

8. System Alternatives

8.1. Introduction

This chapter provides a planning-level analysis of issues or scenarios that may present themselves during the 2020 SDSASP planning horizon and how they might affect South Dakota’s airport system. Planning for alternative scenarios provides an opportunity for preemptive strategies to be in place should significant changes occur to or within the state’s aviation system. The alternative scenarios in this chapter are presented through “what if/could we” statements that first pose the hypothetical scenario then offer an action that could be undertaken by the South Dakota Department of Transportation Office of Aeronautics Services (SDDOT) to prepare for the change. There are six “what if/could we” statements, divided into two categories:

- 8.2 Operational Alternatives
- 8.3 Innovative Alternatives

The alternative scenarios highlighted in each section capture state-specific issues or trends that have the potential to occur over the next 20-year planning period.

8.2. Operational Alternatives

The South Dakota aviation system is made up of a diverse collection of airports, ranging from busy commercial service airports like Sioux Falls Regional Airport, to large, medium and small general aviation (GA) airports that support a variety of crucial activities, such as emergency medical transportation, aerial firefighting, and business aviation. The diversity of operations that South Dakota airports support makes the system susceptible to a variety of outside influences that impact the way system airports and users operate. The following scenarios present operational trends that may impact South Dakota aviation over the 20-year planning horizon, including changes in the national GA fleet, a shift in regional air carrier operations, and a reduction in the pilot population and other key aviation positions. Each one of these changes are occurring, or are expected to occur, at a national scale and have a great potential to change the aviation landscape within South Dakota.

8.2.1. *Changes in the GA Fleet*

An airport’s airfield design determines the type of operations an airport can support. Characteristics such as runway length, width, and strength and the presence of navigational aids determine the type of aircraft that can and will use an airport. For example, airports with shorter runways can be used by smaller, single-engine piston aircraft, whereas airports with longer, wider, and stronger runways and enhanced navigational aids are likely to be used by larger, multi-engine piston aircraft and turbine aircraft such as business jets. Understanding the needs of the aircraft fleet operating in the state is critically important as airports, SDDOT, and the Federal Aviation Administration (FAA) plan for future activity.

While single-engine piston aircraft have historically composed the greatest share of the GA fleet for many years, the FAA Aerospace Forecast FY 2019-2039 predicts a gradual but continuous decline in this segment of the GA fleet during the planning horizon. It is estimated that the decline will occur at a rate of approximately one percent annually (compound annual growth rate [CAGR]). While the single-engine piston aircraft are declining, the turbine-powered aircraft fleet (composed of jets and turbo-props) is

expected to grow at a rate of nearly two percent over the planning period. **Table 8-1** shows the FAA’s historical data as well as forecasts for the nation’s single-engine piston and turbine-powered fleet from 2010 to 2039.

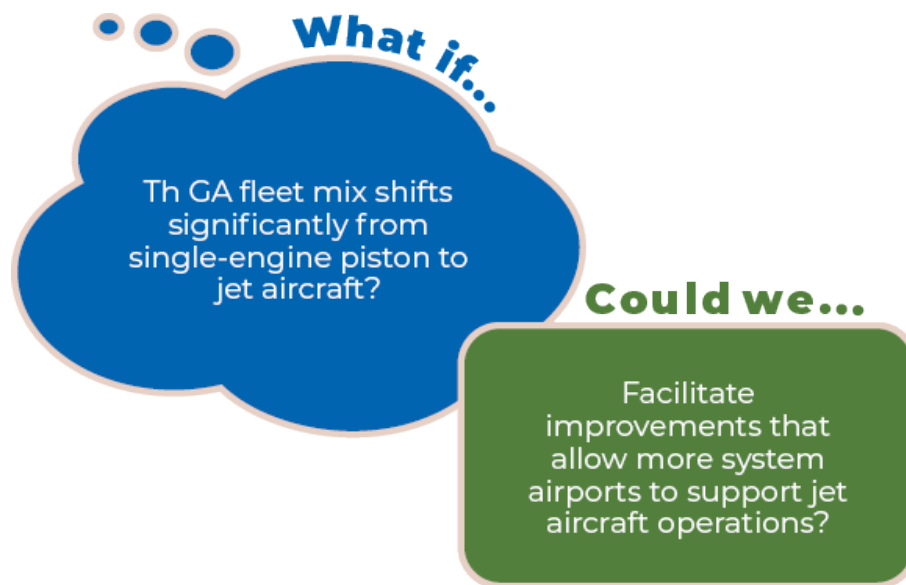
Table 8-1: FAA Aerospace Forecasts for the National Single-Engine Piston and Turbine-Powered Aircraft Fleet

Timeframe	Single-Engine Piston CAGRs	Turbine Powered Aircraft* CAGRs
Historical		
2010-2018	-0.9%	2.0%
2018-2019	-0.5%	1.6%
Forecast		
2019-2029	-1.0%	1.8%
2019-2039	-1.0%	1.8%

Source: FAA Aerospace Forecast, Fiscal Years 2019-2039

*Note: Turbine powered aircraft refers to the cumulative growth of both turbo prop and turbo jet aircraft.

The FAA forecasts, while not guaranteed, do indicate a pattern in a changing fleet that will impact many South Dakota airports, particularly those not prepared to handle an increase in larger and more demanding turbine-powered aircraft traffic. These aircraft require different physical infrastructure as well as services to operate that are not found at every airport in the system. Airports without a minimum runway length of 4,200 (turbo-prop) or 5,000 (jets), Jet A fuel, navigational aids, and approaches will be at a disadvantage as they cannot support significant operations by the typical GA turbine-powered aircraft. Predicting the shift in the GA fleet is important to plan ahead for the necessary changes to airports in the system, and while a change in the fleet has been and will continue to be seen, it is not a change that is going to occur overnight. Many single-engine piston aircraft will continue to operate in South Dakota’s aviation system (including recreational users, agricultural sprayers, and others) and therefore not all airports will require major changes to infrastructure or services over the planning horizon. However, it is important to identify the airports most likely to accommodate the new aircraft entering the system so improvements can be accounted for in a timely manner to continue supporting aviation demand.



To address the changing airport needs to accommodate the changing aircraft fleet, SDDOT first needs to know where jet activity is increasing in the system. Since funding is limited, it is essential that any infrastructure developed to accommodate jet aircraft be made available at the airports supporting the majority of the shift in activity. To increase awareness of this segment of activity, SDDOT could reach out to businesses and industry organizations such as the National Business Aviation Association (NBAA) to learn more about businesses that are purchasing jet aircraft and the airports these aircraft are intended to operate at. Of course, continued communication with airport sponsors will also help in the monitoring of this activity. Letters of support from businesses and airports that need related improvements may help in the justification of such facilities ahead of the activity.

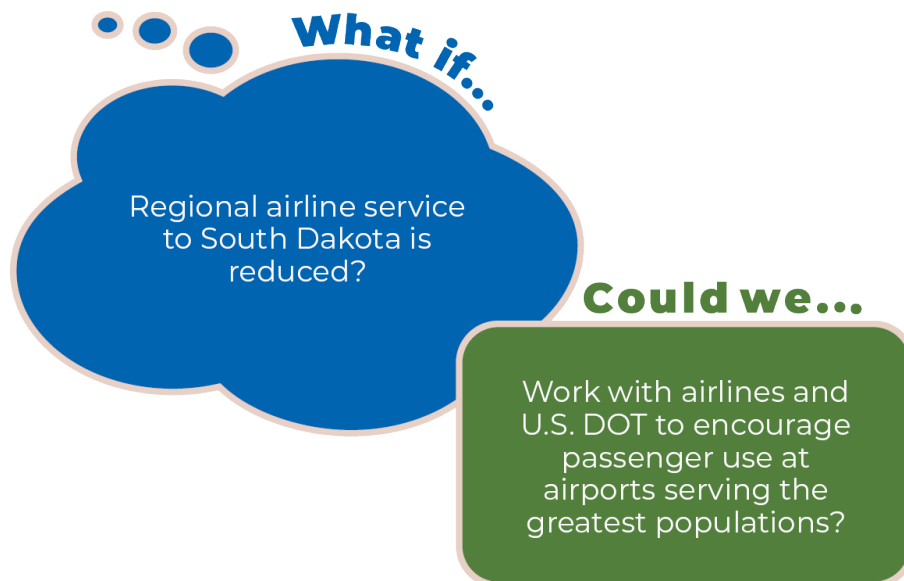
When the location and extent of the jet activity is better known, SDDOT could make proactive funding and/or policy decisions that facilitate improvements at airports expected to handle the more demanding fleet that currently lack the design features necessary to support it. This could be supported through the development of a project priority rating model that considers the likelihood for a changing fleet at airports and assigns a higher priority to those projects. SDDOT could also consider the purchasing of navigational aids (including weather reporting equipment) for system airports with a justified need. The more SDDOT can prepare for the changes to the national fleet, the more attractive and user friendly their aviation system will become, for both public and private entities.

8.2.2. *Reduction in Regional Airline Service*

Commercial airline service is an essential component of South Dakota’s aviation system, accounting for more than 900,000 enplanements in the state annually at the state’s five commercial service airports. However, attracting and maintaining this service has historically been challenging in a state with modest population. Since commercial airlines experience relatively slim profit margins (largely in part due to the high cost associated with maintaining their operations), they are sensitive to market shifts in supply and demand as they try to maximize profits. This can be seen in the reduction of commercial service airports in South Dakota from nine in 1996 to five in 2020. As such, it is important to plan for potential changes in commercial service to make proactive decisions that preserve the best possible airline service and connectivity for residents of and visitors to South Dakota.

There are five commercial service airports in South Dakota that provide airline service to a variety of domestic destinations for South Dakota residents and visitors. Two of the airports (Sioux Falls Regional and Rapid City Regional) offer mainline carrier service, while the remaining three offer service on regional airlines operating under mainline carrier codeshares. An example of this is SkyWest Airlines doing business as Delta to and from Aberdeen Regional Airport. Aberdeen, Watertown, and Pierre rely on government subsidies through the U.S. Department of Transportation's (USDOT) Essential Air Service (EAS) program to maintain their service. While helpful in securing a minimal level of scheduled airline service, the airports are subject to the airlines that have proposed service to their community through this federal program, some of which have been less than reliable.

With such a large presence of regional airline operations in the state, South Dakota is highly susceptible to changes in regional airline activity. As presented in **Chapter 4. Forecast of Aviation Activity and System Demand**, the FAA is predicting a reduction in regional airline activity. In the FAA's Aerospace Forecast FY 2019-2039, regional airline enplanements are predicted to grow at a slower rate compared to mainline carrier enplanements and the U.S. regional carrier fleet is expected to decline at an annual rate of -0.4% over the planning period. Over the last 10 years, regional airlines saw an overall decline in enplanements of -0.6% annually, compared to a 3.5% growth in enplanements annually for mainline carriers. It is important to recognize that other industry trends may be impacting this change, including airline efforts to up-gauge their fleet, offering more seats on fewer flights. This does two things; first, it requires communities to have enough passenger activity to support the larger aircraft being used by regional airlines, and second, it can lower enplanements by offering a fraction of the flight options and times previously offered with smaller aircraft.



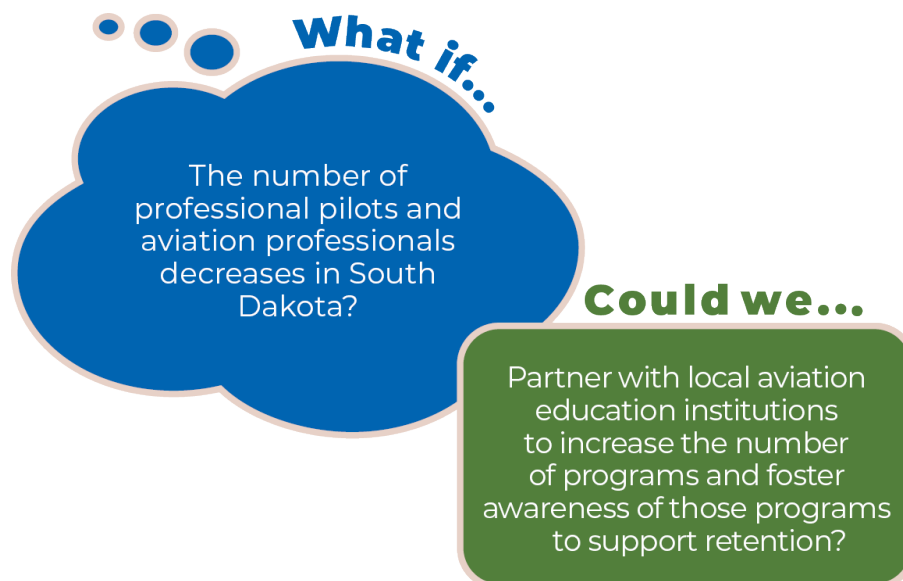
If regional airlines experience any significant reduction in operations over the planning period, airports in South Dakota served by these carriers could be at risk for reduced service or elimination of service altogether. It is expected that mainline carriers will continue to grow and not impact service availability at Sioux Falls Regional Airport or Rapid City Regional Airport. However, airports in Aberdeen, Pierre, and Watertown may be impacted by this shift in activity from regional to mainline carriers, resulting in

potential loss of economic impact, including on-airport jobs (airlines, concessions, rental cars, etc.) and visitor spending.

There are a few strategies that SDDOT could employ to help prepare, protect, and /or prevent a loss of regional service. One option is to initiate a marketing campaign to increase awareness of the service that is available and the requirements to keep service in the smaller markets. Additionally, SDDOT could work with airlines and the U.S. DOT to identify airports serving the greatest populations and encourage the continued offering of air service at those few airports. This strategy would require SDDOT to determine which airports are serving the highest share of statewide population, and consider the likelihood of residents, businesses, and visitors to travel to one location over another. Another option to consider is the development of a state-operated air service program/airline, as seen currently in Wyoming. However, this strategy may be the least likely to be implemented due to the challenges experienced when the state last tried to establish a state-operated airline in the late 1990's. The airline was short-lived, lasting only four months due to the lack of ridership needed to sustain a program as large as intended. Regardless of the solution, it is anticipated that when electric aircraft enter the commercial airline market it could significantly reduce the cost of operation, potentially making air service viable in more locations.

8.2.3. *Shortage of Local Pilots and Aviation Professionals*

As mentioned in **Chapter 4. Forecast of Aviation Activity and System Demand** and **Chapter 5. System Performance** there are growing national concerns that the number of licensed professional pilots and aviation professionals is decreasing at a rate that may make it difficult to meet current and future demand. This shortage is due to a variety of factors, such as the high cost of education, the length of time it takes to become licensed, changes to minimum requirements, and scarcity of programs that offer relevant trainings and licensure opportunities.



South Dakota has a number of successful pilot and aviation professional programs that are contributing to a growing population of local pilots, mechanics, and more. South Dakota State University (SDSU) and Lake Area Technical Institute (LATI) both have professional pilot programs. The SDSU aviation program is a four-year program that prepares students for a career in the aviation industry as a professional pilot

and/or aviation instructor. The SDSU program allows students to specialize in flight instruction and even begin instructing other students by their junior or senior year. This benefits the students and the program by creating a sustainable and self-sufficient source of flight instructors available to the newer students and gives the more advanced students hands-on job experience in their field. LATI offers student opportunities in both professional fixed-wing piloting and aviation maintenance technology certification. LATI's 2018 placement report shows 100 percent of the students who graduated secured positions in their field and 43 percent of those students remained local and are employed in South Dakota's aviation industry.

To help combat a decrease in the number of pilots and aviation professionals located within South Dakota, SDDOT could work with local aviation education institutions to foster awareness not only of available programs but of available aviation employment opportunities in the state post-graduation. Additionally, encouraging the creation of additional South Dakota's promising secondary education programs in aviation point to a positive outlook for the supply of aviation professionals, however, it is important for the new generation of aviation professionals trained in South Dakota to remain in South Dakota to fulfill workforce needs. Encouraging new students to enroll in these programs and to remain in state upon graduation will help bolster the population of aviation professionals in the state who are critical to the function of the aviation system and continued aviation activity.

8.3. Innovative Alternatives

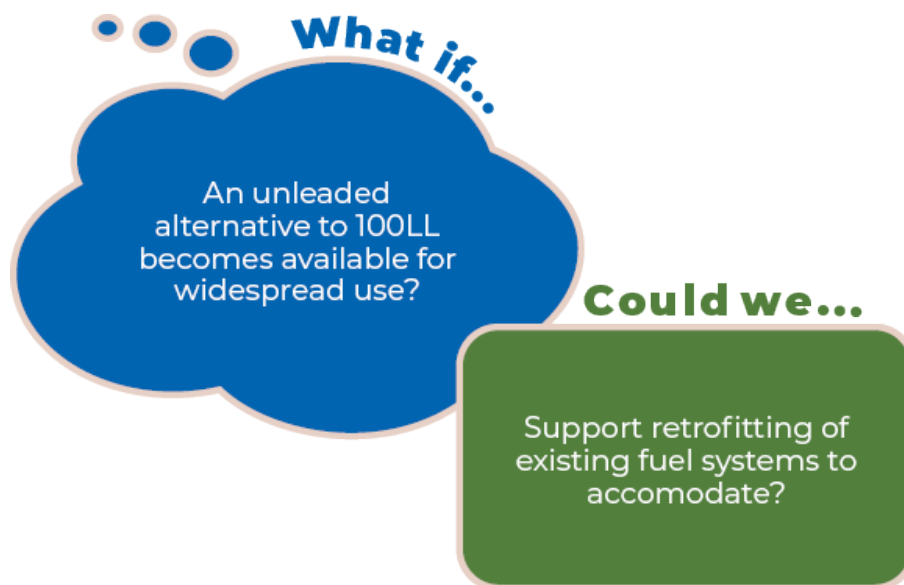
The aviation industry has always been an industry of advancement and innovation. The concept of flight was once a stretch of the imagination, and now it supports economies, local to global, and is a key component to the worldwide transportation network. Advancements in aviation never stop, with new technologies and trends constantly emerging. Understanding technological advancements that are likely to impact the state's system airports is important to prepare for industry change. Some of the more prominent technological advancements occurring in the aviation industry currently are the developments made in alternative, unleaded fuels; electric aircraft; and the proliferation of Unmanned Aircraft Systems (UAS).

8.3.1. *Availability of Unleaded Aviation Fuel*

One-hundred low lead (100LL) fuel, often referred to as avgas, is the most commonly used fuel for piston aircraft. The use of 100LL is very limited worldwide and is most commonly used in North America and western Europe. The reason for its limited availability is due to the tetraethyllead (TEL) additive, which is a toxic lead-based substance used in the fuel to prevent engine knocking, which can lead to sudden engine failure. While the TEL additive has proven necessary for safety purposes, the environmental and health concerns associated with emissions from 100LL has motivated the FAA and the Environmental Protection Agency (EPA) to phase out 100LL as soon as possible.

While no current unleaded fuel alternatives for piston aircraft are currently on the market, the FAA and other agencies are investing a significant amount into the research and development processes to develop a safe and effective alternative. The FAA established the Piston Aviation Fuels Initiative (PAFI) to lead the work in developing an unleaded aviation fuel solution. In June 2019, PAFI conducted a wide range of tests at the William J Hughes Technical Center in New Jersey. The testing included an optimized Shell fuel and three other fuels not previously tested as a part of the PAFI efforts. Unfortunately, none of the four alternative unleaded fuels were successful in providing a safe and effective fuel alternative, however, PAFI remains committed to testing all potential alternatives. Moreover, Shell is committed to

further research and development to complete refinements on their fuel solution to make a safe and viable unleaded alternative.¹ With the urgency of finding an alternative unleaded solution, and the continued investment in this endeavor, it is likely a new unleaded aviation fuel will become available for widespread use in the near term.



Ideally, these fuels can be developed as ‘drop-in’ fuels meaning that no significant alterations to existing airport fueling systems or aircraft engines would be needed to accommodate the new fuel. However, with the probable difference in weight of the fuel and other factors it is likely some changes to aircraft engines and airport fueling systems will need to be made, including fuel pumps and tanks. To help aircraft owners and airport sponsors prepare for the requirements of new fuel(s), support from government agencies (and possibly private entities) will be necessary to complete the transition – similar to the assistance provided by the FAA to aircraft owners retrofitting their aircraft to accommodate the NextGen requirements for ADS-B.

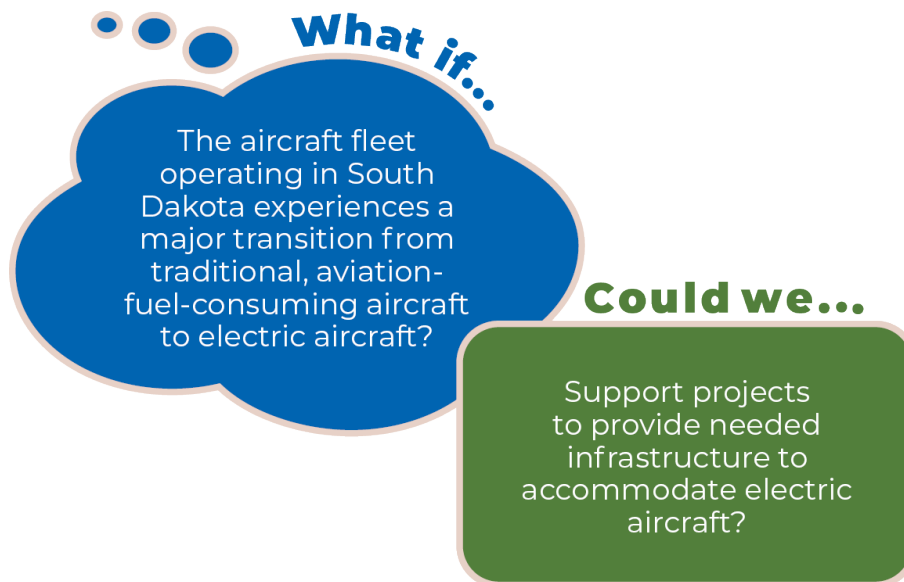
While it appears likely the fleet of piston aircraft that rely on 100LL will decline over the planning period, these aircraft will still be operational for many years to come and will require 100LL or an alternate fuel for many more years. As such, it is still important that SDDOT and other agencies support the remaining fleet of piston aircraft as these aircraft continue to rely on state system airports. One of the ways in which SDDOT could support a major fuel transition from 100LL to an unleaded alternative is through the development of a state program that is funded to cover the design and retrofitting of existing airport-

¹ <https://www.faa.gov/about/initiatives/AvGas/>.

owned fuel facilities. This could be accomplished through a statewide contract, similar to the pavement maintenance and repair program currently in place.

8.3.2. *Advancement of Electric Aircraft Manufacturing*

Developments in electric aircraft have been significant since 2012 when the first all-electric aircraft broke the 200mph barrier. Since then, notable advancements in electric technology have been made and it is estimated that nearly 200 different models of electric aircraft are currently under development. The electric aircraft market is made up of large and familiar names like Boeing and Airbus, yet smaller unknown start-ups are responsible for an estimated 46 percent of aircraft electrification research and development.² In addition to developing electric aircraft for GA users, the race is on for these companies to develop the first viable electric aircraft for large-scale commercial use. One regional airline in the U.S. has already committed to purchasing electric aircraft for their service. It is anticipated that more will follow suit.



As the likelihood of the GA and commercial fleet transitioning from 100LL (or an unleaded replacement) and Jet A-reliant aircraft to electric aircraft increases, it is important for SDDOT and airport sponsors to be prepared for the shift. Electric aircraft proliferation could impact airport infrastructure in a variety of ways. The early battery power technology will be most suited for small fixed-wing aircraft and therefore it is likely that the GA facilities will see changes to their operations first.

The most significant infrastructure change for electric aircraft proliferation will be charging capabilities. Initially, aircraft will need to be charged after every flight. Aircraft could use charging stations powered by the grid or renewable energy sources located on- or off-airport property. In addition, and perhaps most important, there may be a need to expand ramp space that will need to be devoted to aircraft charging stations as demand grows. As electric aircraft become more popular, congestion issues could result from charging wait times and too few stations. It will be important for universal charging stations to be developed so they can accommodate a wide range of electric aircraft.

² <http://www.flightofthecentury.com/long-esa/>.

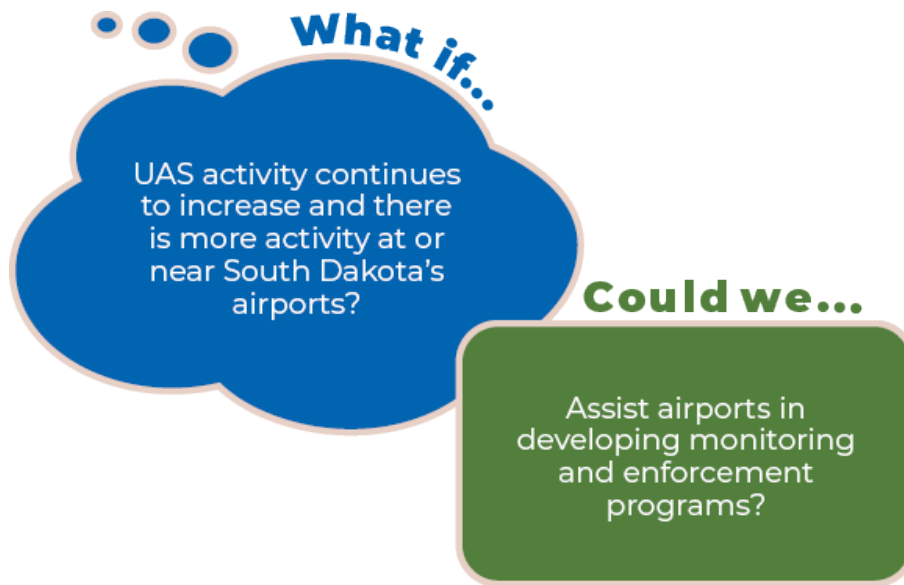
In addition to charging capabilities and apron and hangar space, other infrastructure changes are likely. For example, one of the potential benefits of electric aircraft is that they may require shorter runways since the lithium-ion batteries provide near-instant power making it easier for aircraft to reach take-off speeds. The demands of electric aircraft may prompt a need for the FAA to reassess current runway design criteria to ensure existing regulations are appropriate for electric aircraft.

A separate, but related, component of electric aircraft use is the potential for a new generation of pilots and aircraft owners to join the national aviation system, spurring the need for enhanced terminals and pilot and passenger facilities such as restrooms, food and beverage options, and parking. To prepare for increased operations by this segment of the national fleet, SDDOT could consider the near-term infrastructure needs proactively to be prepared for requests for assistance to expand aprons and provide charging stations at system airports. Like some other scenarios, establishing a priority for these projects or creating a state program to address these needs could be helpful. Outreach to electric aircraft manufacturers to understand the basic needs of these aircraft will be beneficial as requests roll in.

8.3.3. Proliferation of Unmanned Aircraft Systems (UAS) Activity

Unmanned Aircraft Systems (UAS) uses Unmanned Aerial Vehicle (UAV) technology to provide an array of applications for commercial, governmental, educational, and recreational purposes. UAV and UAS technologies are emerging quickly and their usage is becoming more prolific as the technology continues to expand into the commercial market. UAS implementation is associated with a number of benefits, such as increased safety, decreased costs, and improved efficiency on a variety of tasks, both for public and private sectors. UAS are even being used on airports to capture visual data of pavement conditions, evaluate possible obstructions to a runway approach, provide three-dimensional mapping of airport structures (e.g. airport terminals and air traffic control towers), as well as be used for a variety of other on-airport survey needs. However, the industry, potential users, and regulatory authorities including the FAA and state agencies, airports, and others will have to consider the challenges and opportunities associated with UAS as the technology transitions from the conceptualization phase to widespread implementation.

Despite the many benefits that UAS provide, this activity can pose a significant risk to airports of all sizes due to the potential interference with navigable airspace. More than half of the 56 system airports reported experiencing UAS activity on or near their airport and yet only six airports report having any type of monitoring or enforcement programs in place to limit the risks associated with activity nearby. UAS activity on or near airports is prohibited without prior authorization from the FAA. The newly developed Low Altitude Authorization and Notification Capability (LAANC) program was designed to support UAS integration into the airspace by providing an almost immediate application and approval process to authorize UAS usage in controlled airspace. More information about the LAANC program can be found in **Section 5.5.6 of Chapter 5. System Performance**. While LAANC is a leap in the right direction for UAS monitoring on and near airports, it is only available at eight of the 56 SDDOT system airports.



To assist airports in monitoring UAS activity and protecting against unauthorized use, SDDOT could develop a model UAS monitoring plan that could be tailored and adopted by individual airports. This plan would address the type and frequency of operations specific to an airport and define counteractive measures to be implemented when unauthorized activity is observed, or UAS activity is impacting the safe operation of manned aircraft. These plans would rely on increased coordination between the FAA, SDDOT, airports and local authorities to develop policies and procedures that meet the needs of the airport and prevent fractionalized control of navigable airspace.

8.4. Summary

The six alternative scenarios featured in this chapter demonstrate different ways South Dakota aviation may change over the coming 20-year planning horizon. From changes to the GA fleet, to a reduction in regional airline service, to the development of alternative fuels and electric aircraft, and the proliferation of UAS, there are many industry changes on the horizon that have the potential to impact airports, regulatory agencies, pilots, aircraft owners, and other stakeholders. Investigating these alternative scenarios provides an opportunity for SDDOT to evaluate the changes most likely to occur in the near-, mid-, and long-term timeframes and put specific programs, policies, and procedures in place to address the changes if/when they occur.