional business and community business airports account for an average of $84 million and $26 million per airport, respectively, while local service airports average $20 million per airport.
- Airside projects make up the largest share of project cost, accounting for 60.6 percent of the total costs, followed by Landside and Facilities, Service and Equipment, which make up 8.2 percent and 7.8 percent, respectively.

[14] As shown in Table 9-16, there are exceptions to the funding allocation method for both federal and state eligible projects.

Table 9-17: Development Cost Summary Tables

VATSP Unconstrained Summary

VATSP Service Role	Funding Source Eligibility			
	Total	Federal	State	Local
Commercial Service	$2,651,387,000	$1,956,658,000	$544,483,000	$150,246,000
Regional Business	$2,339,749,000	$1,909,509,000	$327,511,000	$102,729,000
Community Business	$460,371,000	$223,713,000	$182,752,000	$53,907,000
Local Service	$221,373,000	$0	$176,092,000	$45,282,000
New Airport	$247,721,000	$222,949,000	$19,818,000	$4,954,000
Total	**$5,920,601,000**	**$4,312,829,000**	**$1,250,656,000**	**$357,118,000**

Project Type Summary

VATSP Service Role	Funding Source Eligibility			
	Total	Federal	State	Local
Airside	$3,586,765,000	$2,949,024,000	$507,876,000	$129,865,000
Facilities Service and Equipment	$458,945,000	$312,838,000	$116,885,000	$29,221,000
Landside	$488,130,000	$318,345,000	$135,828,000	$33,957,000
Terminal	$208,617,000	$112,893,000	$18,166,000	$77,558,000
New Airport	$247,721,000	$222,949,000	$19,818,000	$4,954,000
Planning	$257,037,000	$212,969,000	$35,255,000	$8,814,000
Security	$58,505,000	$48,569,000	$8,857,000	$1,079,000
F&E	$198,416,000	$135,243,000	$58,080,000	$5,092,000
Maintenance	$355,882,000	$0	$289,305,000	$66,576,000
Other	$60,583,000	$0	$60,583,000	$0
Total	**$5,920,601,000**	**$4,312,830,000**	**$1,250,653,000**	**$357,116,000**

Source: VATSP Analysis.

Using published project eligibility guidelines, project costs were assigned to federal, state, and local categories. Over the planning period, 73.6 percent of costs are estimated to be covered by federal funds (**Table 9-18**). A federal share below 90 percent reflects the fact that some projects (e.g., those at non-NPIAS airports or maintenance projects) are not eligible for AIP grants and must be funded fully by state and local sources. The cost of projects eligible only for state and local funding or the state share of federally eligible projects account for 20.6 percent of project costs. The local share of project costs is estimated to be 5.8 percent.

Table 9-18: Development Cost for All Virginia Airports by Funding Source

Funding Source	Total Planning Period Project Costs (in thousands of $)				
	2022	2023-2027	2028-2032	2043-2044	Total
Federal	$200,227	$777,571	$971,183	$2,363,848	$4,312,829
State	$49,366	$203,519	$326,411	$671,358	$1,250,654
Local	$12,987	$57,371	$90,167	$196,593	$357,118
Total	**$262,580**	**$1,038,461**	**$1,387,761**	**$3,231,799**	**$5,920,601**

Source: VATSP Analysis.

As annual funding levels have varied, multiple years of historical federal and state funding for Virginia airports were examined to determine an average annual level of funding. A period before the pandemic was chosen for this analysis to exclude one-time grants due to pandemic relief efforts. From 2015-2019, Virginia airports received $88.8 million in federal and state funding each year on average. This $88.8 million is 64.9 percent lower than the estimated average annual funding needs of $252.8 million (see **Table 9-19**), indicating that funding gaps will occur over the planning period.

Table 9-19: Average Annual Funding Need vs. Historic Average Annual Funds

Funding Source	Historic Average Annual Funds (2015-2019)	Average Annual Funding Needs				
		2022	2023-2027	2028-2032	2033-2044	Total
Federal	$64,178,000	$200,227,000	$155,514,000	$194,237,000	$216,166,000	$197,520,000
State	$24,606,000	$49,366,000	$40,704,000	$65,282,000	$57,651,000	$55,266,000
Federal and State Subtotal	**$88,784,000**	**$249,593,000**	**$196,218,000**	**$259,519,000**	**$273,817,000**	**$252,786,000**
Local	Unavailable	$12,987,000	$11,474,000	$18,033,000	$16,809,000	$15,749,000
Total	**$88,784,000**	**$262,580,000**	**$207,692,000**	**$277,552,000**	**$290,626,000**	**$268,535,000**

Notes: State historic average annual funding includes the CAF (entitlements and discretionary) but not Special Aviation Funds due to lack of data; Federal includes AIP and grants to the Commonwealth as a whole (not a particular airport).
Source: FAA, DOAV, VATSP Analysis.

Over the planning period, Commonwealth funding required will vary by year and airport. **Table 9-20** below presents the VATSP state funding needs by airport role, source, and development time frame. A total of $788.0 million in state funding is needed over the entire planning period. Commercial service airports account for 27.6 percent of state funding needs at $217.8 million. Regional and Community Business airports account for 28.9 percent and 20.4 percent of needs, respectively. New airports are expected to require $19.8 million in state funds. The majority of state funds needed are from the CAF, with much smaller amounts from the Maintenance and F&E special funds (which are both limited by an annual budget).

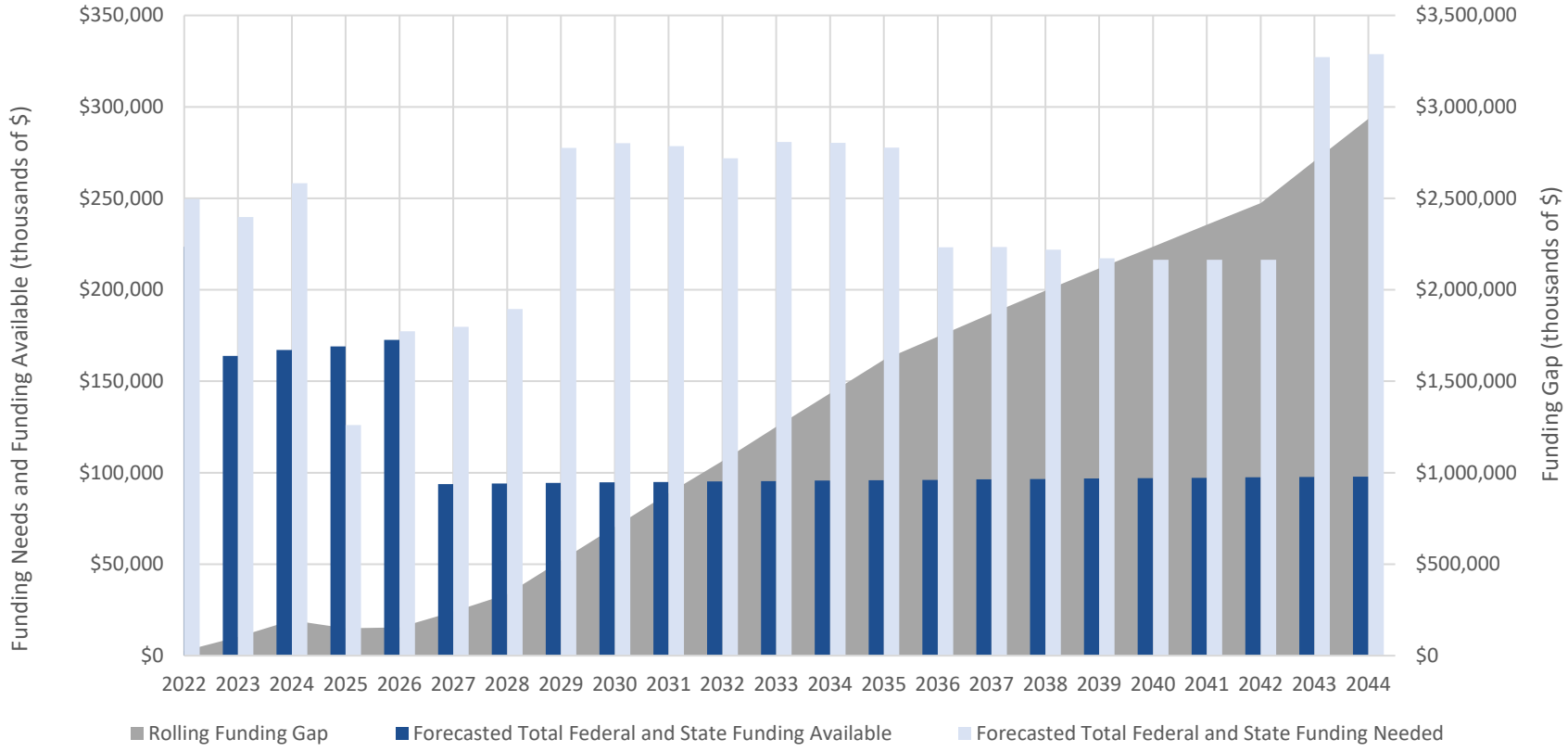
Table 9-20: State Funding Needs Over the Planning Period (2022-2044)

VATSP Service Role	Capital Funding Needs	Special Funding Needs		
		F&E	Maintenance	Total
Commercial Service	$201,930,000	$6,039,000	$9,809,000	$217,778,000
Regional Business	$211,210,000	$6,624,000	$10,186,000	$228,020,000
Community Business	$157,869,000	$1,428,000	$1,806,000	$161,103,000
Local Service	$159,501,000	$519,000	$1,200,000	$161,220,000
New Airports	$19,818,000	$0	$0	$19,818,000
Total	**$750,328,000**	**$14,610,000**	**$23,000,000**	**$787,939,000**
Plan Period Phases	**Capital Funding Needs**	**Special Funding Needs**		
		F&E	**Maintenance**	**Total**
2022	$38,667,000	$635,000	$1,000,000	$40,302,000
2023-2027	$84,684,000	$2,771,000	$5,000,000	$92,455,000
2028-2032	$206,688,000	$3,581,000	$5,000,000	$215,269,000
2033-2044	$440,746,000	$7,623,000	$12,000,000	$460,368,000

Source: VATSP Analysis.

Gap Analysis

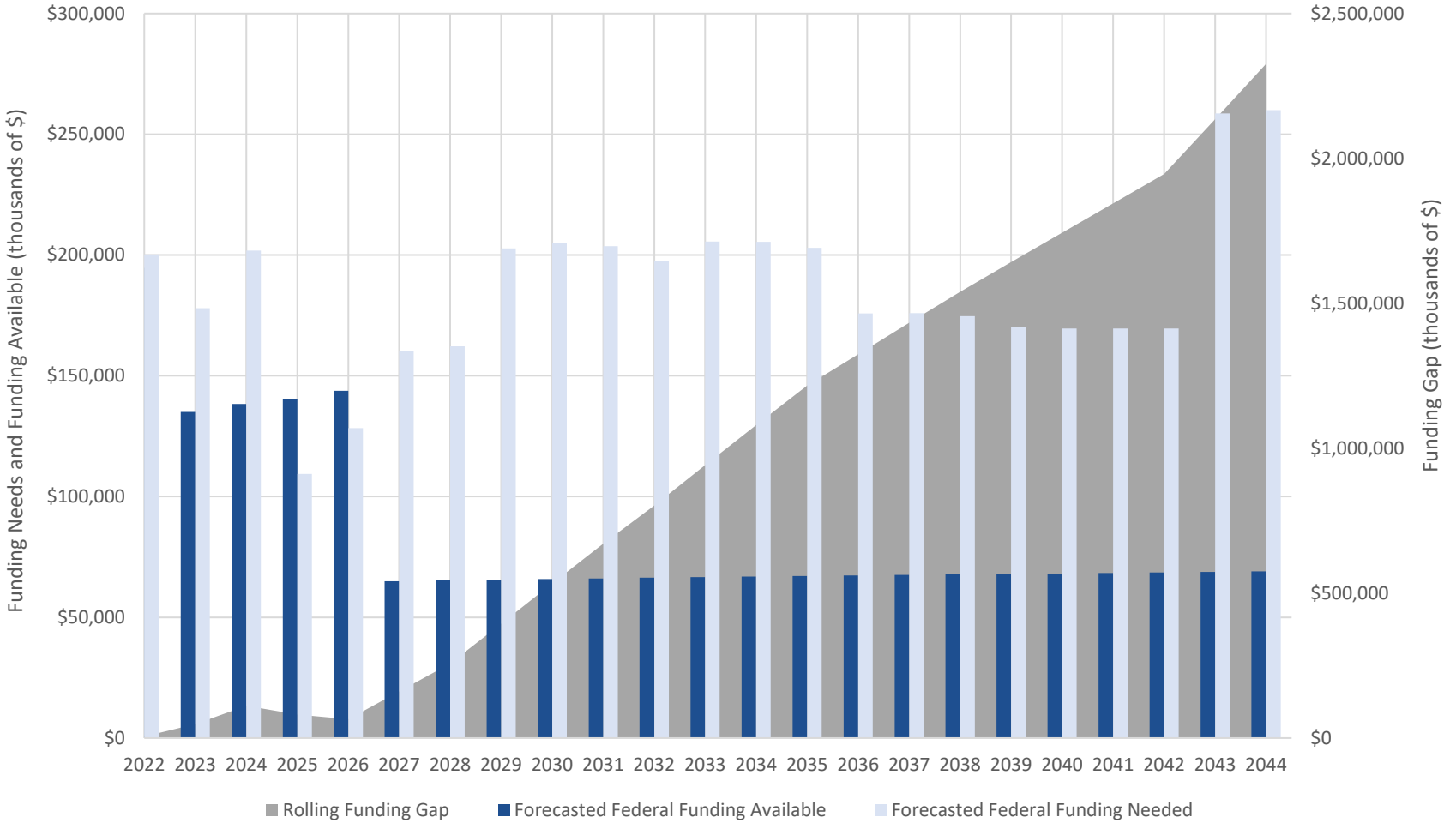
This section compares the funding available to the needs identified in the system plan and discusses the shortfall in terms of federal and state funding. A local funding shortfall is not addressed. Over the planning period, $5.6 billion in anticipated projects costs are eligible for federal and state funding out of the $5.9 billion in total needs, with approximately $2.6 billion in federal and state funding available. As shown in **Figure 9-6**, this results in a $2.9 billion funding shortfall for federal and state funds for the total planning period. After 2028, estimated costs are based on projects extrapolated from the list of airport capital improvement projects. For these projects, which have an unknown timeframe, the costs are assigned to the mid-point of the period when they were expected to take place. These costs have been distributed over the remaining time period of 2029 to 2044 to show expected funding needs. This includes funding needs in 2043 and 2044 for new airport development.



Source: FAA, DOAV, VATSP Analysis.

Figure 9-6: Federal & State Funding Available, Federal & State Funding Needed, and Rolling Funding Gap for Federal & State Funds (in thousands of dollars)

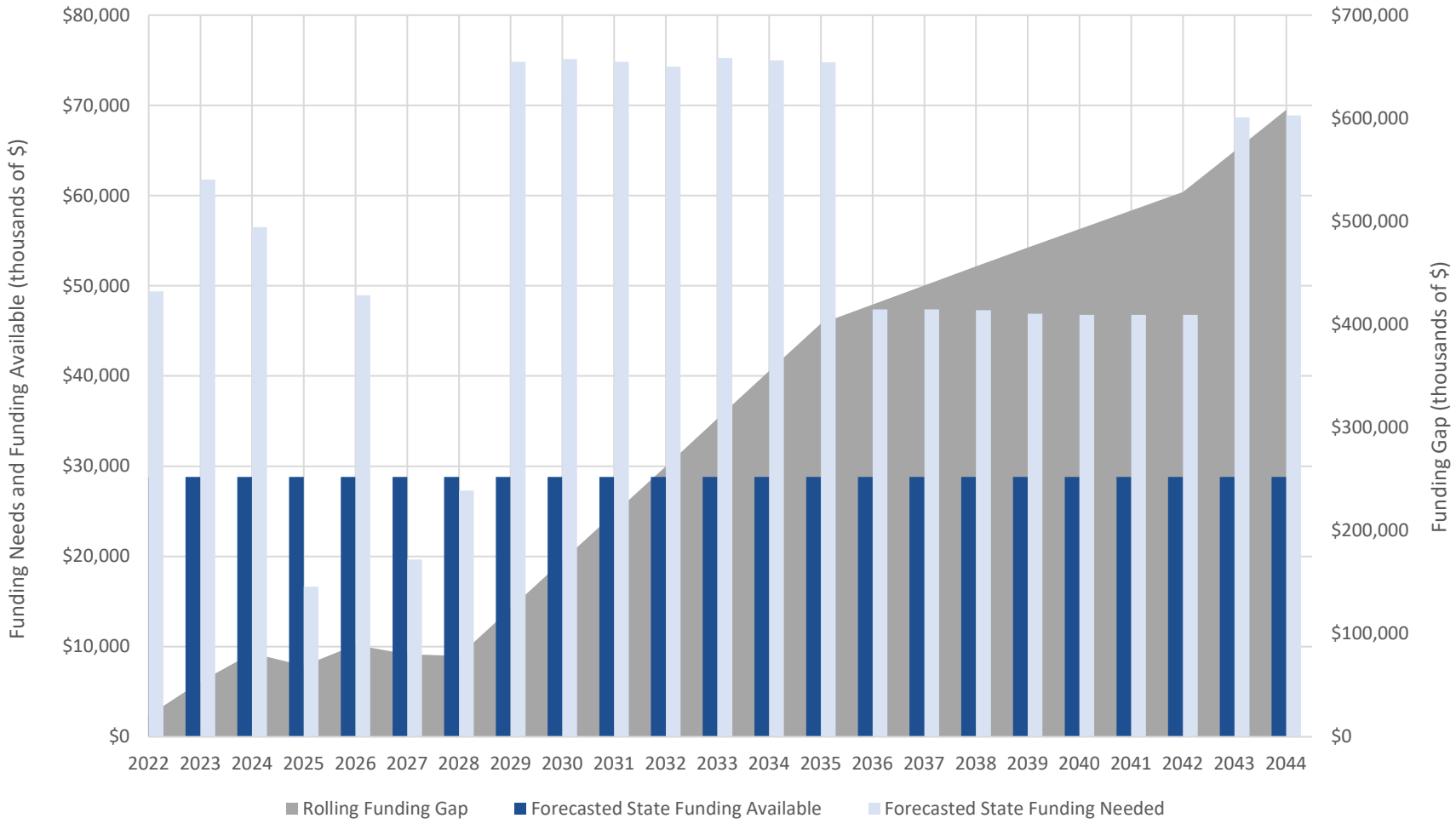
Figure 9-7 shows the forecast for available federal funding along with the federal funding needs. In the first five years, traditional federal funding of AIP grants is augmented by BIL funding. Due to this additional federal funding source that ends in FY 2026, the federal funding gap is $65.6 million, which is lower than historic levels. However, the BIL funding is only through FY 2026 with federal funding levels returning to historic levels in FY 2027 and beyond. As a result, there is an increase in the federal funding gap beginning in FY 2027 and lasting throughout the rest of the planning period. For the planning period, the federal funding shortfall is $2.6 billion.



Source: FAA, VATSP Analysis.

Figure 9-7: Federal Funding Available, Federal Funding Needed, and Rolling Funding Gap for Federal Funds (in thousands of dollars)

State funding, which consists of the CAF and Aviation Special Fund, remains relatively constant throughout the planning period. However, the level of funding needs increase, resulting in a growing funding shortfall on the state level. Throughout the planning period, there are state funding levels of $663 million with $1.3 billion state funding needs. This results in a state funding shortfall of $608 million. This is shown in **Figure 9-8.**



Source: DOAV, VATSP Analysis.

Figure 9-8: State Funding Available, State Funding Needed, and Rolling Funding Gap for State Funds (in thousands of dollars)

Peer State Analysis

As discussed in the previous section, Virginia will have a $3.2 billion funding gap. Similar to many state aviation departments, the funding shortfall will be addressed through a prioritization model that funds top priority projects and defers actions on the others to the next year. Funding prioritization models are used at all of Virginia's peer states and are a key element in allocating funds in years where funds fall short. The prioritization process reflects the combined efforts of the local sponsor initiating project funding, and the state using their model to prioritize. Virginia's model is the "Project Priority Model," which uses objective criteria to rank projects. DOAV has used the model since 1987. The project ranking allocates discretionary funds from the CAF when constrained. The intent is to ensure first priority funding for projects with the greatest impact.

The Project Priority Model has four categories:

- Project merit description
- Situational considerations
- Operational considerations
- Airport activity

Each category has elements that are assigned points, and the highest scoring projects are funded first. This methodology is similar to how Virginia's peer states prioritize projects. **Appendix A** discusses Virginia's peer states in greater depth. The peer states include: Kentucky, Maryland, South Carolina, and West Virginia. It also includes four block grant states Georgia, North Carolina, Pennsylvania, and Tennessee. The following text describes each state's prioritization methodology based on the interviews conducted during the development of **Appendix A:**

Kentucky Department of Aviation – prioritizes pavement projects as the highest priority, followed by lighting and security, obstruction clearance, maintenance, fuel services, and vertical development projects. Unlike DOAV, the Kentucky Department of Aviation funds revenue generating projects including T-hangars and terminals; however, all revenue generating projects are evaluated case by case and must be needs based.

Maryland Aviation Administration (MAA) – created a funding prioritization model in 2012 that assigns a score to four categories similar to DOAV's: Project Merit, Situational Considerations, Airport Factors, and Airport Activity. The total score of a project is then ranked with top ranking projects receiving funding priority. MAA has also implemented an interim policy of funding hard costs only until the funding increases to a level that would allow them to support both hard and soft costs. Over the past two years, MAA has been able to support and deliver on construction projects and has shifted the burden of soft cost projects to the sponsor.

South Carolina Aeronautics Division – has a funding prioritization model created in 2008 as part of the South Carolina Airport System Plan Update and used to score and rank the projects when there are budget limitations. Projects are funded starting at the top of the list and working downward until the funding is depleted. If a fiscal year ends, and not all projects have received funding, they are not carried over to the new fiscal year. The factors considered in the prioritization system are:

- Project justification (i.e., safety, safety rehab, security, economic development, planning, standards/upgrades).
- Airport classification and demand (i.e., air carrier airports/GA airports, annual operations).
- Sponsor responsibility (i.e., does sponsor have an approved security plan).
- Other relevant factors include if the FAA supports the project and provides funding.

The following text describes the prioritization model of the four block grant states:

Georgia Department of Transportation (GDOT) Intermodal – their prioritization system first requires the project to be identified in the system plan to qualify for funding. The state also uses a funding method for its block grant money based on the FAA's priority system. For GA state funding, points are given to various factors with small airports being the focus. GDOT Intermodal gives priority to airports that do not compete well for federal dollars. Projects are prioritized by:

1. Safety
2. Runway pavement
3. Taxiways
4. Aprons.

Airport projects are eligible for additional points if economic development is a factor in the development. Revenue producing projects like T-Hangars or fuel farms are not eligible.

North Carolina Department of Transportation (NCDOT)[15] – follows a project priority number system based on the Airport Development Plan system objectives within the *2015 State Aviation System Plan*. In unique cases, adjustments can be made to the priority rating system on a case-by-case basis and include the following variables:

1. Cost
2. Geography
3. Public safety
4. Airspace constraints
5. Local support
6. Transportation, industry, and regional impacts
7. Airport infrastructure
8. Based aircraft
9. Airport operations.

Pennsylvania Department of Transportation (PennDOT) – follows the federal prioritization model for airport projects approved for federal funding. With state and local projects, PennDOT prioritizes projects through four criteria that include airport role and enplanement/activity levels, project type, equity and obligation and department goals. Project elements that are prioritized are:

1. Runway/Planning
2. Taxiway
3. Terminal/Apron
4. Landside.

PennDOT allocates the funding equitably, reviewing past funding an airport has received, or evaluating the number of open grants the airport has currently. An airport that has been well-funded or has open grants is given a lower score. Besides the historic funding/open grant factor, PennDOT's prioritization of project funding is similar to the FAA. All the projects that PennDOT supports must be justifiable and feasible.

The two main project types that help meet the PennDOT's goals are System Preservation (i.e., maintaining airfield and airfield-supporting equipment) and Economic Development (defined as revenue producing facilities such as T-hangars, new fuel farms, air cargo development, terminal area projects like a restaurant, fixed-base operator, or business parks). PennDOT also prioritizes planning/intermodal projects, but this factor ranks third on the list.

Tennessee Department of Transportation (TDOT)[16] – prioritizes the funding of projects based on state priorities including:

1. Safety
2. Security
3. Pavement preservation/maintenance
4. Preservation of infrastructure
5. Compliance with current FAA standards
6. Planning
7. Increased capacity and modernization
8. Equipment
9. Landside improvements
10. Revenue producing.

Projects associated with economic development, increased capacity, or modernization are reviewed case by case. Grant issuance adheres to federal and state guidelines.

DOAV's process of handling funding shortfalls is in line with its peers' states. Their funding prioritization model prioritizes high need projects and addresses key objectives for Virginia.

[15] North Carolina Airports Program Guidance Handbook
[16] Tennessee Aviation System Plan

Non-Traditional Funding Options (including Public-Private Partnerships)

In addition to the funding mechanisms discussed, other non-traditional funding mechanisms through private parties may be considered. In general, these would include private funding of certain facilities, or joint funding of facilities using a public/private partnership (P3) structure. Airports of all sizes have used these types of arrangements, and they generally work well for projects that will generate sufficient cash flow to reimburse the investor and provide an adequate return on investment.

Examples of private investment at airports frequently include hangars developed and managed by a corporate developer, or fuel farms and fueling facilities developed and managed by an aircraft fueling company, ground handler, or fixed base operator. Fixed Base Operators; Maintenance, Repair, and Overhaul stations; and aircraft painting facilities are examples of private investments in airports by strategic operators of such businesses. In any of these types of investments, the operator may partner with a financial investor such as an infrastructure investment fund, pension fund, or other private equity fund. These investments are all self-sustaining meaning that they are fully funded by the private sector at airports in which the private sector believes there is sufficient demand for it to develop a profitable business.

P3s at airports include joint investment by airport sponsors and private parties. Although not as common in the US as in other countries, the development of passenger terminals at John F. Kennedy International and LaGuardia airports in New York have used a P3 structure involving either airlines or international terminal operators as the private party. Similar structures have been used at smaller airports as well, including Orlando Sanford, Paine Field, Austin South Terminal, and most recently, Gulf Shores International Airport. San Juan Luis Munoz Marin International Airport is the only example of a full airport P3 in the United States. These projects are substantially self-sustaining but may require some upfront investment by the airport sponsor to defray initial investment costs. Both the public and the private party are then repaid with a rate of return from the proceeds of the business.

Finally, some P3s operate on an availability payment model, essentially off-balance sheet financing. A strategic investor makes the up-front investment to construct and perhaps manage and operate a facility, but then the airport sponsor repays the investor over time including an agreed upon rate of return. This structure is typically used if an airport sponsor cannot finance the upfront payment but can commit to a repayment schedule over the useful life of the project.

DOAV addresses the issue of P3s in its *Airport Program Manual*:

> *The Public-Private Transportation Act of 1995, (PPTA) as amended, offers processes for the innovative delivery of transportation improvements; incorporating the attraction of private equity; appropriate transference of risks; incorporation of life-cycle costs; and advancement of projects in a timelier manner. The PPTA Implementation Manual and Guidelines provides a delivery framework that identifies, evaluates, develops, and delivers Virginia's Public-Private Partnership (P3) transportation projects in a consistent, transparent, timely, and cost-effective manner.*
>
> *To expand procurement and financing opportunities for airport sponsors, the VAB adopted the policies and procedures in the PPTA and incorporated the PPTA Implementation Manual and Guidelines, into the DOAV Airport Program Manual. For P3 projects, airports sponsors are eligible to request their project share from the VAB at the state funding participation rate of 80 percent. The project request will have to compete against other requests before the board.*[17]

[17] *DOAV Airport Program Manual*, page 5-24.

Impacts on Future Funding

Future funding for Virginia airports is contingent on the continuation and financing of traditional federal, state, and local sources. The FAA's ability to spend funds must be reauthorized periodically. Current authorization (via the FAA Reauthorization Act of 2018) extends through FY 2023, but the FAA must be reauthorized for FY 2024. The reauthorization process has sometimes been challenging and is not smooth. In addition, Congress must appropriate funds for the FAA annually. U.S. government shutdowns have occurred in the past causing FAA employees to be furloughed and funding processes to be paused. Similarly, funds for DOAV must be appropriated; in Virginia, this occurs biennially. At the local level, PFC revenue is directly related to the volume of passengers traveling to/from Virginia airports. As air traffic continues to recover following the COVID-19 pandemic, PFC revenues will increase proportionately. There have also been several proposals by the FAA to Congress to increase the maximum PFC level to $7-$8 (up from $4.50). However, none of these have been accepted or implemented by Congress. An increase in the national allowable PFC maximum (or removal of the limit altogether) would allow Virginia airports to increase this local revenue source.

Source: Heather Ream.

Chapter 10: Implementation Plan

The previous chapter identified a funding shortfall of $3.2 billion from all state and federal sources over the 22-year planning period. To address this shortfall, this study recommends the Virginia Department of Aviation (DOAV) undertake a two-pronged strategy. The first strategy involves increasing the funding available to airports to help reduce, but not eliminate, the funding shortfall. The second strategy consists of reorganizing how airports are characterized by role to better allocate funding. This study recommended changes to the airport roles and the method for assigning them. These changes serve to make the process more transparent, provide more focus on economic development at airports, and give DOAV an opportunity to better align their funding priorities with their goals of aviation system preservation and business development.

However, DOAV does not have the unilateral ability to impose all of the changes recommended in this study. DOAV, the Virginia Aviation Board (VAB), and Virginia's airports operate within a set of laws and regulations that reference the airport roles that this study recommends changing. The next section briefly describes the legislative framework that regulates the oversight and funding of Virginia's airports.

Key Takeaways

- Virginia's airport roles are referenced by regulations found in the Code of Virginia and Virginia Administrative Code.
- Changes to airport roles recommended in the VATSP are only advisory in nature. They cannot take effect until legislative changes are made to the Code of Virginia and Virginia Administrative Code.

In addition to describing the existing legislation, this chapter outlines the steps necessary to accomplish the implementation of the recommendations provided in Chapter 8. This information is broken into the following sections:

- Virginia's Legislation Governing Airports
- Expanding Funding for Virginia's Airports
- Prioritizing Virginia's Airport Projects
- Phased Planning and Tracking Progress

Source: DOAV.

Virginia's Legislation Governing Airports

The rules and regulations governing the oversight of Virginia's airports are generally found in the Code of Virginia and the Virginia Administrative Code. Permanent laws passed by the General Assembly and signed by the state governor are codified in the Code of Virginia. The Virginia Administrative Code contains the permanent regulations for Virginia. Regulations are similar to laws in that they have the force of law, but the General Assembly authorizes state agencies to write and administer these regulations.

Virginia addresses aviation issues in the Code of Virginia under Title 5.1 Aviation. *Code of Virginia §5.1-1.1* created DOAV. The *Code of Virginia §5.1-2.1* establishes the Virginia Aviation Board (VAB) as a continuation of the Virginia Aviation Commission. Under *Virginia Administrative Code 24VAC5*, the VAB is authorized to develop regulations that govern the construction and inspection of airports, as well as other matters necessary to promote safe aviation practices and operations. The VAB also fields questions and comments from citizens, stakeholders, and airport sponsors regarding airport issues, serving as a communication channel for DOAV.

The VAB is also tasked with allocating state aviation funds to airport sponsors. Along with this responsibility, the VAB sets the policies for airport funding programs. While the VAB has a good deal of discretion in how state aviation funds are allocated, the Virginia General Assembly has imposed some controls and restrictions on the distribution of those funds. In doing so, the Virginia General Assembly has embedded within its law certain aspects of the aviation system. The Commonwealth Aviation Fund (CAF) was codified under the *Code of Virginia §33.2-1526.6,* and within this law are funding formulas that rely on the definitions of air carrier and reliever airports.

Before the recommended changes in airport roles can be implemented, the Code of Virginia and the Virginia Administrative Code must be amended to reflect these changes in nomenclature. DOAV will need to work within this legislative framework as they undertake the efforts to improve funding for Virginia's airports and restructure the funding formulas that meet the VAB's priorities.

Expanding Funding for Virginia's Airports

The peer analysis of the aviation systems in other states compared Virginia's airport funding levels with several peer states. As shown in **Figure 10-1**, Virginia's average annual state funding for airports falls in the middle of its peer states. Compared to its peers with better funding, Virginia has about half of the state funds available to Tennessee, a third of what Pennsylvania spends, and less than a fifth of North Carolina's money.

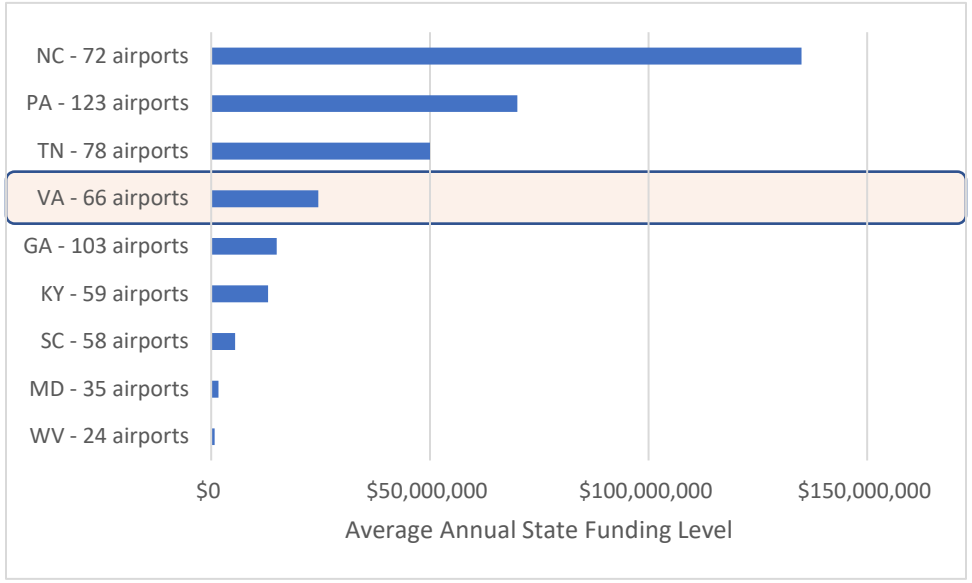
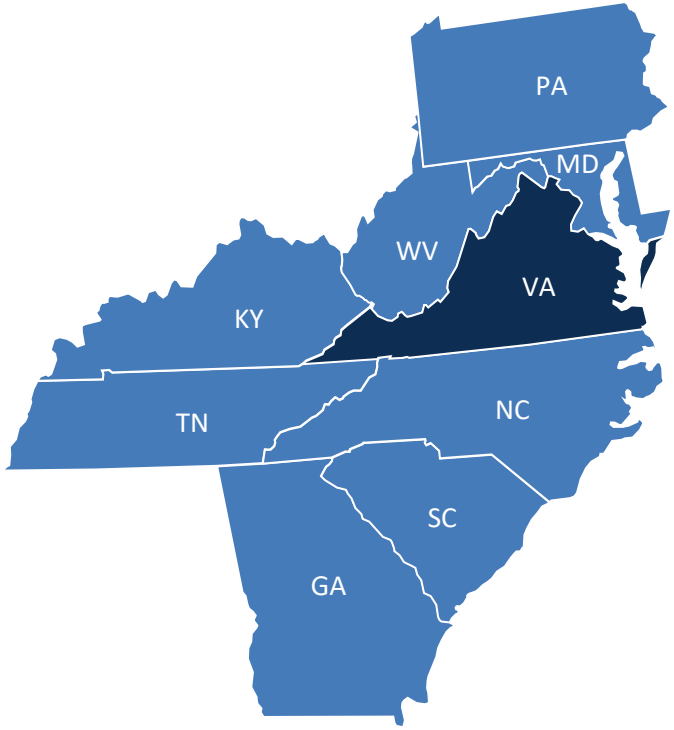


Figure 10-1: Average Annual State Funding for Airports



On a per airport basis, Virginia compares more favorably with its better funded peers. Virginia has about two-thirds the funding of Pennsylvania, 60 percent of Tennessee's funding, but still about a fifth of North Carolina's well-funded aviation system, as shown in **Figure 10-2**.

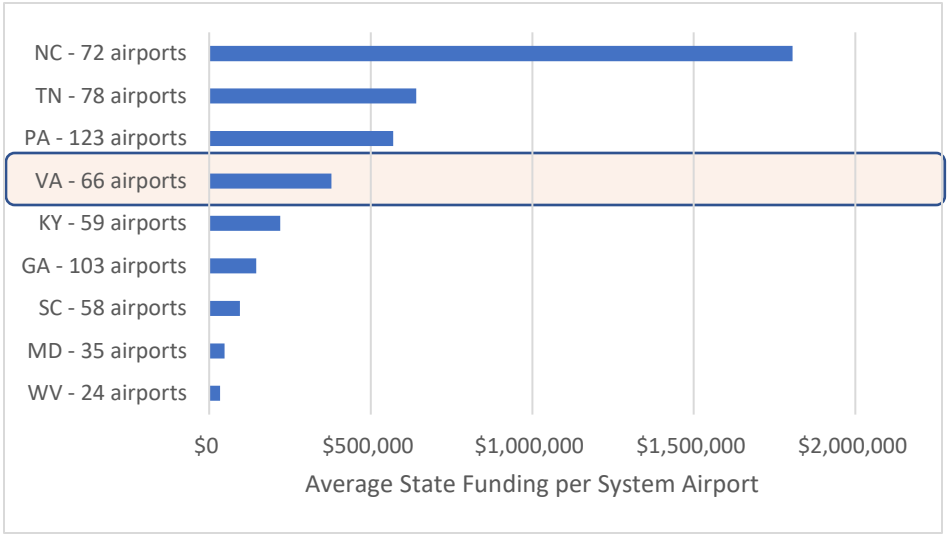


Figure 10-2: Average State Funding per System Airport

This information supports a case for more state airport funding for Virginia's airports to be more competitive with state aviation system peers. As stated in the peer analysis, additional state funding for airports in Virginia could:

- Fund identified fiscal requirements;
- Offset reductions in federal, state, or local funding; and
- Achieve aviation system strategic goals and objectives.

DOAV will likely want to explore various options that could result in more funding for Virginia's airports. The following two examples illustrate options DOAV may want to consider.

- State aviation funding appropriated by the General Assembly – In light of the $22.9 billion in economic output generated by the Virginia aviation system,[18] the General Assembly may want to consider increasing the amount of state funding available to airports so the aviation system can continue to act as an economic engine for the state.
- Expanding public-private partnerships – Virginia allows airport sponsors to request up to 80 percent funding for public-private partnership projects. DOAV may consider undertaking efforts to increase this share to attract more private equity to Virginia's airports.

[18] Virginia Department of Aviation. 2022. *Virginia Airport System Economic Impact Study Executive Summary*. (https://doav.virginia.gov/contentassets/ab031db6ded94e008f22a57a3bf082d4/doav-econ-impact-exec-summary---final----accessible-05-03-18.pdf)

Prioritizing Virginia's Airport Projects

With strong evidence from the previous chapter that funding is insufficient for all of Virginia's airport projects, DOAV, in conjunction with the Federal Aviation Administration (FAA), will need to make hard decisions about which projects get funding and which projects get deferred until later. Prioritizing projects is not necessarily a constant. As an aviation system grows and matures, development priorities can shift. Typically, in a mature system, maintaining the infrastructure takes an increasing share of capital investment. DOAV has shepherded its aviation system to a well-developed position where deferring needed capital maintenance can cost more over time than addressing the needs in a timely fashion. Typical examples are runways that will later need more costly replacement if timely, but less expensive, rehabilitation projects are not undertaken when needed. The result is that there is added pressure to address aviation system capital maintenance needs sooner rather than later to make the best use of the money available. Naturally, these demands for capital maintenance will be competing with demands for new infrastructure. DOAV, along with the FAA and individual airports within the system, will need to address these competing needs, weigh the pros and cons of each, and make reasoned decisions in allocating their funding resources.

One of the tools that can assist them in this endeavor is the guidance found in the *DOAV Airport Program Manual*. This document provides the eligibility criteria for funding projects and the priority formulas for funding projects. DOAV will need to assess their present policy regarding project funding eligibility and determine if any changes are necessary to accommodate the changes in their aviation system. For example, DOAV may determine that airport electrification is a priority for system airports to promote the development of an airport network that can support electric aircraft, and electric vertical takeoff and landing (eVTOL) aircraft, as well as electric ground service equipment and passenger vehicles. If so, then DOAV may need to reconsider the policy that limits funding for only safety or preservation projects at Local Service Airports, as shown in **Table 10-1**. Of course, these changes go hand in hand with the recommended changes to the airport roles.

Table 10-1: Funding Program Eligibility Based on Airport Role

Program		Airport Role†				
		Air Carrier	Reliever	General Aviation (NPIAS*)	General Aviation (non-NPIAS)	General Aviation (non-NPIAS) Local Service
Federal	AIP Entitlement/Discretionary	X	X	X		
	CARES/CRRSA/ARPA**	X	X	X		
	BIL	X	X	X		
State	Entitlement	X				
	Discretionary	X	X	X	X	***
	Aviation Special Fund	X	X	X	X	***
Local	PFCs	X				
	Other	X	X	X	X	X

*National Plan of Integrated Aviation systems.
**These COVID-19 response acts apply to funding in FY 2020-2021 only.
***Local service general aviation airports are eligible only for safety and preservation projects under the State Discretionary Program and the Facilities and Equipment Program.
† The airport roles shown are given in terms based on the Federal classification of airports and are described on page 3-2.
Source: *DOAV Airport Program Manual*, revised August 2021.

Project priority is assessed through a methodology explained in Appendix D of the *DOAV Airport Program Manual*. The airport's role in the system serves as one of the criteria evaluated and is a means of directing funding toward areas of focus. Similar to project eligibility, DOAV and the VAB may consider changes to project prioritization to better reflect the status of the aviation system and shifting priorities.

Phased Planning and Tracking Progress

In consideration of the preparations needed, this implementation plan assumes that the earliest opportunity to make the proposed changes to Virginia's laws and regulations would be the 2024 session of the General Assembly. This would mean that DOAV should be prepared to put into practice the recommended changes no later than fiscal year 2025, which starts on October 1, 2024. Considering the process that the Virginia government uses, it is recommended that DOAV implement the proposed changes in this study using a phased approach.

The first phase consists of DOAV determining how to best use the revised airport roles to direct funding to where policy dictates it is most needed. These efforts will entail changes to the *DOAV Airport Program Manual* and coordination with the VAB, with consideration given to input from the Virginia Airport Operators Council (VAOC). DOAV will also want to disseminate information to stakeholders about the proposed changes to Virginia's airport roles and how those changes are tied to the planned policy changes in regard to the funding of Virginia's airports. During this phase, DOAV should work closely with the VAB to draft proposed changes to the Code of Virginia and Virginia Administrative Code in preparation for presentation to the General Assembly.

The second phase involves monitoring the legislative changes to their conclusion. While this is occurring, DOAV should continue its efforts to communicate how these changes will improve the aviation system. At the same time, DOAV should be working with the VAB to implement changes to the *DOAV Airport Program Manual* to harmonize it with the legislative changes and adjust the funding eligibility criteria and project priorities to reflect the needs of the aviation system.

DOAV should also consider methods for tracking the progress of these changes and the fruits of their efforts. For the legislative changes, DOAV will want to track the legislative calendar to ensure that no deadlines are missed. In the lead up to changes to the funding allocation methods, DOAV may want to track where state funds are appropriated by airport role under the current system for easier comparisons with how the funds are distributed under the new system.

Key Elements by Phase

- Phase 1
  - Policy decisions regarding funding and priorities
  - Coordination with VAB and VAOC
  - Outreach to stakeholders
  - Suggest legislative changes to nomenclature
- Phase 2
  - Monitor legislative changes to completion
  - Continue outreach to stakeholders
  - Track progress toward desired changes

Summary

This aviation system plan developed recommendations for improving Virginia's airports, estimated the costs for doing so, and has outlined in this chapter the steps necessary to accomplish the implementation of these recommendations. DOAV, working with the VAB, will need to craft policies that guide the allocation of their limited financial resources. Changes to the airport roles recommended in this study can assist DOAV in formulating those policies. However, with certain aspects of the Virginia aviation system and its associated funding defined by legislation, DOAV will need to examine and analyze the process of amending the appropriate legislation and regulations. This is a deliberative process that takes time and careful consideration, so carefully phased implementation is recommended. The first phase focuses on the desired policy changes, along with a communication effort directed at stakeholders. The second phase focuses on making the legislative changes needed to accomplish the desired policy changes. Finally, it is recommended that DOAV establish a means of tracking its progress toward accomplishing these changes.