TN TDOT Department of Transportation

TASP TENNESSEE Aviation System Plan

Chapter 4: Aviation System Issues

Introduction

Aviation is a constantly evolving industry with advances in technology, changes to the economy and environment, updated regulatory requirements, as well as many other factors that each impact aviation in a unique way. While circumstances are constantly evolving, airports and their sponsors remain tasked with providing safe and secure aviation facilities that promote mobility and equitable access for all airport users, while also operating in a resource-constrained environment. Understanding the issues facing Tennessee's aviation industry and how it may impact users, airports, and airport sponsors is important in order to assess the system's historical, current, and future performance.

To help identify and provide context on some of the most important issues impacting the aviation industry in Tennessee, this chapter provides an overview of the issues that airports, airport sponsors, and the advisory committee identified as most significant – affecting airports' abilities to optimally support Tennessee aviation system users. The issues identified in this chapter were collected from two primary sources, including:

- **Advisory Committee (AC):** In coordination with TDOT Aeronautics Division, the project team organized an AC that includes members from a diverse cross section of agencies and entities, including the Tennessee Aeronautics Commission, Tennessee airports comprised of both commercial service and general aviation (GA), Metropolitan Planning Organizations (MPOs), and other TDOT modal and planning offices. These individuals were selected to provide guidance and support for implementation of the TASP and Economic Impact Study, including identifying issues facing the Tennessee aviation system. Based on an AC meeting held on August 18, 2019, 12 issues were identified as having the greatest potential to affect airports and the aviation industry over the next 20 years.
- **Airport manager interviews:** Site visits were conducted at the five commercial service and 73 GA airports that compose the TASP airport system. As part of these site visits, airport managers were asked to complete an Inventory Data Survey which included a section to identify the top three issues facing their facilities (more information on the Inventory Data Survey and the data collection effort is provided in Chapter 2: Inventory and Existing System Performance). Airport managers identified issues ranging from facility and operational constraints such as hangar shortages and lack of services, to broader issues such as regional growth and funding availability. The three most frequently identified issues were selected to be further evaluated as part of this task.

Once all the potential issues were collected from the AC and the airport manager interviews, 15 of the top issues were selected for further evaluation as part of this task. These are presented in alphabetical order of the issue title in subsequent sections, with no priority indicated. It is important to note that these issues and much of the information regarding the issues were collected before and during the initial outbreak of COVID-19 in the United States. The aviation industry has been hit hard by the global COVID-19 pandemic and it is not yet known when the industry will recover to its 2019 levels. It is also not yet known if major changes will take place within the industry to address the resulting impacts. It is noted where COVID-19 has the potential to impact or has already impacted an issue.

A brief overview of each of the selected issues is provided below, with more detailed information on each issue provided starting on page 6.

Change to State Fuel Tax: An aviation fuel tax cap was passed under the 2015 Tennessee Laws Public Chapter 462 (SB982/HB1147). This cap meant that state funding for aviation projects decreased from a high of $60 million to its current level of approximately $20 million.

Competition: Tennessee has 78 airports in the state system, many of which are competing for the same finite amount of federal and state resources. Additionally, some airports have greater community support for financial resources like local matches for grants, increasing the disparity between the “haves” and the “have-nots.”

Consumer Expectations: The modern airport user expects a seamless travel experience, including check-in and boarding conveniences and modern amenities. Tennessee airports will have to meet and exceed these expectations in order to continue to attract travelers and pilots.

Funding: Tennessee’s airports must share a finite pool of state and federal funding. Additionally, while many of Tennessee’s airports are in the National Plan of Integrated Airport Systems (NPIAS), those that are not are ineligible for federal funding. In a funding constrained environment, projects across the state must be planned, programmed, and executed to ensure that the system remains safe, operational, and financially viable.

Future Aircraft and Fuel Sources: Aircraft technology and fuel sources continue to change and adapt, meaning that airports and aviation professionals must change and adapt with them. By remaining adaptable and resilient to changes in aircraft types and fuel sources, Tennessee will ensure it remains at the forefront of aviation.

Hangar Availability: Many of the state’s airports reported having a hangar shortage and stated that one of their top issues was the lack of funding to build additional hangars. Having adequate hangar storage is important to retain based aircraft in the state, generate revenue, and continue to grow operations at Tennessee airports.

Industry Concentration: Airports are frequently supported by clusters of “aviation-reliant businesses,” or businesses that need to be located near an airport in order to conduct the essential functions of their business. Some Tennessee municipalities have “industry concentrations” of such businesses, meaning their airports are well supported by their facility’s increased use.

Infrastructure Needs: Many of the state’s airports stated that one of their top issues was some type of infrastructure need. Functional infrastructure that meets the current and projected needs of an airport is important for an efficient aviation system.

Natural Disasters: A tornado hit Middle Tennessee the morning of March 3, 2020, killing multiple people, damaging infrastructure, and knocking out power to thousands of residents. This tornado also severely damaged John C. Tune Airport. Preparing for, withstanding, and recovering from natural disasters such as tornados is critical to the overall wellbeing of Tennessee’s aviation system.

Pandemics: Part of the response to the ongoing COVID-19 crisis is governments issuing "stay at home" orders, meaning non-essential travel is banned or severely discouraged. Tennessee mandated a "stay at home" order in March 2020. COVID-19 has severely impacted air travel and outcomes will likely continue to be felt in the ensuing months and years.

Population Growth: Nashville frequently tops lists of fastest-growing U.S. cities, and other areas of Tennessee are experiencing rapid growth as well. With population growth comes the need to accommodate the needs of a greater number of travelers.

Promotion and Marketing: While the state provides numerous resources for its aviation system, individual airports typically promote and market their facilities themselves. Airports who do not engage in promotion and marketing may miss out on or lose existing users.

Technology: Aviation technology is always changing. Currently, many airports are trying to adjust to the FAA's Next Generation Air Transportation System (NextGen) and to the rise of unmanned aircraft systems (UAS) use. Changes needed to continue adapting and accommodating new technology are a concern.

Urban growth: Airport managers in areas surrounding Tennessee's major cities frequently discussed local metropolitan growth, including possible encroachment, as one of their top issues. Not only do airports within these fast-growing cities need to accommodate such growth, but airports on the outskirts need to prepare for "spillover" growth.

Workforce: The number of licensed pilots and other individuals in the aviation workforce, such as mechanics, airport personnel, and other aviation professionals, is falling. Tennessee must encourage growth in the aviation workforce in order to meet the demand for aviation to accommodate passengers and cargo.

The sections that follow provide details about each of these topics and highlight their potential impacts on the current and future aviation system in Tennessee. The sections are organized alphabetically and do not indicate an order to the importance of the issues. Sections begin by providing the scope of the impact. For instance, issues with a global impact include Future Aircraft and Fuel Sources and Pandemics while issues with a local impact include Infrastructure Needs and Urban Growth. Sections continue by examining the existing information and data for each issue, the range of impacts, as well as how each issue compares and relates to other issues.

These issues also have a relationship to the TASP Goals. The TASP Goals outline the priorities of TDOT Aeronautics Division concerning the performance, function, and future of the Tennessee aviation system, while aligning with the overarching transportation planning initiatives conducted by TDOT. Many of the issues outlined in this chapter are reflected in the TASP Goals. For instance, Goal #1 – Preserve Airport Infrastructure considers the protection and preservation of existing airport infrastructure, a concern that was identified by airport managers and is discussed in the Infrastructure Needs section. While discussing each of the following issues, this chapter also notes the relationship between each issue and TASP Goals. The relationship between issues and TASP goals are explored further in ***Table 1***, and an outline of each of the Goals follows.

Goal #1 – Preserve Airport Infrastructure: Protect and preserve existing airport infrastructure by prioritizing aviation system needs.

Goal #2 – Transportation Options: Provide an aviation system with available and cost-efficient transportation options for moving people and freight.

Goal #3 – Safety and Security: Improve the safety and security of aviation system users.

Goal #4 – Funding and Environment: Maximize federal, state, and local resources to meet the aviation system needs and minimize environmental impacts.

Goal #5 – Workforce and Economy: Invest in the aviation system and the aviation workforce to support economic growth and competitiveness.

Table 1: TASP Goals and Issues Matrix

	Goal #1 – Preserve Airport Infrastructure	Goal #2 – Transportation Options	Goal #3 – Safety and Security	Goal #4 – Funding and Environment	Goal #5 – Workforce and Economy
Change to State Fuel Tax	✓			✓	✓
Competition		✓			✓
Consumer Expectations		✓		✓	
Funding	✓			✓	✓
Future Aircraft and Fuel Sources		✓	✓		
Hangar Availability	✓			✓	✓
Industry Concentrations					✓
Infrastructure Needs	✓	✓	✓	✓	✓
Natural Disasters	✓	✓	✓		
Pandemics		✓	✓	✓	✓
Population Growth		✓		✓	✓
Promotion and Marketing			✓		✓
Technology		✓	✓		
Urban Growth	✓	✓	✓	✓	✓
Workforce		✓			✓

Change to State Fuel Tax

Scope: Statewide

Related Goals:

Goal #1 *Goal #4* *Goal #5*

Introduction and Existing Conditions

In 2015, the Tennessee State Legislature passed Senate Bill (SB) 982, instituting a cap on aviation fuel taxes that applies to all aviation fuels. As enacted, this bill revised the provision governing tax on aviation fuel as well as created an advisory task force to study revenue measures regarding the operation of Tennessee's aircraft and airport facilities and the funding available to airports from the Transportation Equity Fund (TEF). The TEF is the state funding source that provides grants for airport planning, development, and construction projects. In the five years since the aviation fuel tax cap went into effect, funding for state aviation projects has been cut by more than half. This decrease in state funding has greatly impacted airports' abilities to complete necessary projects and compete effectively with airports in other states.

SB 982 was passed to encourage aviation-reliant business growth in Tennessee and imposed a progressive cap on aviation fuel tax revenues. Prior to the implementation of this cap, aviation users would pay a four and a half percent tax on aviation fuel purchased, regardless of the amount purchased or paid in taxes. After the implementation of the aviation fuel tax cap, any given business or user would cease paying taxes on aviation fuel once that business or user reached the cap. The fuel tax cap was gradually decreased in the five years after implementation, as follows:

- For the period of July 1, 2015 through June 30, 2016, the aviation fuel tax cap was $21,375,000;
- For the period of July 1, 2016 through June 30, 2017, the aviation fuel tax cap was $17,750,000;
- For the period of July 1, 2017 through June 30, 2018, the aviation fuel tax cap was $14,125,000; and
- On or after July 1, 2018 and continuing to the present day, the aviation fuel tax cap is $10,500,000.[1]

An advisory task force was convened to study the impact of the tax cap, known as the Legislative Aviation Task Force. This task force found that the fully implemented aviation fuel tax cap would result in a $20 million annual loss of revenue to the TEF. The task force also identified four other sources of state tax funding which, if partially redirected, could restore approximately one-half of the airport improvement funding lost as a result of the aviation fuel tax cap.[2] These include:

- Tennessee state sales tax from taxpayers who purchased airplanes
- Tennessee state sales tax from other aviation related sales tax accounts

---

[1] http://news.cchgroup.com/2015/05/21/tennessee-sales-and-use-tax-caps-placed-on-aviation-fuel-tax/corporate-solutions/
[2] https://taa38.wildapricot.org/news/3612010

- Tennessee Motor Fuel Tax paid on aviation fuel
- Tennessee Environmental Fee paid on aviation fuel[3]

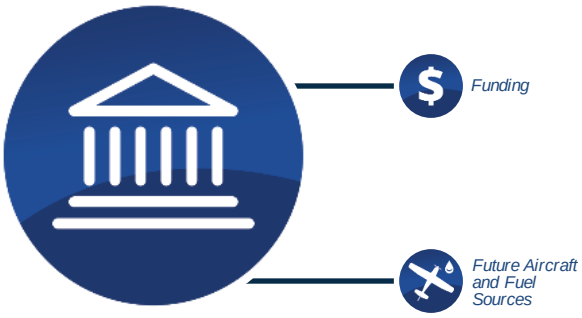
There is currently no redirection of state tax money to make up for the loss in tax revenue that has resulted from the implementation of the aviation fuel tax cap. The task force also briefly discussed pooling TEF funding with other transportation funds in order to increase the possibility that other transportation funds may become available for aviation projects. However, industry groups such as Tennessee Association of Air Carrier Airports (TAACA) and Tennessee Aviation Association (TAA) were opposed to such a pooling, stating that the airport community felt that airports would not be able to consistently compete against larger budget demands of surface transportation projects. Ultimately, this suggestion was not acted upon, and the task force concluded without determining any viable alternatives to the state funding lost as a result of the aviation fuel tax cap.

Impacts of the Issue

The impact of the aviation fuel tax cap on Tennessee's aviation industry continues to be felt. Once the tax cap was fully implemented, some businesses contributed less than one-third of what they had contributed prior to 2015.[4] The reduction in aviation fuel tax has had a direct impact on the TEF, which in Fiscal Year 2018 had a 46 percent reduction in funding over Fiscal Year 2014.[5] Decreases in the TEF due to the loss of aviation fuel tax revenue have resulted most notably in reduced state funding for capital improvement projects in the five years since the fuel tax cap's implementation.

Though not intended to, decreases in the TEF have disproportionately impacted GA airports. While commercial service airports are generally better equipped to provide partial funding and local community grant matches for capital improvement projects, GA airports have traditionally relied heavily or even solely on state funding for such projects[6] and the loss of revenue from the TEF has not been met with decreased demand for capital improvement projects. Further, the aviation fuel tax cap does not take into account inflation, meaning that funding being contributed to the TEF from aviation fuel taxes will remain fairly steady even as the cost of doing projects continues to increase, causing the TEF to continuously lose value.

Related Issues:



Change to State Fuel Tax

In the five years since the aviation fuel tax cap was implemented, TDOT Aeronautics Division has responded to this issue by simply being unable to fund as many projects as were previously funded. Several airports expressed their frustration with the decreased funding, with many expressing the need for improved infrastructure, additional hangars, or increased services while also expressing the knowledge that state funding for such projects has decreased.

[3] https://taa38.wildapricot.org/news/3612010
[4] https://trace.tennessee.edu/cgi/viewcontent.cgi?article=4927&context=utk_gradthes
[5] Ibid.
[6] Ibid.

The Change to State Fuel Tax issue relates to both the Funding and the Future Aircraft and Fuel Sources issues. Funding for aviation projects has decreased as a direct result of the aviation fuel tax cap. The Funding issue section discusses additional aspects of Tennessee's aviation funding, such as federal funding and local funding. Further, a move to alternative aviation fuels may further decrease revenues generated from the aviation fuel tax or will require additional legislative action to address potential changes based on alternative fuels and aircraft types.

What's Next

Several alternatives have been proposed by the Legislative Aviation Task Force to make up for the lack of state funding as a result of the aviation fuel tax cap, including partial reallocation of different state tax sources and pooling the TEF with other transportation funds in order to increase the possibility that other transportation funds may become available for aviation projects. To date, no alternatives have been implemented. Further, although these potential state tax revenue sources are promising, even if these state tax sources were fully allocated to aviation projects, they would not make up for the loss from the aviation fuel tax cap.

As of the writing of this report, the aviation fuel tax cap of $10,500,000 had been fully implemented for the past two years. Since the aviation fuel tax cap was first implemented in 2015, the TEF experienced over 50 percent reduction in funding. As a result, TDOT Aeronautics Division has funded fewer and smaller capital improvement projects than they did before the implementation of the aviation fuel tax cap. While the intention of the aviation fuel tax cap was to stimulate economic growth and retain aviation-reliant businesses within the state, the negative impacts to airports in the state has been considerable. The COVID-19 pandemic may also have an impact on funding from the aviation fuel tax cap. Aviation activity has decreased dramatically as a result of COVID-19, and this will impact the amount of fuel companies and users purchase. The TEF will likely see another dip in funding due to this decreased activity. TDOT Aeronautics Division should continue to stay informed on any other future legislative changes that will impact aviation funding, monitor the continued impact of the aviation fuel tax cap, and determine the feasibility of increasing state funding for aviation projects through other means.

Competition

Scope: Statewide

Related Goals:

Goal #2 *Goal #5*

Introduction and Existing Conditions

Tennessee's aviation system consists of 78 airports, of which 74 are publicly owned, with the remaining four being privately owned, but open for use by the public. Across the system, all 78 airports are eligible for state funding; however, the four privately owned airports are only eligible to receive state funding for safety related projects. Of the 78 airports in the system, 69 are included in the FAA's National Plan of Integrated Airport Systems (NPIAS) and are therefore eligible for federal funding. A significant number of public-use airports must thus compete for the pools of both federal and state funding. Of the airports not eligible for federal and/or state funding, competition is still a factor. These airports must be sufficiently financially supported by their respective communities in order to continue being able to compete for users.

Of all the airports in the system, many play a similar role and offer similar facilities and services to potential users. For instance, many of the GA airports across the state are competing with each other for based aircraft or potential on-airport businesses. As such, not only are airports competing for the same pools of funding, they are competing for the same pool of potential passengers, operations, based aircraft, and businesses. While from the state perspective each airport plays a unique role in the overall aviation system, airports often see each other as competitors. This section explores several factors of the Competition issue, including community support and public engagement, competition for funding, and competition for passengers.

COMMUNITY SUPPORT AND PUBLIC ENGAGEMENT

Publicly owned airports depend in many ways on the support of their local communities and government officials. While airports may receive federal and state funding, they depend on the local government for matching funds for capital improvement projects as well as sometimes funding these projects with their own resources. They also rely on their local sponsors for airport operating expenses, salaries and benefits, and other funds for the airport's operation. The amount of funding airports receive from their local communities often depends on the value those communities perceive because of having the airport located there. The airport manager of Warren County Memorial (RNC) stated,

> "*The airport prides itself on being business-friendly and retains enough revenues to support other local community facilities, such as police facilities and schools.*"

While some airports have the full backing and support of their local officials, other airports are not as fortunate. Whether it is because the community does not see the value in having an airport or has other demands on its revenue, airports without community support are often at a distinct disadvantage compared to airports with community support.

TDOT Aeronautics Division encourages airports to conduct public engagement activities with their local communities to foster support and encourage a positive view of airports in their local communities. Many airports report their own public engagement activities such as fly-ins, open

houses, and hosting community events. For instance, Lawrenceburg-Lawrence County Airport (2M2) noted that they host numerous community events including field trips, periodic fly-in events, and training events for fire and rescue. The airport also built a new shelter for community events and a community/conference room for parties, business meetings, and other community gatherings.

To better understand how airports are engaging their local communities and promoting their airport, airport managers were asked to report what type of engagement activities they conduct. ***Table 2*** lists the percentages of airports that report engaging in several different forms of public engagement including fly-ins, air shows, and advertising of any kind. Public engagement is a helpful tool for encouraging community participation with a local airport, as well as boosts the profile of the airport in its community leading to increased community support.

Table 2: Airport Community Engagement

Public Engagement	Percentage of Airports
Host an annual air show	22%
Host an annual fly-in	60%
Advertise (Internet, TV, magazine, etc.)	95%

Source: TASP Inventory Data Survey, 2019

COMPETITION FOR FUNDING

There is limited funding available for airport projects and consistently there are more projects requested than there is available state and federal funding. TDOT Aeronautics Division prioritizes projects based on a discrete set of factors including projects that increase safety and security, pavement preservation/maintenance, and projects that preserve existing infrastructure. Airports that need lower priority projects may not receive funding for several years, if at all.

Over time, airports with unfunded projects will likely be negatively impacted. As an example, pavement deteriorates at a rapid pace after a certain point and without state funding and continued delays in pavement preservation projects, the project size will increase as it may require a complete rehabilitation instead of an overlay. This could affect an airport's ability to be financially viable or even to remain open.

COMPETITION FOR PASSENGERS

Commercial service airports face a different kind of competition, for passengers. As air travel has increased, the ease of booking and the drop in prices has led many consumers to consider multiple airlines, and crucially, alternative airports, for each trip. Consumers may be willing to travel a little further beyond their nearest commercial service airport if it means a cheaper, shorter, or more convenient trip. Not only do Tennessee's commercial service airports have to compete at times with one another for passengers, but they also compete with nearby commercial service airports in the bordering eight states. For instance, on the east side of Tennessee, Asheville Regional Airport (AVL) is about an hour and a half drive from the state border. The busiest airport in the world, Hartsfield–Jackson Atlanta International Airport (ATL), is about a two-hour drive from the southern state border. Unlike the residents of other states that border fewer states or are geographically larger in size, Tennessee's residents can choose

from a variety of out-of-state airports which, although potentially further away, may offer additional options and amenities, including more flights and airlines.

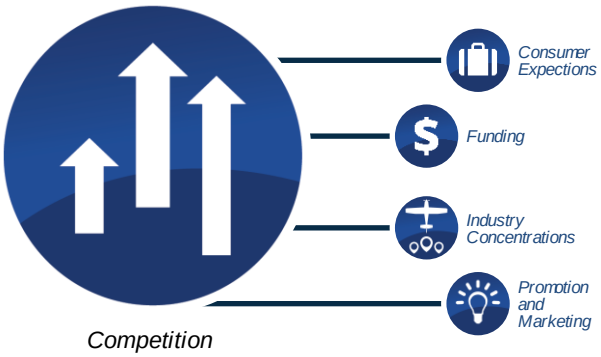
Impacts of the Issue

Tennessee's airports face competition from a variety of sources which can lead to a dichotomy of "haves" and "have-nots." The "haves" of Tennessee's aviation system are those airports that are supported and engaged with their community, compete effectively for funding, and, for commercial service airports, compete effectively for passengers. The "have-nots" of Tennessee's aviation system are those whose communities do not support them, cannot or choose not to engage with their community, are unable to compete effectively for funding, and, for commercial service airports, are losing passengers to other commercial service airports either in or out of state.

While some airports have the full backing and support of their local officials, other airports are not as supported by their communities. Whether it's because the community does not see the value in having an airport, or has other demands on its revenue, airports without community support are often at a distinct disadvantage compared to airports with community support. Similarly, airports who cannot or choose not to engage with their community are also at a disadvantage as they are not able to communicate and demonstrate the full value of the airport to their community. This disadvantage may manifest in a variety of ways, including:

- Lack of funding for matching state and federal grant funds, leaving airports unable to complete projects that maintain the airport's ability to operate in a safe and secure manner.
- Persistent lack of local investment in the airport, including neglecting to fund workforce and operating expenses, as well as neglecting to promote the airport, resulting in a loss of operations, business co-location, and based aircraft, in turn leading to potential lost revenue.
- Lack of understanding about safe aviation operations, leading to the possibility of encroaching land use development or unsafe activities in the airspace.

Related Issues:



The Competition issue relates to Consumer Expectations, Funding, Industry Concentrations, and the Promotion and Marketing issues. Many factors lead to competition between airports, many of which are described in these separate issues sections. Rising consumer expectations leads to competition between airports as they increase services and amenities to attract visitors and local users. This can be exacerbated with promotion and marketing by airports to attract pilots and passengers to their airports whether they are in proximity to the airport or not. Funding and the clustering of aviation-reliant industries also lead to competition between airports as they vie for increased revenue and money for capital improvement projects. Funding for aviation projects has decreased as a direct result of the aviation fuel tax cap. The Funding issue section discusses additional aspects of the Tennessee aviation funding, such as federal and local funding.

What's Next

As part of the TASP and Economic Impact Study, multiple deliverables have been developed that can be used by a variety of audiences to better understand the analysis, findings, and recommendations. Of particular interest to the Competition issue is the airport brochures, which highlight each airport's economic impact. Airports can use these brochures as part of their overall public engagement effort and as a way to market themselves to their local communities, demonstrating the economic impact the airport has on the region and the state. Outside of assistance provided by TDOT Aeronautics Division through state grants and this project's deliverables, airports must continue to foster relationships in their local communities to be able to compete effectively for funding, passengers, operations, based aircraft, and business co-location. COVID-19 may also have an impact on competition through airports by disrupting current trends. Whereas currently bigger cities have larger, more well-funded airports, due to the impacts of COVID-19 many people may choose to relocate from bigger cities to smaller communities. As a result, smaller commercial service and GA airports may grow faster than expected, putting them in a more advantageous position to compete for funding and users than was previously anticipated.

Consumer Expectations

Scope: Global

Related Goals:

Goal #2 *Goal #4*

Introduction and Existing Conditions

According to the World Bank, in 1970 the global aviation industry supported a little less than 500 million passengers. By 2018, that number jumped to over 4 billion passengers, with increases in all regions of the world and at all income levels.[7] As flying has become a more common and preferred mode of travel, consumer expectations have risen. While paper tickets and minimal amenities were the norm in the 1970s, travelers have come to expect electronic tickets and check-in, fare shopping for the lowest price, and amenities such as lounges. With rising consumer expectations, airports and airlines must meet and exceed these expectations in order to retain passengers, all while the consumer's price of flying is dropping and revenue sources are being depleted. This section explores several factors of the Consumer Expectations issue as it relates to both commercial service and GA airports. For commercial service airports, these factors include competitive fares and service options, airport amenities, e-tickets and check-ins, and intermodal access. For GA airports, these factors are focused on airport amenities and intermodal access. Both commercial service and GA airports will need to take into account the results of COVID-19 on consumer expectations, particularly for advanced cleanliness and control of disease spread.

COMPETITIVE FARES AND SERVICE OPTIONS

Competitive fares and service options are increasing competition between Tennessee's commercial service airports and causing potential loss of Tennessee's passengers to surrounding states. Multiple websites, search engines, and applications or apps are now solely devoted to helping consumers find the cheapest and best fare for a given route. Consumers are comfortable shopping around for the best flight to get from their origin to destination. As competition driven by fare shopping has risen, airlines have responded by adding additional services and service options as a way to draw in additional customers. While customers can now choose between, for example, economy, economy plus, business, business plus, first class, and other flight classes, they can also simply choose to fly different airlines if they are displeased with the service of a particular airline. As some researchers have stated,

> *"With access to customized service alternatives and credible online service reviews and recommendations, today's consumers no longer need to quietly accept service dissatisfaction."*[8]

A recent search of ticket prices from Nashville International Airport (BNA) to John F. Kennedy International (JFK) for an overnight trip using Google Flights shows the great discrepancy in ticket prices just depending on the class of seat and the number of layovers, as shown in ***Table 3***.

[7] https://data.worldbank.org/indicator/is.air.psgr
[8] https://journals.sagepub.com/doi/pdf/10.1177/0047287516684979

Table 3: Airline Ticket Options from BNA to JFK

Flight	Price
Economy, nonstop	$197
Economy, one layover	$199
Premium economy, nonstop	$315
Premium economy, one layover	$319
Business, nonstop	$529
Business, one layover	$419
First class, nonstop	$529
First class, one layover	$419

Source: Google Flights Analysis, 2020

However, not only can consumers choose between airlines, service options, and times of day, they can choose between multiple airports. As previously noted, Tennessee borders eight states with multiple out-of-state airports to choose from; consumers in the middle of the state can also reasonably choose between the state's five commercial service airports. Therefore, in addition to supporting multiple airlines and service options to retain choosy consumers, Tennessee's commercial service airports must compete with other commercial service airports in the state that offer similar service or service that is of interest to a passenger.

AIRPORT AMENITIES

Both commercial service and GA airports attract and retain users by improving and increasing their airport amenities. If airport amenities are not up to consumer expectations, Tennessee's airports may lose users to airports outside the state.

One of the commercial service amenities that has been increasing in usage in the past five years is airport lounges. In the first two months of 2017, the Airport Lounge Development (ALD) network of lounges experienced over a 70 percent increase in guest volumes year over year.[9] Airport lounge access, once restricted to elite travelers such as those flying first class, has become increasingly available to all travelers. Additionally, consumers expect a "digital lounge experience," which comes in the form of self-service check-in facilities to mobile phone applications that assist with the airport experience.[10] Use of airport lounges and the expectation of premium experiences, such as elevated dining and a personalized touch, will only continue to increase as the number of passengers increases.

For GA airports, an important amenity is pilot lounges. Pilot lounges typically include flight planning equipment as well as amenities such as vending machines, restrooms, televisions and computers, and couches or beds. Pilots may choose an airport to fly into based solely on its

[9] https://www.aviationpros.com/airports/article/12369315/how-changing-consumer-expectations-are-causing-shifts-in-airport-lounge-usage
[10] Ibid.

pilot lounge. An airport without a pilot lounge, or with a pilot lounge lacking in amenities, may be losing users.

The allure of other amenities at both commercial service and GA airports affect travelers' impressions of the airport and likelihood to return. Services and amenities such as restaurants, bars, shopping, and transportation are being improved as consumer expectations increase. More than any other amenities, restrooms are being scrutinized not only for their cleanliness, ease of access, and convenience, but for a pleasant experience. For instance, a recent Transportation Research Board (TRB) publication stated:

> *"If travelers can have a massage and grab a coffee en route to their gate, they feel it reasonable to expect restrooms with a few touches of hospitality such as soft lighting, warm water, and calming music."*

Even basic amenities such as Wi-Fi, access to a public telephone, vending machines, a conference room or classroom, and adequate auto parking, will affect a consumer's impression of the airport. ***Table 4*** shows the percentage of Tennessee's airports that have these basic amenities. Airports without these amenities may lose users to other airports.

Table 4: Available Airport Amenities

Amenity	Percentage of Airports
Auto parking	94%
Public restroom	92%
Wi-Fi	91%
Conference room or classroom	85%
Pilot lounge	82%
Public telephone	68%
Vending machines	65%

Source: TASP Inventory Data Survey

E-TICKETS AND CHECK-INS

Modern infrastructure to support e-tickets and check-ins are increasing competition between Tennessee's commercial service airports and causing potential loss of Tennessee's consumers to surrounding states. Electronic tickets, or e-tickets, provide numerous benefits to consumers. In addition to being more difficult to lose and easier to obtain, having ticket information stored electronically makes it easier for consumers to change details of their travel, including changing itineraries, canceling flights, and changing seats.[11] E-tickets also have benefits for airlines, most of all in fees: the elimination of paper airline tickets has been estimated to reduce airline costs by as much as $3 billion worldwide and cut the cost of issuing a ticket from $10 to $1, according to the International Air Transport Association (IATA).[12] Electronic tickets also enable travelers to check-in for their flights at home, up to 24 hours before their flight. This check-in process is also

[11] https://traveltips.usatoday.com/electronic-airline-tickets-work-63549.html
[12] https://abcnews.go.com/Travel/story?id=4976367&page=1

made easier by using self-service kiosks to print boarding passes, check luggage, and confirm safety questions.[13]

In order to keep up with consumer expectations, airports must support the airline's infrastructure that enable the seamless check-in and boarding process that e-tickets allow. Infrastructure to support e-tickets include kiosks that allow users to check-in and print their boarding passes, independent baggage check kiosks, and Wi-Fi to support electronic boarding passes, although users can also use cellular data to access electronic boarding passes. The quality of this infrastructure can vary from commercial service airport to airport, and similar to competitive fares and services options and other airport amenities, the ability to easily and successfully complete e-ticketing and check-in may influence consumers to choose one airport over another.

INTERMODAL ACCESS

Both commercial service and GA airports could potentially attract and retain additional users by increasing intermodal accessibility. As air travel has increased, so too has congestion at airports and the need for improved intermodal access. Passengers expect minimal delays in accessing an airport, whether in a personal vehicle (parking or being dropped off/picked up), rideshare such as Uber or Lyft, taxi, or public transportation (where available). The majority of passengers still arrive at and depart from airports in private vehicles. However, as passenger demands increase, multimodal alternatives will become more important to efficiently use minimal space for access to, on, and around airports. Some airports may not have enough land to accommodate the additional parking and curbside pick-up and drop-off needs that arise from increasing numbers of passengers and vehicles. These airports would thus need to increase their intermodal capabilities, possibly by adding designated transit space, taxi and rideshare pick-up and drop-off zones, or facilitating pedestrian and bicycle access. ***Table 5*** shows existing intermodal options at Tennessee's airports, including bus, on-demand bus, and shuttle.[14] As shown by the table, the majority of Tennessee's airports currently do not offer intermodal access.

Table 5: Intermodal Access at Tennessee Airports

Intermodal Option	Percentage of Airports
On-Demand Bus	22%
Shuttle	19%
Bus	15%

Source: TASP Inventory Data Survey, 2019

CLEANLINESS AND CONTROL OF DISEASE SPREAD

COVID-19 has had a profound impact on the aviation industry and will likely impact aviation activity for years to come. One of the main impacts on the industry has been consumer expectations as it relates to cleanliness and control of disease spread. Consumers have already

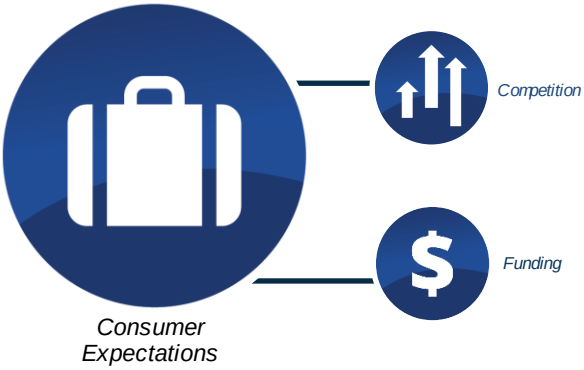
[13] Ibid.
[14] A bus provides regularly scheduled service on a fixed route. An on-demand bus, or paratransit bus, provides service outside of regularly scheduled service and regular routes, typically for older passengers or passengers with a disability. A shuttle provides service between the airport and one location, typically a hotel.

come to expect a certain level of cleanliness in the airport and aircraft. However, the threat of COVID-19 has made advanced cleanliness and control of disease spread measures imperative to ensure consumers feel safe enough to fly. COVID-19 cleanliness precautions cover a range of measures, including enforcing social distancing in the airport, more frequent and thorough cleaning of airport amenities, TSA equipment, and aircraft, and mask mandates.[15] These measures are expected to continue into the foreseeable future, and airports that don't abide by strict cleanliness and control of disease spread measures may lose passengers to other airports where they feel more safe.

Impacts of the Issue

Meeting and exceeding consumers' expectations is important to retain and grow passengers. There are several realms in which consumer expectations have been shifting rapidly even within the past decade. For commercial service airports, these factors include competitive fares and service options, airport amenities, e-tickets and check-ins, and intermodal access. For GA airports, these factors are primarily airport amenities and intermodal access. For both commercial service and GA airports, COVID-19 has impacted consumer expectations regarding cleanliness and control of disease spread. All of these factors have an impact on a consumer's choice regarding which airport to use. While in many cases a user may simply choose the airport that is geographically closest to them, some users may choose a different airport if it offers preferred amenities, more convenient access, or is more updated. If Tennessee's airports are unable to meet consumer demands, then they will experience a loss of passengers to airports in other states.

Related Issues:



Recent research has shown that operators identified three key areas of concern regarding airport access issues: off-airport access roadway congestion, on-airport roadway congestion, and curbside congestion.[16] As enplanements continue to increase, these concerns will also increase. However, as airports shift to pursuing intermodal options, they must also reckon with decreased parking reliance. A decrease in parking usage represents a major loss of revenue for airports. A recent study of commercial service airports in the U.S. and Canada revealed that 49 percent of airport revenue is from non-aeronautical sources, and of this 49 percent, 41 percent of revenue came from parking and ground transportation.[17] Even a small decrease in utilized parking spaces may result in a considerable drop in airport revenue, especially at smaller commercial service airports, which provide more spaces per passenger.[18] Although this study does not evaluate the impact of parking on airport revenues at GA airports, it does highlight the importance of rental car companies on airport revenue. Fifty-eight of Tennessee's GA airports, or 74 percent, also have rental car services at their airports. Similar to the impact of parking at commercial service airports, a decrease in

[15] https://www.tsa.gov/coronavirus
[16] https://rosap.ntl.bts.gov/view/dot/13884
[17] https://www.parking.org/wp-content/uploads/2017/07/2016-ACI-IPI-Parking-Survey-Results.pdf
[18] Ibid.

rental car usage in favor of different modal options could result in decreased revenues at both commercial service and GA airports. While airports need to consider consumer expectations for increased multimodal options and decreased congestion at airports, it is also important to consider the negative impact this may have on airport revenue.

The Consumer Expectations issue primarily relates to the Competition and Funding issue, especially considering how increased consumer expectations have led to a race to provide additional services, increasing competition and the need for funding among airports. As consumer expectations continue to evolve, different airports may gain an advantage.

What's Next

Increasing consumer expectations means airports must consider offering increased service and amenities to remain competitive. Whether it's supporting competitive service options, to providing high-quality airport amenities and supporting e-ticketing and boarding options, to improving intermodal access, airports have a lot of arenas in which to meet growing consumer expectations. It is important to note that funding is an issue when it comes to meeting advanced consumer expectations. Many of the amenities noted in this section cannot be funded with FAA or state grants, so airports must find funding at the local level or through airport revenues. Some of these amenities, such as e-ticketing and boarding equipment, are airline decisions and costs. Airports may not necessarily be able to force airlines to provide these amenities, or may be unable to if it's incompatible with the airline's existing systems. Many of Tennessee's airports are already offering enhanced services. However, Tennessee's airports must remain flexible as they look to the future and the everchanging nature of consumer expectations.

Funding

Scope: National and Statewide

Related Goals:

Goal #1 *Goal #4* *Goal #5*

Introduction and Existing Conditions

Funding is often the number one factor people think of when they think of how the state supports its airports. Tennessee, being an FAA block grant state, is even more involved in the funding of its non-primary airports than non-block grant states. Funding is necessary to continue providing a safe and efficient airport system that supports all users. Many airports rely on federal and state funding to keep pavement at usable levels, build passenger terminals, provide some pilot amenities, eliminate obstructions, and complete other projects that increase safety and improve the passenger experience. Funding is also important because airports are generally not self-sufficient, meaning they can't support their operations and continue to provide a safe aviation environment without outside financial assistance from the airport sponsor as well as federal and state sources.

Funding is contingent on a multitude of factors, most notably on availability and priority. The amount of federal and state funding changes from year to year and from airport type to airport type. Priority for this limited amount of funding also changes from year to year. In general, projects that increase airport safety and security always have top priority.

TDOT Aeronautics Division allocates funding from three major sources: the state Transportation Equity Fund (TEF), federal apportionment, and federal non-primary entitlement (NPE) funds. For Fiscal Year (FY) 2020, funds planned for these funding categories were as follows:

- State TEF: $8,000,000
- Federal apportionment: $3,600,000
- Federal NPE (dependent on demonstrated need): $9,300,000
- *Total: $20,900,000*[19]

Funds are distributed based on an airport's Airport Capital Improvement Plan (ACIP) which is the primary planning tool for each airport to systematically identify, prioritize, and assign funds to implement critical airport development and associated capital needs.[20] The state then ranks projects put into the ACIP, with priority given to projects concerning safety, security, pavement preservation/maintenance, preservation of infrastructure, and compliance with current FAA standards, in that order.[21] The ACIP is used for evaluating both FAA and state-funded projects. Projects not in the ACIP are not eligible to receive funding, and more airports input projects into the ACIP annually than there are available state and federal funds.

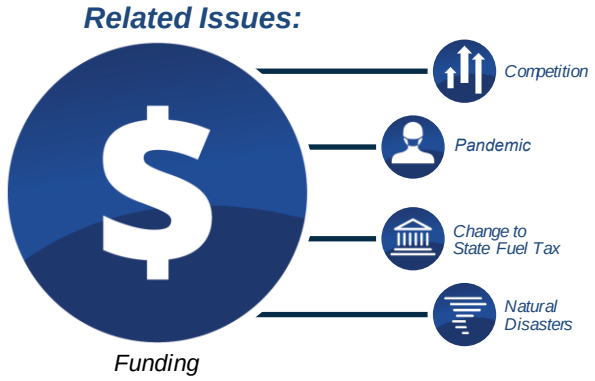
[19] https://www.tn.gov/content/dam/tn/tdot/aeronautics/planning/ACIP%20Presentation%20Slides.pdf
[20] https://www.tn.gov/content/dam/tn/tdot/aeronautics/planning/ACIP%20Infographic.pdf
[21] Ibid.

Airports in the NPIAS are eligible for AIP funding. The AIP is a federal grant program that represents a major source of funding for airport development and planning.[22] The FAA refers to recipients of AIP grants as "sponsors." A sponsor's eligibility to receive funds under the AIP program varies per the type of airport and the type of proposed project.[23] Eligible projects generally include projects concerning airport safety, capacity, security, preserving airport infrastructure, meeting FAA standards, and environmental concerns.[24] The AIP does not reimburse sponsors the full amount of a project expense; rather, the amount of reimbursement will vary per the type of sponsor. FAA reimbursement ranges from 75 percent at primary airports (large and medium hub) to 95 percent at GA airports in economically distressed areas.[25] The majority of GA airports have a 90 percent reimbursement rate. Tennessee also participates in the FAA's State Block Grant Program (SBGP). States that participate in the SBGP assume responsibility for administering AIP grants at nonprimary commercial service, reliever, and general aviation airports. Each state is responsible for determining which airports will receive funds for ongoing project administration.[26] TDOT Aeronautics Division also submits projects to the FAA for discretionary funding consideration. However, these projects are not guaranteed to receive discretionary funding as they must compete on the national level for this type of funding. In the last five (5) years, two (2) Tennessee airports have received discretionary awards averaging $5,000,000 per airport.

Outside of these sources, airports also generate revenue which they can use to fund projects. GA airports generate revenue through leases, fuel sales, hangar rentals, and real estate fees. Commercial service airports generate money through these sources and also through aeronautical revenue, such as landing and parking fees, and through non-aeronautical sources, such as retail. While many airports operate at a deficit, especially in terms of covering both operating costs and capital improvements, all airports generate some revenue which helps offset the costs of operating and improvements that increase the safety and utility of an airport.

Impacts of the Issue

While the state and federal government strive to provide the maximum amount of funding possible for each airport, as applicable, need will always exceed available funds. As stated earlier, more projects are put into the state's ACIP than there is money available to fund them.



This means that the state must make difficult choices concerning which projects at which airports take precedence. Project priority is clearly laid out in the state's guidance. However, sometimes unexpected events occur which may impact this priority ranking. For instance, the tornado that hit John C. Tune Airport (JWN) in March 2020, or the global COVID-19 pandemic, necessitate priority. Airports without much or any local support will have more need for outside

[22] https://www.faa.gov/airports/central/aip/sponsor_guide/media/0100.pdf
[23] Ibid.
[24] Ibid.
[25] Ibid.
[26] https://www.faa.gov/airports/aip/state_block/

funding than other airports with local support. Airports in economically disadvantaged areas, airports without community support, or airports with aging infrastructure have arguably more need than airports without these circumstances.

The Funding issue relates to other issues including Competition, the Pandemic, Change to State Fuel Tax, and Natural Disasters, especially as it relates to funding sources, funding availability, revenue generation, and project priorities. Funding affects competition between airports because there is always more requested funding than there is available funding. Competition for this funding inevitably arises. Additionally, pandemics such as COVID-19 and natural disasters lead to new funding needs, meaning that other proposed projects may be delayed in order to assist with completely unexpected events. Such events can also prompt additional federal resources. The Coronavirus Aid, Relief, and Economic Security Act (CARES Act) provided, among other resources, additional federal funding for aviation projects, and all FY 2020 aviation grants were funded fully by the FAA. On an annual basis, authorizations from aviation bills and annual appropriations can impact airport funding. These factors affect when grants are released, which in turn affects when projects can get started and completed.

What's Next

The state does not currently anticipate changing its funding priorities for future cycles. However, as impacts from the global COVID-19 pandemic continue to be felt, airports will need additional financial support to continue providing essential services while lacking sufficient revenue from operations and enplanements. Reprioritization for COVID-19 mitigation will certainly impact future funding cycles and may stall other critical airport projects. Further, TASP results will be used to reexamine funding priorities and needs, helping to determine changes that may be needed to implement study recommendations.

Future Aircraft and Fuel Sources

Scope: Global

Related Goals:

Goal #2 *Goal #4*

Introduction and Existing Conditions

As new advances continue to be made in transportation such as proposed hyperloop development and autonomous vehicles, new technologies are also emerging in the world of aviation.[27] Advancements in airplane technology, composite materials, and manufacturing techniques are resulting in a new wave of research and development to introduce new commercially viable aircraft to the global market. These emerging technologies may impact the types of aircraft used throughout the industry in the future as well as the environmental impacts. The widespread application of electric aircraft is anticipated to reshape the future of aviation. Alternative aviation fuels and other means of powering aircraft are being developed in response to growing concerns over the environmental impacts of greenhouse gas (GHG) and carbon (CO_2) emissions associated with the aviation industry. A switch to alternative fuels could increase the aviation industry's resilience against volatility in oil markets. Further, COVID-19 has had an effect on aviation environmental impacts by reducing GHG and CO_2 emissions due to fewer flights. This may lead to expectations that the reductions will continue, or may advance electric aircraft or alternative fuels sooner than expected. This section explores future aircraft and alternative fuels separately.

FUTURE AIRCRAFT

Aircraft development has evolved over time to many now being made with lightweight composite materials. What hasn't changed for many years is how they are powered. The development of electric aircraft, which encompasses all-electric, hybrid, and turbo-electric, is a response to growing environmental concerns with fossil fuel consumption and GHG and carbon emissions. Applications of electric aircraft support a wide range of aviation activity from pilot training to long-distance routes for commercial service travel. [28,29] Newly designed electric aircraft are lighter than previous models and can perform operations on shorter runways, which increases access to smaller airports that can accommodate these aircraft without costly investments to airfield design. Additionally, noise generation from electric aircraft is significantly reduced compared to their traditional counterparts, making them ideal for airports operating near urban development.[30] Although the existing electric aircraft fleet is used almost exclusively for training purposes, development is rapidly advancing to make way for commercially viable aircraft capable of supporting regional/commuter and long-distance passenger flights in the years to come.

---

[27] UAS and other technology developments are addressed separately in the Technology issue section
[28] https://transportup.com/headlines-breaking-news/vehicles-manufactures/ampaire-to-electrify-caravan-twin-otter/
[29] https://mashable.com/feature/electric-airplanes-future-flight/
[30] https://www.ampaire.com/

Hydrogen-powered aircraft are also on the horizon of future aircraft capable of addressing environmental concerns associated with the aviation industry. Although currently in the development and testing phase, proposed hydrogen-powered aircraft are estimated to produce zero emissions and have lower fueling and maintenance costs than today's aircraft. [31,32]

ALTERNATIVE FUELS

The price of oil can directly correlate with consumer spending on air travel and profitability. High oil prices typically equal higher costs to the airlines and GA users and decreased travel spending as these costs are generally shouldered by the consumers. The FAA forecasts the price of oil will continue to rise through 2040 due to high costs of extraction and growing global demand outpacing supplies.[33] Market volatility associated with the oil industry causes uncertainty regarding long-term profitability for airlines and healthy GA activity at the national level. In response to increasing resiliency against oil market volatility and renewed sustainability commitments, alternative fuels are being developed that can take the place of traditional Jet A and 100LL (100 Low Lead, or commonly referred to as "AvGas"). Advancements in sustainable aviation jet fuel (SAF) has resulted in five FAA-approved alternative fuels since 2016 that could replace Jet A used by commercial service, air cargo, business/corporate flying, medical flights, and the wildland firefighting sector.[34] The use of "drop-in" alternatives, alternatives mixed with traditional fuel, facilitates an easier transition to SAF as no changes to aircraft components are needed to process the fuel.[35] Commitments to deploy SAF exist in both commercial service and GA sectors. However, limited volumes of SAF production result in higher price points for end-users than traditional fuel types. The financial costs to providing SAF are often reported as one of the biggest barriers to widespread adoption at all levels of the industry[36].

Unfortunately, most of the GA fleet is being left behind in terms of advancements to alternative fuels. Piston aircraft, which make up the largest proportion of the national GA aircraft fleet, is reliant on AvGas which has no approved alternative fuel to date. Four alternative AvGas fuels have been developed but have not been successful in withstanding the rigorous testing process for approval by the FAA's Piston Aviation Fuel Initiative (PAFI). PAFI is continuing efforts and investment into the development of an AvGas fuel alternative to safely satisfy the demands of GA users.[37]

Impacts of the Issue

Electric aircraft and alternative fuels represent some of the most exciting advancements in aviation that may shape the future. Due to decreased takeoff distances and quieter engines, electric aircraft operations may be ideal at small airports with limited infrastructure and airports

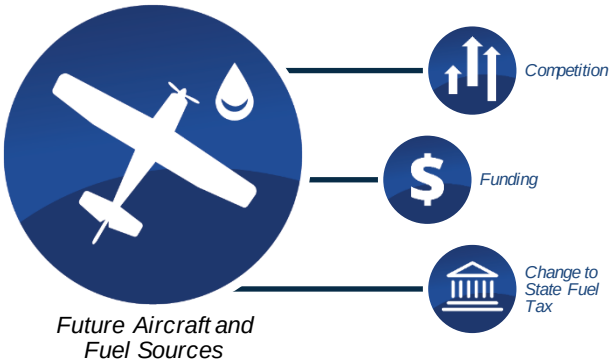
---

[31] Quailan Homann. "Aviation." 2019. http://www.fchea.org/in-transition/2019/11/25/aviation
[32] ZeroAvia. "Our Mission" 2019. https://www.zeroavia.com/
[33] Federal Aviation Administration. 2020. "FAA Aerospace Forecast: Fiscal Years 2020-2040". https://www.faa.gov/data_research/aviation/aerospace_forecasts/media/FY2020-40_FAA_Aerospace_Forecast.pdf
[34] https://www.faa.gov/news/updates/?newsId=85425
[35] Commercial Aircraft Propulsion and Energy System Research, 2016
[36] https://www.portseattle.org/sites/default/files/201805/RMI_Sustainable_Aviation_Innovative_Funding_SAF_2017.pdf
[37] https://www.faa.gov/about/initiatives/AvGas/

constrained by or operating near dense urban development. The General Aviation Manufacturers Association (GAMA) noted advances in technology support positive outlooks for electric aircraft manufacturing especially as battery capacity and thermoregulation testing aims to accommodate greater flight distance which would result in a wider range of applications than the existing electric aircraft fleet.[38] Tennessee airports should remain fluid to accommodate changing infrastructure needs of new technologies such as electric aircraft and alternative fuels. As more of the aircraft fleet is anticipated to become electric, airports will need to address additional electrical capacity and the development of charging stations. Although existing alternative fuels do not require modifications to infrastructure, this may change as new alternatives are introduced in the future.

A switch to electric aircraft and alternative fuels will also negatively impact revenues from the aviation fuel gas tax, which has already been impacted by the fuel tax cap. As Tennessee, along with the rest of the aviation community, looks to increase and promote use of alternative fuels for their many benefits, they must also plan and prepare for the dip in revenue from the aviation fuel gas tax.

Related Issues:



The Future Aircraft and Fuel Sources issue relates to several other issues including Competition, Funding, and the Change to State Fuel Tax issues. As previously explored, available funding sources allocated to Tennessee's system are quickly outpaced by the financial needs of system airports. Development costs to outfit airports with additional infrastructure to support electric aircraft charging and/or alternative fuel may cause additional strain to already limited funding sources. Funding will be further decreased if users move away from traditional aviation fuel, resulting in decreased revenue from aviation fuel tax, further exacerbating the issue caused by the aviation fuel tax cap. These additional needs may increase competition between airports looking to implement development for future aircraft and fuel types.

What's Next

Tennessee system airports will need to continually assess airport development needs in response to advancements in new aircraft technologies and alternative fuel developments. TDOT Aeronautics Division holds ACIP meetings to identify, plan, and prioritize airport development and can act as a catalyst to developing system airports in response to user demands for new infrastructure and services. TDOT Aeronautics Division may also start to examine potential revenue sources or ways to offset the reductions in the state fuel tax revenues as a result of a switch to alternative fuels.

[38] General Aviation Manufacturers Association. "General Aviation Aircraft Shipment Report". https://gama.aero/wp-content/uploads/GAMA_2019_Year-end_Report.pdf

Hangar Availability

Scope: Statewide

Related Goals:

Goal #1 | Goal #4 | Goal #5

Introduction and Existing Conditions

Hangars are enclosed buildings used to safely and securely store aircraft and protect the significant investments made by owners and operators. Hangars shelter aircraft from external elements such as weather, dust, and wildlife which can impact the longevity of peak aircraft performance. According to 50 of the 78 system airports, insufficient hangar storage remains a top issue to serving airport users across the state. Currently, system airports provide almost 3,000 cumulative conventional box, T-hangar, and shade hangar spaces to users and the airports indicated more are needed to accommodate demand. These needs are projected to become more acute as continued population growth brings new users to the state and projections indicate a shift in the national aircraft fleet over the next 20 years.

At the national scale, the FAA projects the active GA fleet to decline annually by 0.9 percent while projecting a loss of 12,120 GA pilots over the next 20 years.[39] Conversely, the FAA also projects significant growth in the business jet fleet and jet hours flown at the national level, driving the need for additional hangar space.[40] Therefore, depending on a region's current mix of aircraft use and operations, demand for hangars may increase or decrease through 2040.

Overall, state trends in population growth, increased tourism, and other indicators point to growing hangar needs in Tennessee. According to the TASP Inventory Data Survey, 67 system airports indicate having hangar shortages, either requiring more facilities to accommodate projected demand or having no additional facilities to offer current airport users. Currently, 61 airports maintain a waitlist of approximately 800 aircraft across the state, indicating a critical need for additional hangar space to meet current demand. It is important to note that hangar waitlist numbers are a high-level review of airport-reported data, may include duplicate applicants for available hangar space at multiple airports, and were not validated.

Hangar shortages result from a variety of factors including demand outpacing supply, cost barriers to hangar development, lack of available airport land for hangar development, and changing demographics leading to increased demand. Many system airports such as Mark Anton Airport (2A0) cite a growing demand and current users needs that are unable to be accommodated by existing facilities. A representative from Mark Anton Airport (2A0) stated:

> *"We have a waiting list over 30. I am currently turning 2-3 potential customers away due to an unknown factor of when I will have hangars come available."*

In addition to demand outpacing available hangar spaces, some airports face cost barriers to hangar development. Lebanon Municipal (M54) reported that:

---

[39] Federal Aviation Administration. 2020. "FAA Aerospace Forecast: Fiscal Years 2020-2040". https://www.faa.gov/data_research/aviation/aerospace_forecasts/media/FY2020-40_FAA_Aerospace_Forecast.pdf

[40] Ibid.

> *"Demand is rapidly increasing in the region. State and federal funding [is] not available to aid in T-hangar development for stakeholders."*

Other airports reveal that a lack of available land presents challenges to constructing more hangars, in addition to funding deficiencies. Cleveland Regional Jetport (RZR) indicated that there is a:

> *"…lack of developable property. Simply stated, we presently have no room for further development of hangars and facilities. The property is ours, we just can't develop it presently due to infrastructure funding."*

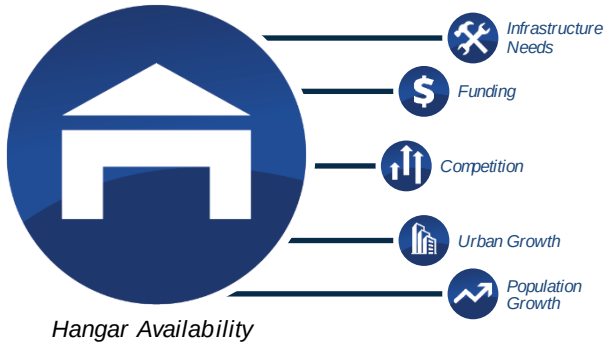
Several airports indicate rapid population growth and changing user demographics are driving unmet hangar demands by current facilities. Winchester Municipal (BGF) revealed:

> "*hangar capacity [is an issue] as the local community is going through a quick expansion. Several retirees are moving to the area and many are wanting to bring aircraft with them. Capacity is a statewide problem. If airports in the [state] do not have hangar availability, those people will move elsewhere*".

Impacts of the Issue

Providing sufficient hangar space across Tennessee is critical to the long-term financial viability of airports across the state. Providing this infrastructure is advantageous on two fronts: first by allowing the airports to further support a growing aviation community in Tennessee and second by increasing the airports' fiscal resiliency in the face of market volatility. *Airport Cooperative Research Program Report (ACRP) Report 61: Guidebook for Managing Small Airports* indicates that revenue generation and especially diverse revenues can support airports into becoming more resilient in the face of economic shifts, lead to fiscal self-sufficiency, and promote airport growth.

Related Issues:



The Hangar Availability issue relates to numerous other issues such as Infrastructure Needs, Funding, Competition, Urban Growth, and Population Growth. With competition for limited funding between system airports other airfield and landside developments are prioritized over hangar space development at airports especially as project costs are typically supported at the local level. There is also competition for the based aircraft and being able to accommodate more aircraft, especially larger aircraft that are likely to purchase fuel and potentially bring jobs to an area. Population growth will further exacerbate current hangar demands by new users to the state while corresponding urban growth issues may limit the available land needed for new hangar space construction.

What's Next

The gap between available hangar facilities and existing and projected user demand warrants additional study to determine if TDOT Aeronautics Division can provide further support to airports to meet the need for hangars across the state. This study can include turning to other

states to determine how they address hangar shortages, including the possibility of a revolving loan program or capital spending program. The cost to develop hangar spaces is most often placed upon the airport sponsor and local resources. This is due to the fact that hangar projects are considered to be "revenue generating aeronautical support facilities" typically ineligible for federal funding unless the airport sponsor can prove all other airfield requirements have been met.[41] To this end, many airports may lack the capital to construct or expand aircraft storage facilities to meet user demand as other needs to support safe and efficient airport operations are prioritized.

[41] Federal Aviation Administration. Order 5100.38D, Change 1: "*Airport Improvement Program Handbook*". https://www.faa.gov/airports/aip/aip_handbook/media/AIP-Handbook-Order-5100-38D-Chg1.pdf

Industry Concentrations

Scope: Statewide

Related Goal:

Goal #5

Introduction and Existing Conditions

Airports are often catalysts for economic activity within the state. They serve local and regional businesses by connecting them with clients, facilitate the shipment of goods, and provide facilities and services that are integral to business operations. The location of a nearby airport can influence decisions to establish, relocate, or expand facilities resulting in the creation of industry concentrations. Industry concentrations are groups of businesses or firms that share commonalities in markets, technology, professionals, and/or their client-supplier relationships. These industry concentrations can represent aviation-reliant businesses whose operations are dependent upon the facilities and services available at an airport. Businesses who rely on airports range from users dependent on them to receive raw materials, to conducting business/corporate flying, repairing aircraft, etc.

Tennessee's Department of Economic & Community Development (TNECD) and Department of Tourism Development (TDTD) reported that the two biggest aviation-reliant industries in Tennessee were aerospace and tourism industries, which this section explores in more detail. These two industries are representative of industries traditionally reliant on airports for economic success. It is important to note that this is not an exhaustive of all types of aviation-reliant businesses that are or could be supported by airport activity.

TOURISM

Tennessee has a robust tourism sector which heavily relies on the airports to transport domestic and international travelers. Per TDTD's 2019 annual report, the tourism industry generated $22.02 billion in travel expenditures, a six percent increase from 2018 – with growth in domestic travel spending in all 95 Tennessee counties. Davidson, Shelby, Sevier, and Blount counties generated the highest expenditure dollars through 2018. The most highly visited tourism destinations in these counties and their corresponding airports are:

- Davidson County: Nashville
  - Nashville International (BNA)
  - John C. Tune (JWN)
- Shelby County: Memphis
  - Memphis International (MEM)
  - General DeWitt Spain (M01)
- Sevier County: Gatlinburg
  - Gatlinburg-Pigeon Forge (GKT)
- Blount County: Knoxville
  - McGhee Tyson (TYS)

Tourism as a business sector is comprised of several industry types. The industries most associated with tourism in the North American Industry Classification System (NAICS) include accommodation and food services (NAICS code 72) and transportation and warehousing (NAICS code 48-49). Although not all businesses in these two industry types are directly related to tourism, the prominence of these industry types is an indication of tourism in an area. ***Table 6***

provides data on NAICS code 72 and NAICS code 48-49 employment and number of establishments in the top four tourism counties as well as statewide. Employment and number of establishments for these industries is ranked as a comparison to other industries in the area as a proxy for these industries' prominence compared to other industries. In terms of total employment, accommodation and food services consistently ranks near the top of industries for employment in all geographies, ranging from first of 21 industries in Sevier County to fifth of 22 industries in Shelby County. Transportation and warehousing varies a little more, ranging from second of 22 industries in Shelby County to sixteenth of 21 industries in Sevier County.

In terms of total number of establishments, accommodation and food services also consistently ranks near the top of industries for number of establishments in all geographies, ranging from second of 21 industries in Sevier County to third of 27 industries and 19 industries, respectively, in Tennessee statewide and Blount County. Transportation and warehousing ranks in the middle, ranging from tenth of 22 industries in Shelby County to sixteenth of 22 industries and 21 industries, respectively, in Davidson County and Sevier County. Overall, this analysis of total employment and number of establishments in two industries closely associated with tourism shows that tourism is a major sector in the most-visited counties and statewide.

Table 6: Prominence of Tourism-Related Industries

Geographic Area	Ranking of NAICS Code 72 (Employment)	Ranking of NAICS Code 48-49 (Employment)
Tennessee	#3 of 27	#7 of 27
Davidson County	#2 of 22	#10 of 22
Shelby County	#5 of 22	#2 of 22
Sevier County	#1 of 21	#16 of 21
Blount County	#3 of 19	#7 of 19
Geographic Area	**Ranking of NAICS Code 72 (# of Establishments)**	**Ranking of NAICS Code 48-49 (# of Establishments)**
Tennessee	#3 of 27	#14 of 27
Davidson County	#4 of 22	#16 of 22
Shelby County	#4 of 22	#10 of 22
Sevier County	#2 of 21	#16 of 21
Blount County	#3 of 19	#11 of 19

Note: number of total employment codes differs by geography based on different sample sizes

Source: U.S. Census American Community Survey

Tourism also has an impact on the businesses located at airports and the businesses that rely on airports. Five airports including John C. Tune (JWN), Memphis International (MEM), General DeWitt Spain (M01), Gatlinburg-Pigeon Forge (GKT), and McGhee Tyson (TYS) are located in the four most visited counties in the state.[42] These airports have a combined 65 tenants of 353 tenants identified in the entire state airport system. In other words, these airports comprise over

[42] Nashville International (BNA) was excluded from this analysis due to providing tenant information by category, not by individual tenant.

six percent of the total airports in the state and have 18 percent of the tenants. The prevalence of onsite tenants at airports associated with the tourism sector could indicate the presence of business co-location; 22 of the 65 tenants, or 34 percent, are in industries associated with tourism including restaurants/bars, rental cars, and hotels.

Most of the airports in counties associated with the tourism sector also provided information concerning local aviation-reliant businesses.[43] These airports have a combined 149 aviation-reliant business of 367 identified statewide aviation-reliant businesses. In other words, these airports comprise over six percent of the total airports in the state and report 41 percent of the aviation-reliant businesses. Forty-five of the 149 businesses, or 30 percent, are associated with the tourism sector including arts, entertainment, and recreation (including amusement parks), accommodation, and food services.

These statistics clearly illustrate that tourism and tourism-related industries are strong in Tennessee, especially in Davidson, Shelby, Sevier, and Blount counties. Through an analysis of the on-airport tenants and local aviation-reliant businesses, it is also clear that tourism-related businesses rely on their local airports. However, reliance on a sector means that local economies may be negatively impacted by fluctuations in that sector. This is especially true of tourism, which is impacted by seasonal visitation, changes to the economy resulting in less travelers, and global events like COVID-19.

AEROSPACE

Aerospace research, testing, technology, and manufacturing industries comprise a notable section of aviation-reliant businesses. The following NAICS codes were used to identify aerospace industry concentrations present in Tennessee:

- NAICS 336413: Other Aircraft Parts and Auxiliary Equipment Manufacturing
- NAICS 336412: Aircraft Engine and Engine Parts Manufacturing
- NAICS 336411: Aircraft Manufacturing

Aerospace industries are present in 16 different counties across the state and account for more than 2,600 jobs per TNECD. Davidson County, which is home to Nashville International (BNA) and John C. Tune (JWN), represents the highest concentration of employment in aerospace industries across Tennessee.

Aircraft parts and equipment manufacturing industries contribute the highest number of jobs and earnings in comparison to other aerospace industries in the state. However, market disruptions in the industry have resulted in a 16 percent decrease in employment between 2013 and 2018.[44] The other two industries, aircraft engine and engine parts manufacturing and aircraft manufacturing, have shown substantial growth over the same time period. Aircraft engine and engine parts manufacturers have seen a 111 percent increase in employment despite stagnated growth at the national level. Hamblen County where Moore-Murrell Airport (MOR) is located is home to the largest manufacturer of aircraft engine and engine parts.

Aircraft manufacturing represents the smallest segment of Tennessee's aerospace cluster. However, the industry has seen an employment increase of 204 percent despite slower growth

[43] Nashville International (BNA) and John C. Tune (JWN) did not provide this information.
[44] TN Economic & Community Development. "Aerospace and Defense Research Paper". August 2018.

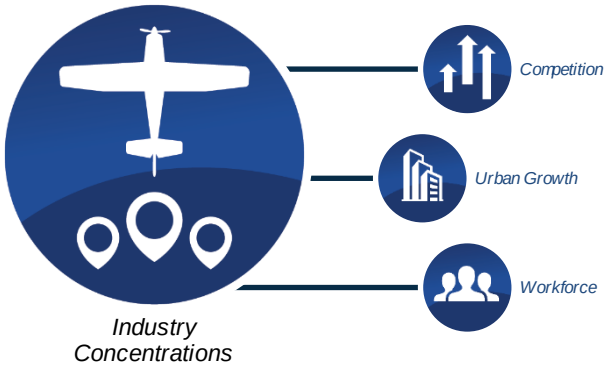
when compared to other states.[45] The largest concentration of employment in this industry is located in Bedford County, which is home to Bomar Field-Shelbyville Municipal (SYI). Another notable concentration of aircraft manufacturing jobs is in Blount County, which is home to McGhee Tyson Airport (TYS), where Cirrus Aircraft is located. According to the TASP Inventory Data Survey, Cirrus employs 157 people.

Although not technically part of the aerospace traded cluster, one of the largest concentrations of aerospace industries is located at the Arnold Engineering Development Complex (AEDC) which is anchored at Arnold Air Force Base in Tullahoma.[46] AEDC houses the largest flight simulation facility in the world and serves more than 55 aerospace and defense research, testing, and manufacturing companies.[47] AEDC's flight simulation test facilities include testing environments that cannot be found anywhere else in the world.

Impacts of the Issue

The Tennessee aviation system serves as an integral part of the state's economy and aviation-reliant businesses are an indicator of economic activity for an individual airport. Airports with these businesses are more likely to support a more comprehensive slate of infrastructure and services to accommodate a wide variety of user needs. According to the 34th Annual Corporate Survey, which surveyed more than 100 corporate executives across numerous industries about future facility expansions in 2020 and beyond, the location of major airports, industry concentrations, and skilled labor are some of the most important factors of new business facilities, relocations, or expansions.[48] The location of a nearby airport, existing businesses with similar activities, and skilled workers can support the growth of present industry concentrations reliant on airports in the state.

Related Issues:



The Industry Concentrations issue relates to three other issues: Competition, Urban Growth, and Workforce. These issues may be highlighted in rural areas or at smaller airports that do not have the infrastructure or funding to support commercial or cargo aircraft that may be related to the industry. Industry concentrations which utilize smaller aircraft such as recreational flying, business/corporate flying, aerial agriculture, etc. can prove to be ideal for rural/smaller airports. To fully optimize the system and attract a robust economy of aviation-

[45] Ibid
[46] U.S. military government operated establishments are not considered traded clusters. Traded clusters are considered to be industry concentrations that trade outside the boundaries of their location.
[47] Tennessee Department of Economic & Community Development. "Aerospace and Defense". https://tnecd.com/industries/aerospace-defense/
[48] Area Development. "34th Annual Area Development Corporate Survey". https://www.areadevelopment.com/Corporate-Consultants-Survey-Results/Q1-2020/34th-annual-corporate-survey-16th-annual-consultants-survey.shtml

reliant businesses, it is important to identify industries which can be supported by the various types and sizes of Tennessee's system airports.

What's Next

GAMA reports yearly international aircraft billing and shipment numbers used to measure changes in aircraft fleet and projections of fleet growth. In their 2019 report, piston airplanes and business jet aircraft deliveries experienced the highest percentages of growth when compared to 2018 numbers. GAMA indicated the general aviation fleet may continue to see a robust growth in the future, demonstrating the need for more aircraft and parts manufacturing activities.[49] Concurrently, TNECD anticipates a high demand for workers related to the aerospace and defense industry according to their *2019 Labor and Education Alignment Program (LEAP) In-Demand Occupations Report*.[50]

Additionally, Governor Bill Lee recognized the importance of fostering tourism development in Tennessee's 78 rural communities with a special emphasis on 15 distressed and 29 at-risk rural counties. A $2.02 million budget was awarded to TDTD to establish the Office of Rural Tourism which included startup funding specifically for rural tourism.[51]

To support the anticipated growth of aerospace manufacturing and tourism industries in the state, the 2020 TASP includes an analysis and determination of the function of each airport in the greater aviation system starting with a robust inventory process. The inventory process collects data about existing infrastructure, services, and types of aviation activity that currently take place at all 78 system airports. The data collected during this process is essential in conducting analyses to determine opportunities which can be leveraged with existing facilities to attract more aviation-reliant businesses to system airports. A critical result of the inventory process is the classification of system airports into roles. Each airport's aviation activity, types of users, and a number of other factors are used to determine the airport's role within the system. Airport roles help to identify the minimum facilities and services the airport should have to fully serve the needs and demands of its current and future users. Additionally, airport roles can often help in the identification of new opportunities, gaps, and duplication of facilities or services provided by Tennessee's aviation system.

---

[49] General Aviation Manufacturers Association. "General Aviation Aircraft Shipment Report". https://gama.aero/wp-content/uploads/GAMA_2019_Year-end_Report.pdf

[50] Tennessee Department of Economic & Community Development. "2019Labor and Education Alignment Program (LEAP) In-Demand Occupations Report". https://tnecd.com/wp-content/uploads/2019/11/LEAP-2019-In-Demand-Occupations-FINAL-REPORT.pdf

[51] Tennessee Department of Tourism Development. "FY 2019 Annual Report". https://industry.tnvacation.com/sites/industry/files/component/pod/Report_Sept_2019.pdf

Infrastructure Needs

Scope: Statewide

Related Goals:

Introduction and Existing Conditions

Safe and efficient airport operations rely heavily upon maintaining and extending the useful life of airport infrastructure such as airfield and landside facilities. As some of the costliest investments an airport can incur, planning for future infrastructure development and continued maintenance is crucial for an airport to remain economically and operationally viable. Factors such as increasing business/corporate flying, intensifying population growth, and shifting technologies will require Tennessee's system airports to develop in response to escalating demand. Airport managers reported that runway and taxiway projects, pavement maintenance, and terminal buildings were the airport infrastructure that represented some of their top concerns. COVID-19 will also have an impact on the potential for infrastructure development. While COVID-19 has had an impact on airport operations, airports will still need the facilities to serve any amount of operations and their based aircraft.

RUNWAY AND TAXIWAY PROJECTS

Increasing runway and taxiway length and improving and preserving runway and taxiway design are two projects frequently identified by airport managers in order to increase operations or improve current conditions at the airport. Such projects aren't possible without state and federal funding. States must compare the statewide capital improvement budget with the large-dollar project requests, including major runway and taxiway projects, along with the many other requests and determine how best to meet the needs of the statewide aviation system with the limited available funding. Funding a runway extension project at an airport in one area of the state may be more advantageous to the statewide aviation system than funding the exact same project at an airport in a different area of the state. Runway and taxiway projects thus become an issue because many airports rightfully identify such projects as being necessary for their airport's continued growth or sustained operations, while states have limited funds with which to grant such projects.

Meeting runway design standards is crucial to safely accommodating take-offs, landings, and accelerate stop distances of the most demanding, regular use aircraft, or critical aircraft, that operate at the facility. Runway design is dependent upon the operational and physical attributes of the critical aircraft and dictate the dimensional standards such as length, width, runway safety areas, and other factors required to mitigate risks during instances of aircraft undershoot, overrun or veering off the runway. Runway length analyses are warranted as the unique characteristics of an airport such as mean temperatures during the hottest months, elevation, and other factors may impact individual runway design.

During the inventory process, runway extensions were the runway design modification that airport managers most often cited as needed at their airports. Some airport managers noted that

growing demands were driving these needs. Nashville International (BNA) indicated a runway extension was needed to serve new markets:

> *"Demand for direct non-stop air service to Asia is driving the need to extend Runway 2L/20R to 12,000 feet to accommodate the larger aircraft needed to travel the extended distance."*

Many airports like Dickson Municipal (M02) directly noted a need to extend their runways, while others such as Fayette County (FYE) stated runway strengthening would allow them to accommodate heavier aircraft.

While many airports desire runway design projects, very few are actually funded. A review of 2019 airport projects funded through ACIPs reveals that approximately four airports had projects related to runway design (not rehabilitation), including design for a runway replacements and extensions. Conversely, approximately 13 airports stated their interest in a runway design project.

Taxiways are important in moving aircraft safely and efficiently off and onto runways. Similar to runway design, taxiways also must be designed to accommodate the activity of the critical aircraft at the facility. Taxiway infrastructure is planned to accommodate the levels of based and transient aircraft operations at an airport and can no longer support maximum efficiency and safety if operations exceed design thresholds. Similar to runway design, taxiways must be planned and developed in consideration of changing aircraft and activity demands. One of the top issues airport managers reported pertained to developing full parallel taxiways either through extending current infrastructure or constructing entirely new taxiways. Full parallel taxiways are considered essential for large or busy airports as they can provide ample runway entrances/exits to facilitate the efficient movement of aircraft on and off the runway as well as maximize an airport's runway capacity. Twenty-five airports currently have a full parallel taxiway on the primary runway, with approximately eight airports stating their interest in such a project. Conversely, a review of the 2019 airport projects funded through the ACIP reveals that approximately seven airports had projects related in any way to taxiway design, including new taxiway design and rehabilitation design. None were for full taxiway projects.

Comments from airport managers regarding runway and taxiway issues warrant additional studies to determine specific projects needed to address current concerns in accordance to the latest FAA guidance (FAA Advisory Circular 150/5300-13A Change 1, *Airport Design*). For instance, per AC 150/5300-13A, recent changes to taxiway design geometries have been made to increase the movement of aircraft transitioning to and from the runway and reduce potential incursions with other aircraft. The AC identifies three primary issues which increase "hot spots" for incursions on taxiways: direct access from the apron, wide expanses of pavement, and three-node intersections. All can result in confusing airfield layouts and decrease a pilot's situational awareness. ***Table 7*** provides an overview of the prominence of these deficiencies at Tennessee's airports.

Table 7: Taxiway Deficiencies

Taxiway Deficiency	Percentage of Airports
Direct access	79%
Wide expanses of pavement	26%
Three-node intersections	6%

Source: Google Earth Analysis, 2019

PAVEMENT MAINTENANCE

As one of the most significant investments an airport can make, pavement conditions are essential to safe and efficient aircraft operations. Pavement requires regular maintenance and assessment to increase its useful life and avoid costly projects for rehabilitation/reconstruction of poor or failing pavement areas. Due to the frequency of use and the speed at which aircraft operate on runways, runway pavement conditions are a significant factor to airport safety as poor conditions can damage aircraft and increase the costs for reconstruction.

Several airport managers prioritized pavement rehabilitation and maintenance as a top concern for their facilities. Humboldt Municipal (M53) indicated their runway and taxiway needed rehabilitation whereas Savannah-Hardin County (SNH) identified an ongoing concern with pavement rehabilitation needs. While many airports desire runway design projects, very few are actually funded by the state. A review of 2019 airport projects funded through the ACIP reveals that approximately 18 airports had projects related to pavement maintenance. Approximately 11 airports stated an interest in a pavement maintenance project in the TASP Inventory Data Survey. Recently, TDOT Aeronautics Division undertook a comprehensive program to definitively and proactively maintain and rehabilitate airport pavements across the state. The Statewide Pavement Maintenance Program was developed to help maintain airfield pavements through the provision of pavement overlays and seal coats to help elongate the useful life of TDOT's existing infrastructure. This program is intended to provide each airport with pavement maintenance every three to four years.

As part of the State Annual Airport Inspection, TDOT Aeronautics Division performs annual pavement inspections and compares those observations with the latest Pavement Condition Index (PCI) study to maintain safe pavement conditions as cost-effectively as possible. TDOT Aeronautics Division updates the PCI data every three years per AC 150/5380-7B. Outcomes of the inspection inform the ACIP which prioritizes funding for projects from the State Block Grant Program. TDOT Aeronautics Division also stores PCI data in the online database Tennessee IDEA, which provides detail on each inspected pavement segment, provides airport-wide summaries, and provides statewide summaries. TDOT Aeronautics Division uses this database as part of their process to prioritize pavement maintenance projects. Pavement preservation/maintenance is a top priority amongst project type rankings in the ACIP program but may not be granted due to limited funding, prioritization of other projects, and other factors.[52]

[52] TDOT Aeronautics Division. "Tennessee General Aviation Airport Inspection Guide: A Guide for General Aviation Airport Managers". https://www.tn.gov/content/dam/tn/tdot/aeronautics/05_Oct_18_TDOT_Aero_Div_Airport_Inspection_Guide_Signed_Final_v2_Secured.pdf

TERMINAL BUILDINGS

Terminal buildings are essential as they facilitate access to air travel for passengers and pilots while also serving as a potential revenue generating facility through vendor leases. Terminal buildings also provide services that may attract users, including restaurant and vending options, pilot lounges, passenger lounges, restrooms, and Wi-Fi. Aging terminal infrastructure and terminals which are inadequate to serve increased demands may become costly investments as overstretched and aging facilities may require more maintenance and upkeep to an airport. New terminal buildings or rehabilitation of existing buildings were reported as needs by 23 airport managers, signaling a significant need for these facilities across the system. However, terminal development at commercial service airports will be impacted by COVID-19 until passenger levels fully recover.

Impacts of the Issue

Due to projected trends in aviation activity and population at the national and state levels, Tennessee is anticipated to experience increasing air travel demands which will impact the facilities and services currently provided at airports. As some of the top issues among airport manager's concerns, airport infrastructure needs are a high priority and will require significant capital investment to support increased aviation activity across the state.

Related Issues:

Infrastructure Needs

The Infrastructure Needs issue relates to several other issues including Population Growth, Urban Growth, and Natural Disasters. In concert with impacting air travel demands, population growth can negatively impact the airports through encroachment of sprawl and urban development. Disappearing developable land can constrain the airports from growing and expanding infrastructure to meet current and future user demands. Encroaching development nearby an airport can deteriorate community support of an airport due to noise and dust generation, among other factors. Finally, the occurrence of natural disasters can exacerbate existing infrastructure needs similar to what was experienced with the tornado at John C. Tune (JWN).

What's Next

Airport infrastructure development is critical to the growth of airports and their ability to accommodate existing and future user demands. Airside, landside, and other airport services will need to be examined to identify gaps between demand and existing facilities, duplication of services, and opportunities for new market growth. Additional studies are warranted to determine if TDOT Aeronautics Division can provide further support to system airports to meet infrastructure needs across the state.

Natural Disasters

Scope: National

Related Goals:

Goal #1 *Goal #2* *Goal #3*

Introduction and Existing Conditions

On March 3, 2020, a tornado generating up to 175 mile per hour (MPH) winds hit Putnam, Davidson, and Wilson counties leaving two dozen dead, 45,000 residents without power, and hundreds of buildings destroyed in its wake. The tornado was responsible for an estimated $93 million in damages at John C. Tune (JWN) and the destruction of 90 aircraft and other personal property.[53] This illustrates a salient fact about the roles of airports in natural disasters: while they can be important staging grounds for emergency relief during and after a natural disaster, they also can be impacted themselves by the same type of event.

AIRPORTS PROVIDING EMERGENCY AID

While airports can be vulnerable to natural disasters, they can also provide the necessary infrastructure for emergency response operations in the state. Airports were an integral part of emergency response and recovery operations during some of the most destructive natural disasters. After Hurricane Florence, a Category 4 hurricane that caused catastrophic damage in the Carolinas in September 2018, McGhee Tyson (TYS) in a joint force effort with McGhee Tyson Air National Guard Base and the Army Aviation Support Facility (AASF#2), provided a staging ground for emergency relief. The airport's location in East Tennessee and access to resources made it an ideal staging ground for crews conducting search and rescue missions.[54] In addition to search and rescue efforts, airports can also be the staging ground for other aviation-reliant relief efforts such as delivery of necessary supplies to impacted areas.

AIRPORTS IMPACTED BY NATURAL DISASTERS

The Tennessee Emergency Management Agency (TEMA) maintains the state hazard mitigation plan (HMP) which documents the 13 greatest hazards and threats that pose risks to residents and property. Eight of the 13 greatest threats to Tennesseans are natural hazards: droughts, earthquakes, extreme temperatures, wildfires, floods, geologic hazards, severe weather, and tornados. TEMA is given the ability through state law and governor's authority to respond and protect the public in the event any of the 13 threats should occur.[55] According to the 2018 HMP, Tennessee is projected to see increased occurrences of natural disasters such as tornadoes, severe weather, geological events (sinkholes, landslides, etc.), and flooding which pose the highest threat to damaging airport infrastructure and disrupting airport operations. Airports near

---

[53] Bowles, Jake. NewsChannel5. "Tornado Causes $93M Worth of Damage at John C. Tune Airport". https://www.newschannel5.com/news/hangars-and-planes-damaged-power-lines-down-at-john-c-tune-airport

[54] https://www.dvidshub.net/news/292899/mcghee-tyson-ang-base-staging-area-units-responding-hurricane-florence

[55] Tennessee Department of Military: Tennessee Emergency Management Agency. "*State of Tennessee: Standard State Hazard Mitigation Plan*". https://www.tn.gov/content/dam/tn/tema/documents/hazard-mitigation-plan/Tennessee%20Hazard%20Mitigation%20Plan%202018%20FINAL.pdf

geologic features may be more susceptible to natural disasters. For instance, General DeWitt Spain (M01) reported a top concern is:

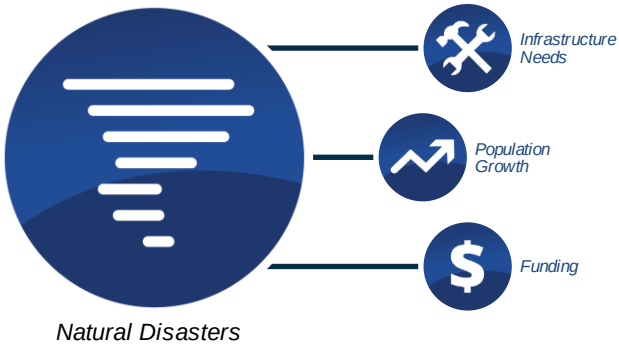
> *"location of airport adjacent to river poses continuous issues and threat of impact to operations at airport [and] flood protection."*

Similarly, Johnson County (6A4) indicated weather negatively impacts their airport "with the intense weather conditions here in the mountains, long term tie-down storage is not an option," calling for a need to develop hangar spaces to protect airport users' aircraft.

Impacts of the Issue

All airports in the system have the potential to be adversely impacted by a natural disaster as well as provide aid to affected communities and airports during the post-recovery phase of an emergency event. Currently, 52 airports have an adopted emergency response plan indicating more than a quarter of system airports are without a plan that could increase safety, mitigate damage, and increase effectiveness of post-disaster recovery efforts. A key action to maintaining Tennessee airports' emergency response capabilities following the wake of natural disasters is to develop emergency response or management plans. These plans can assist the airports in emergency preparation, vulnerability analyses, and action items in the event an emergency damages the airport. Emergency response plans thus mitigate the impacts of natural disasters through effective planning and management.

Related Issues:



The Natural Disasters issue relates to a few other issues such as Infrastructure Needs, Population Growth, and Funding. The effects of a natural disaster increase with growing population levels and increased threats of loss of life or injury. Further, natural disasters may cause widespread property damage, leading to increased or worsening infrastructure needs that may redirect funding away from other projects or may mean that infrastructure needs are not met.

What's Next

Emergency response plans may be considered a planning project which is eligible for state funding under Tennessee's ACIP program to help alleviate the costs of such plans from being completely shouldered at the local level.[56] Tennessee airports can access a slew of resources to assist in the development and maintenance of their own emergency management plans provided by the FAA, ACRP, and other organizations. The FAA created Advisory Circular (AC) 150/5200-31C, *Airport Emergency Plan*, for the development and adoption of effective airport emergency plans (AEPs) by airports. The AC gives guidelines on the content included in AEPs with specific sections dedicated to natural disaster hazards and how airports can assess, plan, and allocate task forces for pre- and post-emergency actions. *ACRP Synthesis 60: Airport Emergency Post-Event Recovery Practices* communicates the indispensable need for airports

[56] It is important to note that although emergency response plans may be eligible for state funding under the ACIP, a submission does not result in immediate approval. Airports typically submit more projects than funding is available to be granted.

to plan for disaster recovery and historic responses and actions by airports to different emergency events. The report also provides airports with additional resources such as Federal Emergency Management Agency's (FEMA's) National Incident Management System (NIMS) and Incident Command System (ICS) which are considered to be comprehensive toolkits airport operators can use to form the foundation of emergency management plans.

Pandemics

Scope: Global

Related Goals:

Introduction and Existing Conditions

In early 2020, COVID-19 emerged on a global scale, quickly moving to the United States and impacting the economy and air travel both domestically and internationally. In recent years, outbreaks of swine influenza H1N1 and avian influenza H5N1, severe acute respiratory syndrome (SARS), and Ebola in foreign countries have caused concern that control methods are not sufficient to prevent an outbreak in the U.S. Public fear and panic over the COVID-19 pandemic has and will continue to have an impact on the aviation industry for years to come.

During times of pandemics, governments and public health organizations typically employ travel restrictions and social distancing measures to slow person-to-person transmission of diseases resulting in significant reduction of travel and travel-related revenues in the aviation industry. The 2003 SARS outbreak shook the global economy with an estimated $33 billion in losses and North American airlines estimating a loss of $1 billion in revenue from a 3.7 percent decline in international travel.

In comparison and based on predictions as of March 2020, the COVID-19 pandemic is setting unprecedented losses in global airline revenues and passenger traffic with analysts predicting a 200 percent loss in earnings for Delta Air Lines' first quarter and an estimated $1.8 billion in lost profits.[57] American Airlines reported a $2.2 billion loss in revenue for their first quarter 2020 and projected even greater next quarter losses which aligns with loss predictions by other airlines. Travel demand has dropped up to 97 percent amidst pandemic measures to contain COVID-19 spread and has forced airlines to cut capacity up to 90 percent to maintain minimal operations.[58] Some major U.S. airports have made decisions to close entire concourses, gates, and runways to cut back on operating expenses as states mandate stay-at-home/shelter-in-place orders, closed non-essential businesses, and warn against non-essential travel.

Under the Coronavirus Aid, Relief, and Economic Security (CARES) Act Airport Grant Program, $10 billion was allocated to support continued operations at all commercial, reliever, and some GA airports resulting in thousands of saved workers' jobs despite falling revenues across the industry. The CARES Act also makes critical changes to Airport Improvement Program (AIP) grants awarded to airports in fiscal year (FY) 2020, relieving them from providing local match contributions and allowing projects to continue regardless of financial hardships due to the pandemic.

---

[57] Isidore, Chris. CNN. "How Bad is the Airline Crisis? We're About to Find Out".
[58] Ibid, 13

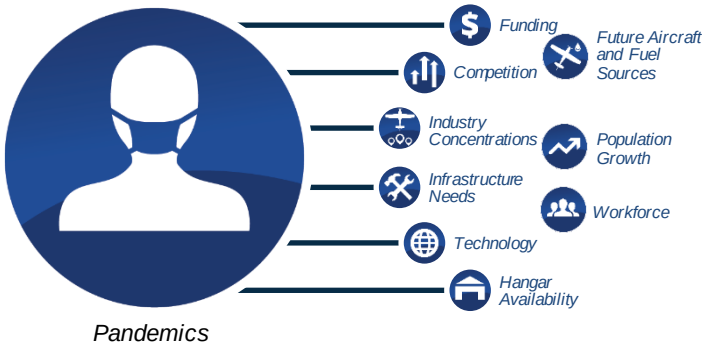
Impacts of the Issue

The depth of impact and timelines for operations to return to normal levels after the COVID-19 pandemic wanes are currently unknown. Optimistic outlooks anticipate COVID-19 may result in short-term decreases in aviation activity followed by rebounds in equal measure which will minimally impact long-term outcomes.[59] If declines in aviation activity were to continue through the years 2021 and 2022, impacts to the industry may be more severe and likely prolonged, but actual impacts of the pandemic are still yet to be fully determined. During the early days of COVID-19 news, businesses, including airline companies, sent out communications to assuage public fears over sanitation practices and adherence to social distancing guidelines. Although it is too early to evaluate the full depth of these types of communications on traveler behaviors, airlines and airports continue to implement additional safety measures such as "fogging" air cabins with disinfectant before physical sanitation practices and requiring masks to ease travelers' concerns.

It is important to note the significant negative impact to Tennessee's tourism industry as a result of the global novel coronavirus (COVID-19) pandemic. To gauge the impacts of the pandemic on the state's tourism industry, TDTD compiled their findings in the "Tennessee COVID-19 Research & Insights". The publication reported Tennessee has experienced a loss of $214.9 billion in travel spending which is a negative 81 percent net change compared to 2019, through the end of May 2020. Although survey results presented in the report indicate traveler attitudes are open to visiting the state in the fall and arrival numbers have increased week over week, the total effects of the pandemic on the state's economy are yet to be calculated.

The Pandemics issue relates to nearly all of the other issues: Funding, Competition, Industry Concentrations, Infrastructure Needs, Technology, Hangar Availability, Future Aircraft and Fuel Sources, Population Growth, and Workforce, especially as it relates to revenue generation and overall aviation activity. The ripple effects of COVID-19 has permeated through all levels of aviation activity as well as ancillary markets reliant on aviation and travel. Due to falling levels of air travel demand and overall aviation activity, revenue generation has been hit hard by the pandemic and decreased already limited pools of funding resources for the airports.

Related Issues:



What's Next

Local and national COVID-19 control measures warning against non-essential travel are still in place. Full determinations of how continued declines in air travel will impact the industry overall are yet to be determined as timelines for lifting control measures are still widely unknown and vary by locale. As states begin to incrementally ease travel restrictions and stay-at-home/shelter-in-place orders, airports have seen some returns to air passenger traffic, but they are still down by half nationwide. Travelers will continue to demand the aviation industry implement additional sanitary practices until COVID-19 is considered to be under

[59] Ibid

control. Until then, airport operators and airlines may continue to enact proactive protocols to mitigate increased virus exposures such as those published in *ACRP Report 91: Infectious Disease Mitigation in Airports and on Aircraft* offering best practice recommendations to decrease the transmission of infectious diseases.

Population Growth

Scope: Statewide

Related Goals:

Goal #2 Goal #4 Goal #5

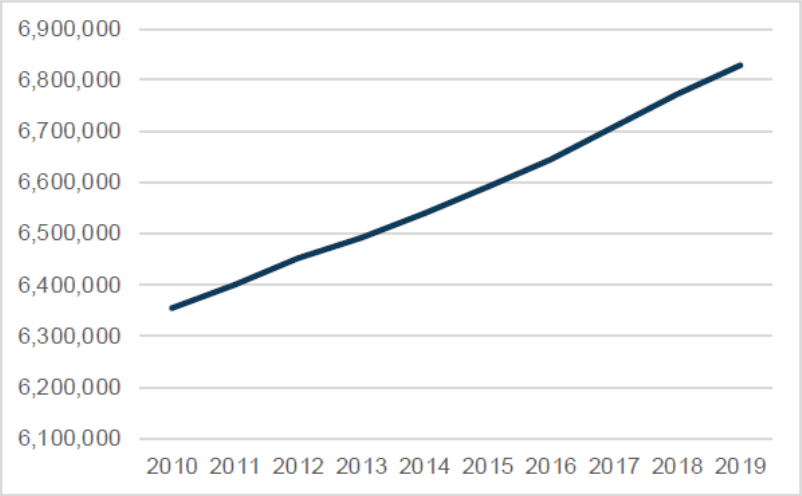
Introduction and Existing Conditions

Population is one of the primary indicators of aviation demand for both GA and commercial service airports. Operational pressures can be particularly acute when population growth is coupled with expanding commercial industries reliant on aviation. To meet growing demand, U.S. carriers are anticipated to increase capacity through additional routes and frequency as well as increase the number of seats per flight, either through up-gauging or reconfiguring existing aircraft.[60] COVID-19 may have an effect on the impact of population growth if people decide to relocate to smaller communities rather than continue to concentrate in larger cities. This impact is yet unknown.

The U.S. population has increased 6.3 percent to 319.5 million people since 2010 and is anticipated to continue rising to 380.2 million people by 2040.[61] During this same historical time period, Tennessee's population outpaced national growth at 7.6 percent, growing from 6.3 million in 2010 to 6.8 million in 2019, as shown in ***Figure 1***. Additionally, cities in Tennessee have experienced some of the fastest population growth in the nation. Nashville-Davidson County ranked as the 24th most populous city in the nation while the following four cities earned a spot amongst the fastest growing cities across the state:

- Murfreesboro
- Clarksville
- Nashville
- Gallatin

Figure 1: Tennessee Population Growth, 2010-2019

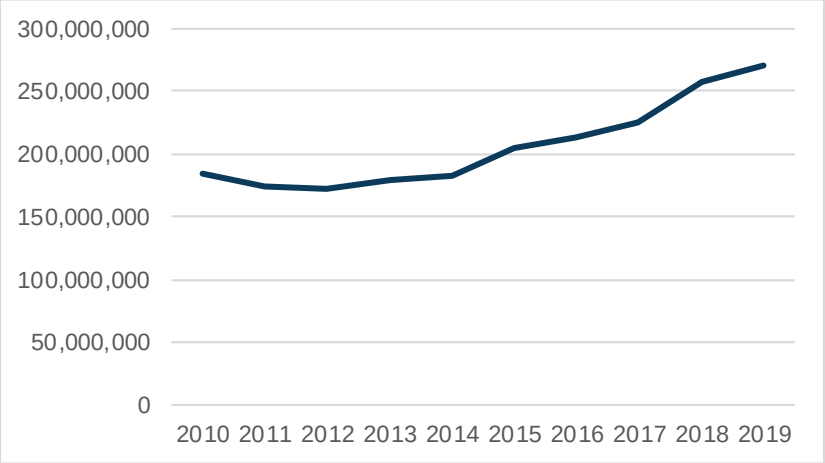


Source: U.S. Census, 2020

[60] *FAA Aerospace Forecasts 2019-2039*
[61] U.S. Census Bureau. "Last Census Population Estimates of the Decade Preview 2020 Census Count". https://www.census.gov/library/stories/2020/04/nations-population-growth-slowed-this-decade.html#:~:text=Since%20the%202010%20Census%2C%20the%20population%20has%20increased%20by%2019.5,97%25%20the%20previous%20decade.

Since 2010 the aviation industry has seen an increase in enplanements at the national level. Enplanement activity in the U.S. has risen to over 900 million passengers since 2010, representing 26 percent growth, while projections predict this trend to remain relatively robust through 2040.[62]

Figure 2: Tennessee Enplanement Growth 2010-2019



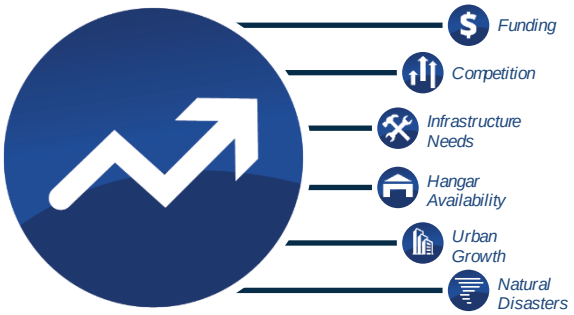
Source: FAA Enplanement Data, CY 2010 - 2019

Since 2010, Tennessee's enplanements have seen tremendous growth showing a 47 percent increase from 2010 numbers to total more than 270 million enplanements in 2019.[63] As one of the fastest growing metropolitan areas in the U.S., Nashville International (BNA) experienced over 100 percent growth from 2010 with enplanements totaling almost 9 million alone in 2019.

Impacts of the Issue

Rising air travel demands are being driven by passengers from all income levels. The U.S. is anticipated to see a continued rise in enplanement activity as the population swells which is expected to be reflected in Tennessee's patterns of future enplanement growth. As one of the fastest growing regions in the U.S. Tennessee must position itself to meet these growing demands through airport infrastructure development and expansion of services to meet user needs. Airports unable to properly accommodate demand may be met with congestion, delays, and overtaxed facilities which represent significant costs to the airport and lost economic opportunity and impact.

Related Issues:



Population Growth

The Population Growth issue relates to many other issues including Funding, Competition, Infrastructure Needs, Hangar Availability, Urban Growth, and Natural Disasters. Airports may need to expand in response to growing aviation demands as the population increases in Tennessee, potentially leading to funding conflicts, competition, and increased infrastructure needs. New airport users in

[62] It is important to note, these projections do not take into account the impact of the COVID-19 pandemic as the industry continues to determine how long the impacts will last and how it will influence overall aviation activity in the future.

[63] FAA Air Carrier Activity Information System (ACAIS), CY 2018 Passenger Boarding Data. https://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/passenger/media/cy18-all-enplanements.pdf

Tennessee may open new markets of aviation and may spur the need to address issues like technology, industry concentrations, and future aircraft and fuel sources.

What's Next

Forecasts of aviation demand indicators such as enplanements, annual operations, and based aircraft inform the levels and types of aviation activity projected to occur across the state. Aviation forecasts utilize population shifts at the state and regional level, national aviation industry trends, and other factors to determine trends that will uniquely influence the future of Tennessee's aviation system. In doing so, TDOT Aeronautics Division can use forecasts to shape future policies, studies, and project and funding prioritization to bridge the gap between the existing system and future aviation needs.

Promotion and Marketing

Scope: Statewide

Related Goals:

Goal #3 *Goal #5*

Introduction and Existing Conditions

One of the ways airports can attract users is through the promotion and marketing of their facilities. Airports market themselves in a variety of ways, whether through industry outreach, word-of-mouth, or print and internet advertisement. Many of Tennessee's airports also brand themselves in a particular way in order to attract particular users. Users typically choose airports that are geographically closest to them, but through promotion and marketing airports can capture new users or users who are looking for a particular experience. In terms of growing the overall use of Tennessee's airports, it is important to market aviation facilities as a way to attract additional visitors.

In discussing how they attract new users and retain existing users, airport managers revealed a variety of ways they market their facilities. Many airport managers stressed that having up-to-date facilities, good and friendly service, and connections with the nearby community helps sustain use of their airport. For instance, the Johnson County Airport (6A4) manager stressed the role the airport plays in the community and how the community in turn supports the airport:

> *" [The airport] constantly strive[s] to open this valuable local resource to the community with fly-ins, car shows, weddings, memorials, birthday parties, award ceremonies, school tours, kids fly days (every chance we get)."*

By engaging with the community through educational outreach, participation in local city and county groups, and different forms of media, including television and radio, print ads, and social media, airports can increase exposure and potential future use of the airport.

EDUCATIONAL OUTREACH

Airports engage in two types of educational outreach: outreach events that increase awareness of the airport in the community, such as fly-ins, and educational outreach to schools to encourage students to pursue a career in aviation. With regards to outreach events, 52 airports, or 66 percent, reported hosting an annual air show or fly-in, also serving as educational outreach for the airport. These types of activities and programs serve a crucial role in not only providing additional benefit to Tennessee's communities, but assisting airports with promotion and marketing.

With regards to educational events, 43 airports, or 55 percent, reported having educational programs that are affiliated with local elementary/secondary schools, community colleges, or technical/vocational schools. Across these 43 airports in 2019, over 4,200 STEM students were presented to airports across Tennessee. Educational outreach is important to increase awareness of an airport's benefit to a community, especially for smaller airports, and to increase the aviation workforce.

PARTICIPATION IN LOCAL CITY AND COUNTY GROUPS

Participation in a local chamber of commerce or other economic development group can be an important way an airport stays involved in its community. In addition to promoting the economic

benefits of an airport in a community through this participation, airports can also become more familiar to community leaders. Forty-two airports, or 54 percent, reported having an active development partnership with chambers of commerce, tourism bureaus, service organizations, industries, governments, military officials, and recreational user groups. Several airports also stated that their involvement in the local chamber of commerce or other economic development organization directly benefited that organization. Ten airports stated that their chamber of commerce helps promote the airport and uses the airport to attract new businesses, with one airport stating:

> *"The airport works with the Chamber to attract business to the area. The Chamber relies on the airport to show services available."*

By participating in local city and county groups such as chambers of commerce, airports can forge mutually beneficial relationships.

MEDIA ADVERTISEMENT

Airports also directly market their facilities through a variety of different types of media. The most common type of media advertisement was use of the internet, with 43 airports, or 55 percent, stating that they use the internet for advertising. Of these respondents, many said they kept an active presence on AirNav or had a social media page, such as Facebook, in order to advertise. Airports reported advertising through other types of media, as shown in ***Table 8***:

Table 8: Airport Advertising

Type of Media	Percentage of Airports
Airport directories	50%
Radio	33%
Television	18%
Newspaper	15%
Billboards	10%
Magazines	9%

Source: TASP Inventory Data Survey, 2019

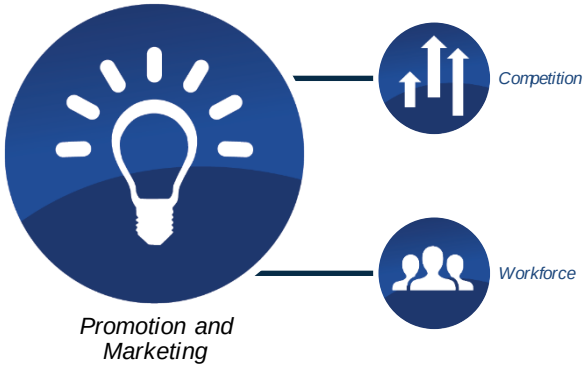
Airports also expressed unique ways they advertise, such as giveaways, participation in aviation events, and hosting contests.

Most airports only used a few types of media to advertise, and two airports reported no advertisement whatsoever. In circumstances where funding is an issue, many forms of advertisement such as the internet, participation in events, and airport directories, are free. Airports who lack sufficient advertising, even forms of advertising that are free, may be losing current or potential users to other airports, whether in-state or even out-of-state, who are more consistent with messaging about the benefits and amenities of their airport.

Impacts of the Issue

Lack of funding is an issue that every airport in Tennessee is aware of. While capital improvement and maintenance projects can have a considerable cost, it oftentimes does not cost anything or very little to engage in promotional activities such as educational outreach, participation in educational programs, or many types of media advertisement such as social media. Many of Tennessee's airports could benefit from increased use of their facilities that may result from such promotion and marketing.

Related Issues:



The Promotion and Marketing issue relates to two other issues: Competition and Workforce. Airports often compete, whether desired or not, with one another for users, and often airports that have the advantage are those who already have high levels of enplanements and operations and are able to promote and market themselves effectively. Similarly, effective promotion and marketing of airports can help attract the workforce necessary to sustain a community's airport and the overall aviation industry.

What's Next

Promotion and marketing of airports continue to be important, especially as funding for capital improvement projects remains tight. Even though airports may not be able to receive funding for major capital development projects, they can still attract and retain users through the previously mentioned methods. Currently, the state does not offer funding for promotion and marketing activities. However, the state as a whole, through the TASP and through its participation in industry events, also helps promote the state's airports. Individual airport brochures are being developed as part of the TASP and Economic Impact Study, which highlight each airport's individual economic impact. Airports can use these brochures as part of their overall public engagement effort and as a way to market themselves to their local communities, demonstrating the economic impact the airport has on the region and the state.

Technology

Scope: Global

Related Goals:

Goal #2 *Goal #3*

Introduction and Existing Conditions

Technological advancements in aviation serve to meet the evolving needs of the aviation industry. However, incorporating technological changes in a safe and secure manner, while meeting user demands, remains a challenge. Early adapters of technology may want to forge ahead with new devices, facilities, or processes, while airport sponsors and governments need to develop and adopt regulations addressing the new technology in order to protect people on the ground and in the air.

There are two technological advancements most commonly discussed by Tennessee's aviation system stakeholders: unmanned aircraft systems (UAS) and NextGen. UAS applications across multiple sectors of the global economy have spurred continued popularization of this technology despite calls for increased monitoring, tracking, and safety measures in the face of recent incidents where UAS have posed costly threats to aircraft operations at airports. NextGen will encourage improved safety and efficiency of aircraft movement but may place a strain on an already overwhelmed infrastructure at Tennessee's airports.

UNMANNED AIRCRAFT SYSTEMS (UAS)

UAS is the term for the control systems which govern the use of unmanned aircraft vehicles (UAV), most commonly referred to as drones. UAS can be utilized for a wide range of tasks such as aerial spraying for agriculture, monitoring environmentally sensitive areas, to providing visual feedback to emergency response crews or conducting military operations. UAS can also include urban air mobility (UAM), which is urban air transportation as part of a municipality's public transportation system. Currently, TDOT Aeronautics Division utilizes UAS to aid in data collection efforts for licensing inspections and have found success in obtaining more accurate Part 77 surface analyses for the airports as well as monitoring ongoing airport construction projects.[64,65]

The FAA has established policies and guidelines to facilitate the safe usage of UAS as popularity and application continue to rise. Generally, UAS operations are permitted within uncontrolled airspace; special permission must be granted by the FAA to commercial operators to use UAS within controlled airspace. According to guidance provided by TDOT Aeronautics Division, operators are supposed to notify an airport before commencing operations. Although the airport cannot deny UAS from operating on the airport, they are able to stop specific users if they are operating carelessly or recklessly.[66] Tennessee's airport managers reported varying levels of UAS activity near their airports, and also reported varying levels of support of such

---

[64] https://www.tn.gov/content/dam/tn/tdot/aeronautics/Frazier_and_Briggs_Presentation_2017.pdf
[65] https://www.tn.gov/content/dam/tn/tdot/aeronautics/05_Oct_18_TDOT_Aero_Div_Airport_Inspection_Guide_Signed_Final_v2_Secured.pdf
[66] TDOT Aeronautics Division. UAS Airport Operators Guide. https://www.tn.gov/tdot/aeronautics/unmanned-aircraft-systems--uas--drones/information-for-airport-operators.html

activity, as shown in ***Table 9***. Overall, airport managers are generally favorable of UAS activity, with 71 percent supporting or not opposed to UAS activity. The Rockwood Municipal Airport (RKW) had a UAS operator conducting aerial inspections the same day as the TASP site visit and stated that he found such usage beneficial to assist with infrastructure upkeep at a reasonable cost.

Table 9: UAS Activity

UAS On or Near Airport Property	Percentage of Airports
Yes, and airport supports activity	31%
Yes, but airport does not support activity	6%
No, but airport is not opposed to activity	40%
No, and airport prohibits activity	22%

Source: TASP Inventory Data Survey, 2019

NEXTGEN

The Next Generation Air Transportation System (NextGen) is an FAA-led initiative to modernize and improve the interconnected systems used to safely identify, navigate, and communicate among users within the NAS. NextGen efforts encompass the implementation and adoption of several cutting-edge technologies such as a satellite-enabled navigation system and a new digital communications system to provide more detailed information about aircraft movement and further minimize the margins of error between aircraft and air traffic controllers.

The FAA has implemented a phased approach to implement NextGen technologies and practices throughout the entire United States through 2030. FAA's NextGen implementation plan monitors the progress of four critical key infrastructure programs important to improving the NAS. These four programs identify the different target users, capabilities, and benefits of each key infrastructure. Additionally, the implementation plan covers 11 portfolios which assess different aspects of NextGen capabilities and communicates the intended users, uses, and potential implementation timelines.

One NextGen technology that will be impacting Tennessee's commercial service airports in the coming years is Terminal Flight Data Manager (TFDM) which is the surface management solution for NextGen. TFDM will alleviate congestion at commercial service airports by making ground aircraft traffic planning more efficient.[67] TFDM capabilities will be implemented incrementally to a subset of NAS Air Traffic Control Towers (ATCTs). Three of Tennessee's airports are projected to receive TFDM capabilities in the coming years, including Nashville International (BNA) in February 2025, Memphis International (MEM) in October 2025, and McGhee Tyson (TYS) in August 2027.[68,69]

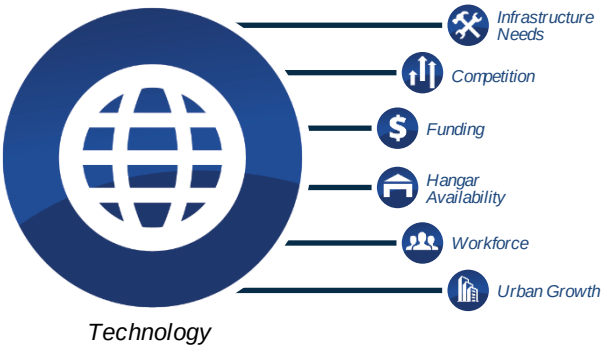
[67] https://www.faa.gov/air_traffic/technology/tfdm/
[68] https://www.faa.gov/air_traffic/technology/tfdm/implementation/
[69] The FAA clarified that these dates are as of March 1, 2020, prior to the COVID-19 pandemic. These dates will be updated once the impact of COVID-19 has been fully assessed.

Impacts of the Issue

The popularity of UAS usage has caused some concerns about monitoring activity near airports and in controlled airspace as collisions between UAS with aircraft cause harm and potential loss of life. While the FAA offers guidance to drone operators regarding airspace restrictions near airports, many of Tennessee's airport managers, even those who support UAS activity, have concerns about their usage near airports.[70] For instance, 17 airports indicated they have a formal program for receiving, managing, and responding to on- or near-airport UAS use requests at their airport, but 11 of these formal programs involve simply notifying the airport through an online form or phone call. These programs do not involve vetting the operations for safety or legal use. A majority of system airports do not have a program in place that assists in maintaining the airspace around their airports free from incursions with UAS.

NextGen adoption is anticipated to address congestion in the air, significantly reduce miscommunication, and increase overall safety. As NextGen is actualized in Tennessee, system airports may experience growth in aircraft operations as flight efficiencies are increased. Additional aircraft operations may impact current airfield, terminal, and other facility capacities, causing strains to infrastructure already experiencing congestion or facility constraints. Airports whose operations begin to approach 60 percent of their operational annual service volume (ASV), or annual number of operations the airport can reasonably support, may experience aircraft delays which are estimated to cost the aviation industry billions of dollars annually[71]. Aircraft delays may drive demand for additional gates, apron space, runways, and/or taxiways to accommodate additional aircraft operations that are costly to develop.

Related Issues:



The Technology issue relates to several other issues including Infrastructure Needs, Competition, Funding, Hangar Availability, Workforce, and Urban Growth. Funding and competition issues impact the implementation of projects needed to develop NextGen capabilities or other technologies, prioritizing limited funding between airports with greatest needs. These issues will become more acute as increased operations from NextGen implementation and growing UAS ownership impact the types of airport developments needed to accommodate these changes. Correlated issues such as infrastructure needs, hangar availability, workforce, and urban growth will be exacerbated as airports develop to meet changing demand stemming from new technologies.

What's Next

Continued popularity and new prospects for UAS can begin to impact the aviation community by increasing collision risks between drones and aircraft. Tennessee airports and TDOT should work to develop additional controls or monitoring systems to mitigate these risks in the face of

---

[70] Federal Aviation Administration, "Flying Near Airports". https://www.faa.gov/uas/recreational_fliers/where_can_i_fly/airspace_restrictions/flying_near_airports/

[71] Jones, Tammy; Takemoto, Paul. Federal Aviation Administration, "Fact Sheet – Inclement Weather". https://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=23074

rising UAS/UAV usage. TDOT Aeronautics Division provides UAS owners and operators information regarding the safe usage of UAS, when UAS operators should contact airport operators, and maintains a checklist for airport operators to use to begin tracking UAS use requests within five miles from their facilities. Although obtaining permission to operate UAS near airports is not required, doing so can increase the safety of airport users and UAS operators alike.

NextGen implementation relies on collaborative efforts between the aviation community and the FAA. As the FAA continues to implement the program, Tennessee airports are encouraged to adopt NextGen practices and infrastructure at their airports to accelerate the process. Airports will need to work in concert with TDOT Aeronautics Division to determine what key infrastructure and equipment are needed and assess funding priorities to bring these capabilities to their facilities. For airports in which NextGen implementation may result in aircraft delays due to increases in operational efficiency, these airports will need to plan for the development of additional airfield facilities to accommodate growing demand.

Urban Growth

Scope: Statewide

Related Goals:

Introduction and Existing Conditions

Overall, Tennessee's population is projected to see a 19 percent increase over the next 20 years, particularly in urban regions. As a natural result, increased urban development is anticipated to take place to adequately serve the needs of a growing population which could impact aviation activity and future development capacities of airports in these regions. Airports on the fringe of urban counties may also be impacted by "spillover" activity signaling a need to plan and prepare for changes due to urban growth. As a frequent part of discussion, airport managers of airports surrounding Tennessee's major cities cite urban growth and encroachment as some of the top issues affecting their facilities. COVID-19 may have an effect on the impact of urban growth if people decide to relocate to smaller communities rather than continue to concentrate in larger cities. This impact is yet unknown.

According to the Boyd Center of Business and Economic Research, Tennessee is projected to grow by over 1 million people by 2040 with the majority of growth anticipated to take place in Middle Tennessee.[72] Middle Tennessee counties projected to experience the highest growth rates and their associated system airports are shown in ***Table 10***. Seven airports are located within these fast-growing counties with the highest population growth anticipated to take place in Rutherford County where Murfreesboro Municipal (MBT) and Smyrna (MQY) are located.

Nearby rural counties are slated to see these population trends spillover and account for some of the highest growth percentages compared to their counterparts. ***Table 11*** lists these rural counties and the system airports located within their boundaries. Eight airports are located within the rural counties expected to see spillover growth in population due to their close proximity to fast-growing urban counties. Wilson and Maury counties are projected to experience the highest percent changes in population which could impact the aviation demands at Lebanon Municipal (M54) and Maury County (MOR), respectively.

[72] Boyd Center for Business & Economic Research, University of Tennessee, Knoxville "2018-2070 Tennessee Population Projections",2019. https://tnsdc.utk.edu/estimates-and-projections/boyd-center-population-projections/

Table 10: Urban Counties with Highest Growth Rates in Middle Tennessee, 2018-2040

County	2018 Population	Projected 2040 Population	Percent Change	Airport(s) Located in County
Davidson	692,587	804,488	16.2%	◆ Nashville International (BNA) ◆ John C. Tune (JWN)
Montgomery	205,950	301,785	46.5%	◆ Outlaw Field (CKV)
Rutherford	324,890	505,396	55.6%	◆ Murfreesboro Municipal (MBT) ◆ Smyrna (MQY)
Sumner	187,149	250,450	33.8%	◆ Portland Municipal (1M5) ◆ Music City Executive (XNX)
Williamson	231,729	361,562	56%	No system airports located in this county

Source: Boyd Center for Business & Economic Research, University of Tennessee, Knoxville "2018-2070 Tennessee Population Projections",2019

Table 11: Rural Counties Adjacent to Urban Counties with Highest Growth Rates in Middle Tennessee, 2018-2040

County	2018 Population	Projected 2040 Population	Percent Change	Airport(s) Located in County
Bedford	49,038	61,073	24.5%	◆ Puckett Field (50M) ◆ Bomar Field-Shelbyville Municipal (SYI)
Coffee	55,700	62,275	11.8%	◆ Tullahoma Regional Airport/WM Northern Field (THA)
Dickson	53,446	63,523	18.9%	◆ Dickson Municipal (M02)
Marshall	33,683	39,795	18.1%	◆ Ellington (LUG)
Maury	93,340	123,724	31.1%	◆ Maury County (MRC)
Robertson	71,012	86,494	21.8%	◆ Springfield Robertson County (M91)
Wilson	140,625	205,293	46%	◆ Lebanon Municipal (M54)

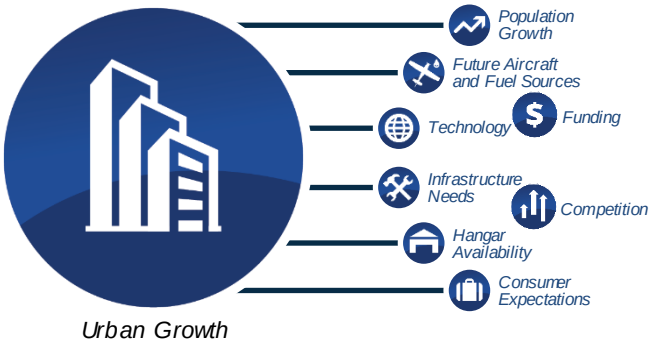
Source: Boyd Center for Business & Economic Research, University of Tennessee, Knoxville "2018-2070 Tennessee Population Projections",2019.

Most airport managers stated excitement over the growth they were seeing at their airport. For instance, the Ellington Airport (LUG) manager stated that the airport is utilized by many "local/regional recreational pilots wanting to avoid the Nashville area," with the Lebanon Municipal Airport (M54) manager further stating that "the airport has…experienced increased corporate/ general aviation traffic in recent years" due to its proximity near Nashville. With this increased growth comes concerns about infrastructure and being able to accommodate increased activity, particularly jets. For instance, the Springfield Robertson County (M91) airport manager stated that they are "[looking] to develop more, [build] corporate hangar areas [and] attract more jet traffic," with the Maury County (MRC) airport manager citing a need for increased "runway strength and length."

Impacts of the Issue

The seven airports located within the fastest growing urban counties may be more susceptible to issues that occur with encroaching development such as noise complaints from nearby communities, development of obstructions, and reduced land availability to maintain control of airport safety areas. Increased urbanization may encroach upon airports and reduce their capacity to develop in accordance with increased aviation demands from a growing population. For airports in spillover counties, growing populations can quickly increase aviation demands especially if urban growth has resulted in limiting urban airports' capacities to develop. Mounting pressure to accommodate spillover demand and new users may become more acute if encroaching urban growth challenges the airports' abilities to do so.

Related Issues:



The Urban Growth issue relates to nearly all issues: Population Growth, Future Aircraft and Fuel Sources, Technology, Infrastructure Needs, Hangar Availability, Consumer Expectations, Funding, and Competition. Future aircraft and fuel sources, technology, infrastructure needs, hangar availability, and consumer expectations drive the types of airport developments identified to support the various user demands across the state and urban growth issues will impact the airports' abilities to implement these projects. Due to constrained land availability, innovative or more expensive project alternatives may be needed to support airport growth and can be influenced by funding and competition issues.

What's Next

Tennessee's projected population growth is anticipated to bring new users and increased aviation demands to the state, most notably in urban counties and surrounding rural counties. Airport land use compatibility practices are helpful tools that can safeguard the airports' capacity to develop in response to growing demands and new markets. Municipalities with the power to enact zoning regulations can influence the development of land surrounding airports to increase the safety of passengers and pilots in the air and persons and property on the ground through the adoption of land use zoning and height controls. Land use zoning and height controls can become important tools to secure appropriate buffer/safety areas around airports, determine compatible land uses for nearby developments, and safeguard the airport's ability to develop in accordance to changing aviation needs.

Workforce

Scope: Region

Related Goals:

Goal #2 *Goal #5*

Introduction and Existing Conditions

Overall, healthy global and U.S. economies have spurred long-term growth in the aviation industry despite short periods of economic decline.[73] Similarly, Tennessee is likely to see healthy growth in aviation demand due to regional increases in aircraft manufacturing, strong domestic and visitor numbers, and anticipated population growth over the next 20 years. Tennessee's aviation industry will rely on attracting, maintaining, and developing more aviation professionals to meet mounting aviation demands despite historic declines in participation and employment of the U.S. labor force over the past 20 years.[74] Additionally, changes to job experience, certification requirements, and specialized training have formed barriers to students and professionals pursuing aviation careers further exacerbating a diminishing pool of qualified professionals.

Declining numbers of aviation professionals critically impacts the growth of the aviation industry now and into the future. The aviation industry relies on a highly educated and specialized workforce including pilots, maintenance technicians, air traffic controllers, and airport managers.

PILOTS

A major concern for the global aviation industry is the growing gap between growing pilot demand and declining number of certified pilots currently and in the coming years. Projections by Boeing anticipate the national U.S. aviation industry will need 117,000 new pilots to accommodate growing air travel demands through 2036 despite over 42 percent, or approximately 22,000 pilots, retiring in the next 10 years. Amplifying this issue, student pilot populations are not growing quickly enough to fill commercial pilot demands. Though there may be additional causes, regulatory changes increasing the number of hours flown before certification, low starting salaries, and high training/educational costs are most commonly cited as disincentives for entry into the industry.

This issue does not take into account the potential impact of COVID-19 on pilot numbers. Airlines may require fewer pilots as operations continue to decline, which may momentarily decrease the number of new pilots that are needed.

The *FAA's Aerospace Forecast Fiscal Year 2020-2040* projects the gap between commercial and air transport pilots (ATP) may be shifting as the number of pilot certificates have grown over the past three years, with private and commercial pilot populations projected to increase 0.6

---

[73] It is important to note, global historic trends do not take into consideration the cumulative impacts of the COVID-19 pandemic. Post-pandemic long-term outlooks for the aviation industry may be adversely impacted, but the effects are still relatively unknown for the future.

[74] Parkinson, Cody. Bureau of Labor Statistics. "Labor Force Participation and Employment Rates Declining for Prime-Age Men and Women". https://www.bls.gov/opub/mlr/2018/beyond-bls/labor-force-participation-and-employment-rates-declining-for-prime-age-men-and-women.htm#:~:text=From%201996%20to%202016%2C%20the,to%2093.4%20percent%20in%202016.&text=Employment%20rates%20for%20women%20fell,same%20period%2C%20to%2079.7%20percent.

percent and 0.1 percent annually over the next 20 years. Although the FAA has currently suspended student pilot forecasts for the third year in a row, data suggests student pilot populations have significantly increased following two regulatory changes in 2010 and 2016. Since 2016, the pilot population has jumped from 128,501 to 197,665 student pilots at the end of 2019. The FAA reports regulatory changes to student pilot certifications are still too new to perform reliable forecasts of student pilot populations into the future.

MAINTENANCE TECHNICIANS

Maintenance technicians maintain the critical components of an aircraft's useful life to ensure the aircraft functions safely and properly for operations. The limited pool of maintenance technicians is shared between the airlines and aircraft maintenance, repair and overhaul (MRO) firms, and other industries (automobile, etc.) increasing the demand for maintenance technicians for the aviation industry. The requirements to become certified require at least 18 months of practical work experience or graduation from an FAA-approved aviation maintenance technician school which requires at least 400 hours of general coursework and 750 hours of related airframe or powerplant technology. Maintenance technicians aiming to receive both airframe and power plant ratings must complete a certified aviation maintenance program or at least 30 months of applicable experience. Factors of educational and work experience requirements along with a limited pool of professionals shared between multiple industries results in an acute need for maintenance technicians to maintain the critical safety of aircraft in the face of rising demand.

AIR TRAFFIC CONTROLLERS

Air traffic control is a highly demanding and complex job necessitating constant focus and technical expertise to safely guide aircraft in the NAS to their final destinations. The pool of future air traffic controllers is extremely limited due to stringent medical and psychological screening, education and work experience requirements, and attrition of professionals due to many factors. Additionally, air traffic controllers must follow a mandatory retirement at the age of 56 years old and also must be 30 years old or younger when applying in order to be eligible. These strict age restrictions may lower interest and dilute the pool of potential candidates who may meet all other eligibility criteria. According to the FAA's "Air Traffic Controller Workforce Plan 2019-2028", an estimated 9,518 air traffic controllers will be lost to promotions and transfers, retirements, academy and developmental attrition, and other factors through fiscal year 2028.[75] The FAA's Aerospace Forecasts indicated potential increases to controller workloads due to forecasted growth in regional and business jets, operation consolidation by air carriers, and fleet mix changes through 2040.[76]

AIRPORT OPERATORS

Maintaining safe operational requirements at each airport facility is dependent upon the types of aviation activities served, the size of the facility, and whether or not the airport must meet the certification requirements to serve air carrier operations. Airport operators are responsible for overseeing the operational, financial, safety, and other facets of managing an airport. *ACRP*

---

[75] Federal Aviation Administration. "Air Traffic Controller Workforce Plan 2019-2028". https://www.faa.gov/air_traffic/publications/controller_staffing/media/2018-ABA-200-CWP_2019_Report_508.pdf

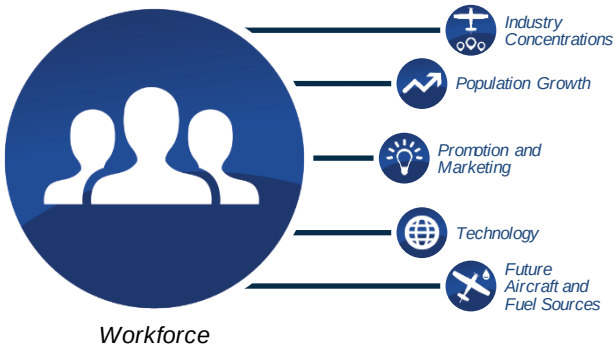
[76] Ibid,16

Report 16: Guidebook for Managing Small Airports provides airport operators industry best practices on managing the airport, serving aviation users, mitigating risks, and enhancing their role as a community liaison. For larger airports providing air carrier operations, airport operators must abide by certification requirements under Title 14 Code of Federal Regulations (CFR), Part 139: *Certification of Airports*.

Impacts of the Issue

Demand on the aviation system is anticipated to grow exponentially in Tennessee and will likely outpace the number of highly qualified and experienced professionals available in the workforce. Despite recent trends in growing certificated and student pilot populations, aviation stakeholders at the federal, state, and local levels must work in a collaborative nature to eliminate barriers for new generations from considering a career in aviation. According to the 2019 Labor and Education Alignment Program (LEAP) In-Demand Occupations Report, nearly 650 Tennesseans received postsecondary educational certificates related to aviation in the past five years highlighting a need to attract and develop more professionals to meet growing demands in the state's aerospace and aviation industries.[77] In FY 2020, TDOT Aeronautics Division awarded nearly $200,000 in grants to schools and organizations which promote student exposure to aviation careers and skill development under its Aviation Education and Outreach Program. Grant awards have been used to purchase equipment such as drones and flight simulation software, create and expand aviation career exploration curriculum at grade schools, and prepare collegiate students for success through increased hands-on experience and FAA-approved program certification.

Related Issues:



The Workforce issue relates to several other issues such as Industry Concentrations, Population Growth, Promotion and Marketing, Technology, and Future Aircraft and Fuel Sources, especially as it relates to the highly specialized workforce required for future airport facility and service development. Industry concentrations, promotion and marketing, and population growth issues drive the state's ability to attract, develop, and retain current and future aviation professionals to Tennessee's robust system. Issues of technology and future aircraft and fuel sources influence the types of skills, training, education, and knowledge required of aviation professionals to support a growing and changing aviation industry.

What's Next

Tennessee system airports can help close the gap between demand and availability of skilled and educated aviation professionals in the field. Currently, 43 airports have some sort of aviation educational program geared towards increasing exposure and opportunities for school-aged students into aviation careers while 11 airports support an airframe and powerplant

[77] Ibid, 16.

program. Supporting an expansion of these programs at system airports can help develop a growing population of new aviation professionals to meet rising demands.