Chapter 4. Aviation System Issues

4.1. Introduction

Aviation is a rapidly evolving industry affected by variables both internal to and external of the system itself. Factors that affect airports can range from global geopolitical forces affecting the price of petroleum, airport security, and immigration; to federal- and state-level concerns such as employment and residency distribution; to local-level planning issues that affect how an airport is operated and the projects that are pursued. Amid these ever-evolving forces, airports and airport sponsors are tasked with providing safe and secure aviation facilities that promote mobility and equitable access for various types of airport users in a revenue-limited environment.

Understanding the major issues affecting Colorado's airports is an important task when assessing the system's historical, current, and future performance. As such, this chapter provides an overview of the factors that airports, airport sponsors, and various aviation stakeholders have identified as most significantly affecting airports' abilities to optimally support Colorado aviation system users. The issues and trends described in this chapter were gathered from a variety of sources designed to capture a broad spectrum of perspectives on the Colorado aviation system including:

- **Project Advisory Committee (PAC).** Established to provide guidance and support for the implementation of the CASP, the PAC comprises representatives from several Colorado airports, CDOT Division of Aeronautics, the Federal Aviation Administration (FAA) Denver Airports District Office, Colorado Aeronautical Board, Colorado Airport Operators Association, and CDOT Division of Transportation Development. During the PAC's first meeting, attendees identified and prioritized current and long-term issues that could most significantly affect the Colorado system.
- **Airport manager interviews.** Site visits were conducted at the 65 publicly owned and 1 privately owned, public-use airports that compose the Colorado airport system. Airport managers were asked to provide a list of the top three issues affecting their facilities. Managers identified issues ranging from site-specific concerns such as hangar shortages and maintenance needs to broad issues such as the international pilot shortage, the impact of unmanned aerial systems/vehicles (UAS/UAV or drones) on air transportation, and state and federal regulatory concerns.
- **Aviation stakeholders.** Key aviation stakeholders representing a cross-section of individuals from local, state, and federal governments; aviation-related industries and trade organizations; educational institutions; and aviation enthusiasts were interviewed by the project team. These extensive discussions asked both targeted and open-ended questions aimed at pinpointing areas of greatest potential impact.
- **Aviation user groups.** The project team conducted targeted outreach efforts with CDOT Modal Managers and emergency service providers. Each of these groups regularly interacts with and depends on airports as part of Colorado's broader transportation network.

The goal categories of the Colorado Aviation System Plan (CASP) provided in **Chapter 1. Study Design and Goals** serve as the framework for the trends and issues identified by these groups. In this way, the many linkages between the system's goals, identified issues, and recommendations developed as the final outcome of this study become clear and demonstrate how the CASP is an important tool in

meeting aviation's challenges today and into the future. The following summarizes the goal categories of the CASP:

- **Goal 1: Safety and Efficiency.** Advance Colorado's airport system by promoting and preserving safe and efficient facilities on and off airports.
- **Goal 2: Access and Mobility.** Provide Colorado's airports with infrastructure and sufficient capacity to access the versatile aviation activities and facilities in the state and provide adequate mobility for users.
- **Goal 3: Economic Sustainability.** Support sustainable economic growth and development and continue Colorado's existing status as a leader in technology, testing, and the aerospace industry.
- **Goal 4: System Viability.** Preserve, maintain, and enhance airport system assets through cost-effective investments to ensure the system's long-term viability.

Table 4.1 summarizes the top 10 issues and trends with the highest potential to impact the future of aviation in Colorado within the framework of the CASP goal categories, as well as by respondent group. Issues that only appeared once are not summarized in this document, as they were rarely identified through this process.[1] The sections that follow provide details about each of these topics and highlight their potential impacts on the current and future aviation system in Colorado. The sections appear alphabetically as presented in the following table. Note that some respondent groups identified issues of concern at specific airports, while those same airport managers did not articulate the same needs in the top issues reported during their airport manager interviews. This highlights the importance of analyzing needs from multiple perspectives during the system planning process.

[1] Modal managers proved the one exception, as these stakeholders focused on intermodal integration in Colorado. This topic is discussed in Chapter 3. Supplemental System Context and thus excluded here for brevity.

Table 4.1. Colorado's Key Aviation Issues by System Goal and Respondent Group

Goal Categories and Respondent Groups/ Associated City, Airport, FAA Identifier	Airspace / Air Traffic Congestion	Aviation Demand	Fuel Types and Availability	Hangar Availability	Infrastructure Needs	Land Use Planning and Encroachment	Pilot / Aviation Workforce Shortage	Public Engagement / Government Support	Revenue Generation and Funding Challenges	Technology
Goals										
Goal 1: Safety and Efficiency	✓				✓	✓				✓
Goal 2: Access and Mobility		✓		✓	✓	✓			✓	
Goal 3: Economic Sustainability			✓	✓		✓	✓	✓	✓	✓
Goal 4: System Viability					✓	✓	✓	✓	✓	
Respondent Groups										
PAC		✓	✓		✓	✓	✓	✓	✓	✓
Aerospace UAS	✓							✓		✓
Aspen Flying Club	✓		✓		✓	✓	✓			
Boutique Air	✓				✓	✓	✓	✓	✓	
Colorado Agriculture Aviation Association	✓		✓		✓		✓			✓
Colorado Air National Guard	✓						✓			
Colorado Aviation Business Association	✓				✓	✓	✓	✓		✓
Colorado Bureau of Land Management (BLM) Fire and Aviation			✓		✓					
Colorado Northwestern Community College (CNCC)					✓		✓	✓	✓	✓
Colorado Oil and Gas Association	✓		✓		✓					✓
Colorado Pilots Association					✓	✓	✓			✓
Colorado Flights Alliance					✓		✓	✓	✓	✓
Department of Public Safety (DPS) Division of Fire Protection Services		✓	✓		✓	✓		✓	✓	

Goal Categories and Respondent Groups/ Associated City, Airport, FAA Identifier			Airspace / Air Traffic Congestion	Aviation Demand	Fuel Types and Availability	Hangar Availability	Infrastructure Needs	Land Use Planning and Encroachment	Pilot / Aviation Workforce Shortage	Public Engagement / Government Support	Revenue Generation and Funding Challenges	Technology
DPS Director of Flight Operations							✓					
Metropolitan State University (MSU)				✓			✓	✓	✓	✓		✓
Office of Economic Development and International Trade (OEDIT)							✓	✓		✓	✓	
Rural Partners in Medicine			✓			✓	✓			✓		
University Corporation for Atmospheric Research (UCAR) Aviation Facility			✓		✓		✓		✓			✓
Emergency Service Providers			✓				✓					✓
CDOT Modal Managers			*See Chapter 3. Supplemental System Context*									
Airports												
Associated City	**Airport**	**FAA Identifier**										
Akron	Colorado Plains Regional	AKO		✓			✓					
Alamosa	San Luis Valley Regional	ALS		✓			✓				✓	
Aspen	Aspen-Pitkin County	ASE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Blanca	Blanca	05V	Not provided (NP)									
Boulder	Boulder Municipal	BDU				✓	✓	✓		✓		
Brush	Brush Municipal	7V5										
Buena Vista	Central Colorado Regional	AEJ			✓	✓	✓					
Burlington	Kit Carson County	ITR			✓	✓	✓					
Canon City	Fremont County	1V6		✓		✓	✓					
Center	Leach	1V8	NP									
Colorado Springs	Meadow Lake	FLY						✓		✓		

Goal Categories and Respondent Groups/ Associated City, Airport, FAA Identifier			Airspace / Air Traffic Congestion	Aviation Demand	Fuel Types and Availability	Hangar Availability	Infrastructure Needs	Land Use Planning and Encroachment	Pilot / Aviation Workforce Shortage	Public Engagement / Government Support	Revenue Generation and Funding Challenges	Technology
Colorado Springs	Colorado Springs Municipal	COS						✓			✓	
Cortez	Cortez Municipal	CEZ					✓				✓	
Craig	Craig-Moffat	CAG				✓	✓					
Creede	Mineral County Memorial	C24				✓	✓					
Del Norte	Astronaut Kent Rominger	RCV	NP									
Delta	Blake Field	AJZ				✓	✓				✓	
Denver	Centennial	APA						✓			✓	✓
Denver	Rocky Mountain Metropolitan	BJC				✓	✓					
Denver	Colorado Air and Space Port	CFO					✓	✓			✓	
Denver	Denver International	DEN					✓	✓				
Durango	Durango-La Plata County	DRO		✓					✓		✓	
Eads	Eads Municipal	9V7					✓					
Eagle	Eagle County Regional	EGE	NP									
Erie	Erie Municipal	EIK		✓		✓		✓				
Fort Morgan	Fort Morgan Municipal	FMM										
Glenwood Springs	Glenwood Springs Municipal	GWS			✓	✓		✓				
Granby	Granby-Grand County	GNB					✓				✓	
Grand Junction	Grand Junction Regional	GJT					✓				✓	
Greeley	Greeley-Weld County	GXY						✓			✓	
Gunnison	Gunnison-Crested Butte Regional	GUC	NP									
Haxtun	Haxtun Municipal	17V				✓	✓					

Goal Categories and Respondent Groups/ Associated City, Airport, FAA Identifier			Airspace / Air Traffic Congestion	Aviation Demand	Fuel Types and Availability	Hangar Availability	Infrastructure Needs	Land Use Planning and Encroachment	Pilot / Aviation Workforce Shortage	Public Engagement / Government Support	Revenue Generation and Funding Challenges	Technology
Hayden	Yampa Valley	HDN		✓							✓	
Holly	Holly	K08	NP									
Holyoke	Holyoke	HEQ						✓			✓	
Julesburg	Julesburg Municipal	7V8	NP									
Kremmling	Mc Elroy Airfield	20V					✓					
La Junta	La Junta Municipal	LHX		✓							✓	
La Veta	Cuchara Valley	07V					✓			✓		
Lamar	Lamar Municipal	LAA			✓	✓	✓					
Las Animas	Las Animas-Bent County	7V9	NP									
Leadville	Lake County	LXV					✓				✓	
Limon	Limon Municipal	LIC					✓					
Longmont	Vance Brand	LMO		✓		✓	✓					
Fort Collins/Loveland	Northern Colorado Regional	FNL		✓			✓			x		
Meeker	Meeker/Coulter Field	EEO	✓					✓			✓	
Monte Vista	Monte Vista Municipal	MVI					✓				✓	
Montrose	Montrose Regional	MTJ									✓	
Nucla	Hopkins Field	AIB	NP									
Pagosa Springs	Stevens Field	PSO					✓				✓	
Paonia	North Fork Valley	7V2					✓					
Pueblo	Pueblo Memorial	PUB							✓		✓	
Rangely	Rangely	4V0				✓	✓					

Goal Categories and Respondent Groups/ Associated City, Airport, FAA Identifier			Airspace / Air Traffic Congestion	Aviation Demand	Fuel Types and Availability	Hangar Availability	Infrastructure Needs	Land Use Planning and Encroachment	Pilot / Aviation Workforce Shortage	Public Engagement / Government Support	Revenue Generation and Funding Challenges	Technology
Rifle	Rifle Garfield County	RIL	✓									
Saguache	Saguache Municipal	04V	NP									
Salida	Harriet Alexander Field	ANK						✓			✓	
Springfield	Springfield Municipal	8V7					✓					
Steamboat Springs	Steamboat Springs	SBS				✓	✓	✓				
Sterling	Sterling Municipal	STK				✓	✓				✓	
Telluride	Telluride Regional	TEX	✓			✓			✓			✓
Trinidad	Perry Stokes	TAD					✓				✓	
Walden	Walden-Jackson County	33V					✓					
Walsenburg	Spanish Peaks Airfield	4V1					✓					
Westcliffe	Silver West	C08	NP									
Wray	Wray Municipal	2V5			✓	✓	✓					
Yuma	Yuma Municipal	2V6			✓	✓	✓					

Source: Interviews and meetings conducted by Kimley-Horn, October 2018 - May 2019

4.2. Airspace / Air Traffic Congestion

Half of the stakeholders interviewed as part of this study reported air traffic congestion as one of the most significant issues facing the state. Air traffic congestion occurs when existing airports and airways do not provide sufficient capacity to efficiently move aircraft and their passengers between their places of origin and ultimate destinations. While the causes for airspace congestion are many, including commercial airline schedules, airport layouts, and environmental concerns (e.g., noise abatement measures that limit hours of flight operations), the ultimate effects are straightforward: delay and, in some cases, safety incursions.

Airspace in the (U.S.) is divided into multiple classes developed to promote the safe and efficient movement and control of aircraft during flight and approach/departure procedures. Each class has different characteristics, dimensions, altitudes, and requirements based on the type of activity they are intended to support. Issues can arise when aircraft of differing weight classes and speed operate in shared airspace, which affects air traffic control processing and can make navigation difficult. Airspace can also ground or significantly impact the movement of some types of operations. The Colorado Air National Guard's 140th Fighter Wing at Buckley Air Force Base (AFB) reported that it operates in 1,500 feet of Class B airspace above Denver. This limits eastbound flights to a narrow tunnel, aircraft must fly elsewhere or at low altitudes during cloud cover, and all operations require extensive coordination with Denver International (DEN) air traffic control. These airspace limitations have precluded the unit from potentially transitioning to the F-35 stealth fighter jets that are more advanced than the F-16s that it currently operates.

Airspace concerns also impact pilot training. The Aspen Flying Club reported a need for a singular source that compiles air traffic control and/or risk mitigation plans within designated flight training areas. Currently, such plans are available from multiple sources, making navigation confusing and potentially dangerous for students and other pilots. Emergency service providers also face challenges associated with operational mixes. Blackhawk and Skycrane helicopters used during search and rescue and wildland firefighting operations need to be separated from other aircraft for safety purposes, which can be exceedingly challenging when operating at small airports.

Airspace concerns and traffic congestion are particularly germane in the Denver area, as demand for air travel has matched the burgeoning population over the past decade, although airports outside of the urban core expressed similar concerns. The use of UAS has exacerbated the issue and made the threat of mid-air collisions increasingly present in the minds of pilots and UAS operators. The FAA's airspace modernization initiative known as the Next Generation Air Transportation System, or NextGen, will also enhance air safety. These issues are discussed in further detail in Section 4.11. Technology.

To mitigate the issues associated with air space and air traffic congestion, CDOT Division of Aeronautics, the FAA, National Air Traffic Controllers Association (NATCA), and Searidge Technologies have partnered with Northern Colorado Regional (FNL) on the Colorado Remote Tower Project. Located in Loveland, Colorado, FNL is the state's busiest non-towered airport with a mix of fixed and rotary winged traffic. Allegiant Airlines had operated at FNL but ceased service due to increasingly high operational levels without an air traffic control tower (ATCT). The remote tower combines visual/camera with radar/track-based input to control the airport remotely. The technology enhances

Remote tower project at Northern Colorado Regional Airport (Shahn Sederberg, CDOT)

safety and efficiency while dramatically reducing the costs associated with the construction and staffing of a traditional ATCT. FNL and CDOT Division of Aeronautics anticipate that scheduled commercial air service will be reinstated once the project is fully operational. Additionally, the potential utility of remote towers at Colorado's commercial ski country airports, including Hayden-Yampa Valley Regional (HDN), Gunnison-Crested Butte Regional (GUC), Montrose Regional (MTJ), Durango-La Plata County (DRO), and Telluride Regional (TEX), has already been recognized. Remote tower technology may allow these busy airports to safely accommodate higher volumes of seasonal activity and reduce aircraft diversions due to adverse weather conditions.[2] While still in its initial testing phase, airports and pilots are hopeful that remote tower technology may provide a cost-effective solution to this challenging issue.

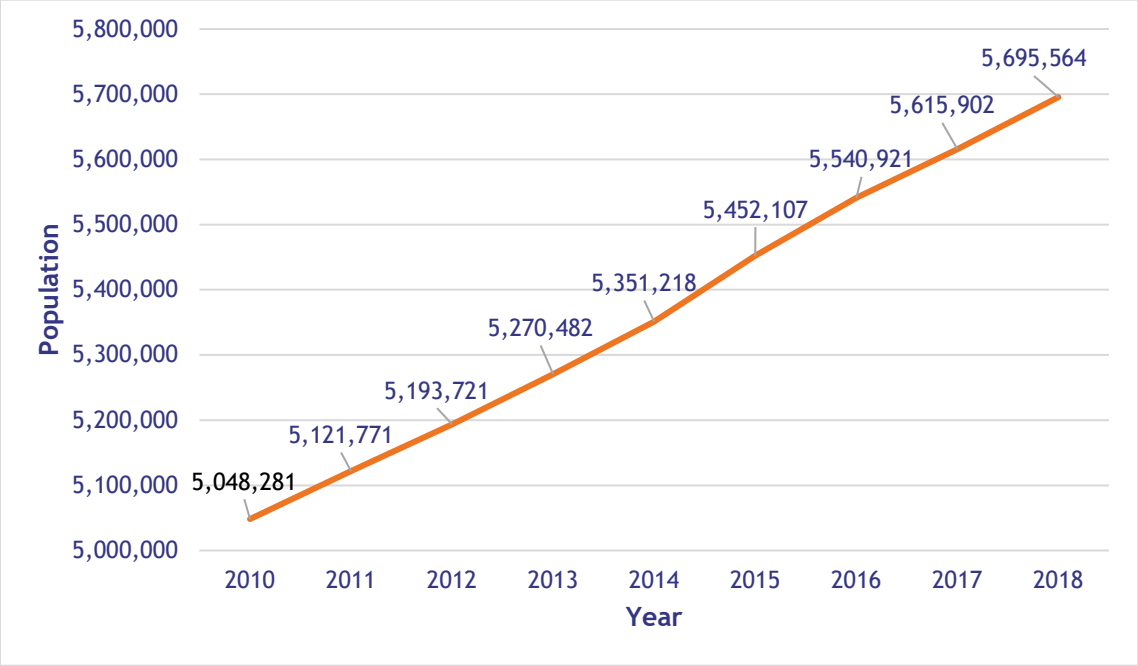
4.3. Aviation Demand

Access and Mobility

Population is one of the primary indicators of aviation demand for both general aviation (GA) and commercial service airports. Operational pressures can be particularly acute when population growth is coupled with expansion in the commercial industries most commonly associated with aviation use. As shown in **Figure 4.1,** Colorado's population grew by 12.8 percent between 2010 and 2018 from 5,048,281 to 5,695,564 residents, earning Colorado the distinction as the fourth-fastest growing state in the U.S. By 2050, that figure is projected to rise to nearly 8,500,000 total residents. During nearly that same time (2010 – 2017), Colorado experienced a 20 percent employment increase, the second-highest rate in the U.S., with growth led by health services; professional and technical services; and accommodation and food.[3] Each of these industries is known to heavily rely on aviation services.

[2] CDOT Aeronautics. (no date [n.d.]). Colorado Remote Tower Project. Online at codot.gov/programs/remote-tower/TheProject (accessed July 2019).
[3] Garner, Elizabeth. (2018). *Growing Colorado: Population and Economic Transitions for Colorado.* State Demography Office, Colorado Department of Local Affairs. Available online at demography.dola.colorado.gov/demography/publications-and-presentations/#publications-and-presentations (accessed May 2019).

Figure 4.1. Colorado Population (2000 - 2018)

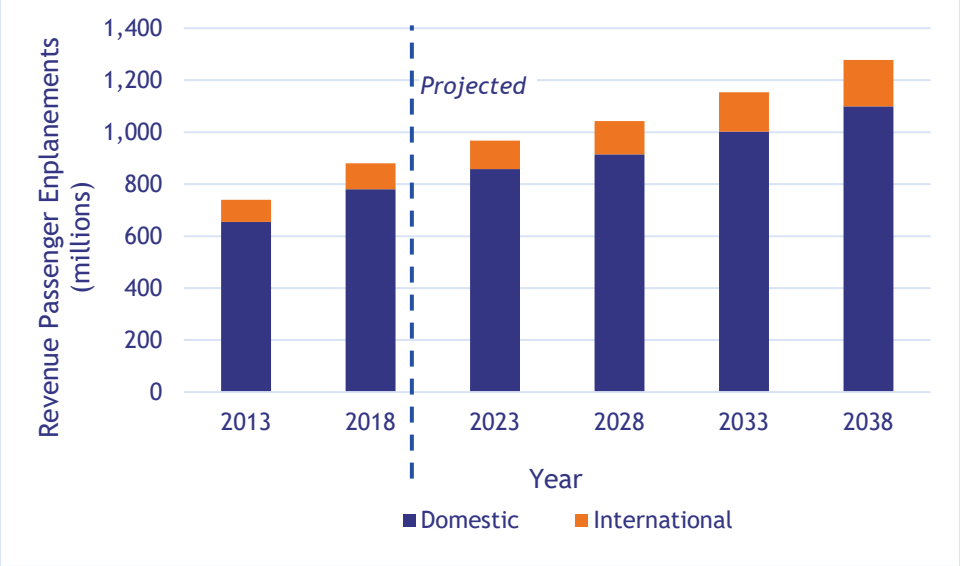


Source: U.S. Census Bureau, 2019

Population growth and economic expansion will have a particularly acute impact on commercial service activity. **Figure 4.2** depicts the projected growth in commercial service in the U.S. Over the 20-year planning horizon of the CASP, the number of revenue passenger enplanements is anticipated to rise by 2.4 percent annually, from 880 million in 2018 to 1,278 million by 2038 (45 percent total growth). Should current trends in Colorado continue, state-specific commercial service growth will likely outpace these national figures.[4]

[4] Additional details about Colorado-specific growth are presented in Chapter 7. Aviation Forecasts.

Figure 4.2. U.S. Revenue Passengers (2013 - 2038)



Source: FAA Aerospace Forecast 2019-2039

Take-off queue at Telluride Regional Airport (Kenny Maenpa)

To meet growing demand, U.S. carriers are anticipated to increase capacity through additional routes and frequency and increase the number of seats per operation, either through up-gauging or reconfiguring existing aircraft.[5] In addition to congestion issues, some airports may have to adapt infrastructure to accommodate larger aircraft—including jet bridges, deicing facilities, support equipment (e.g., tugs and baggage handling facilities), airfield pavement, and terminal/security facilities to process and hold additional passengers. These trends may also mean that the largest airports such as DEN will continue to expand while growth at smaller commercial service facilities without the capacity to handle larger jets may stagnate. Airlines may further reduce service at essential air service (EAS) airports as it becomes increasingly less cost-efficient to operate the small commuter aircraft, many of which are not jet aircraft. Colorado currently has three EAS-eligible communities: Alamosa, Cortez, and Pueblo. EAS funding has been the topic of much debate over the years with political pressures raising discussions to reduce or eliminate the subsidies.

Yet while some airports may struggle to meet existing and potential future commercial service and GA demands, others are working to draw additional operations to their facilities. La Junta Municipal (LHX), San Luis Valley Regional (ALS), and Colorado Plains Regional (AKO) airports all cited under-utilization as their most significant concern. Recent population growth has been clustered around the existing urban core of the state, with the highest rates in Weld, Adams, Denver, Arapahoe, and El Paso counties. Growth in other areas has been moderate, and the population of Colorado's most outlying counties has

[5] *FAA Aerospace Forecasts 2019-2039*

decreased over the last decade. With approximately 35 percent of the population living in just five of the 271 incorporated cities, Colorado has a distinct urban/rural divide that will likely only widen in the coming years. This sentiment was echoed by the PAC and identified as one of the most important issues of concern for the Colorado aviation system.

Ski country airports such as Yampa Valley (HDN), Aspen-Pitkin County (ASE), and Eagle County Regional (EGE) face their own challenges. Airports witness dramatic increases in winter operations with the influx of seasonal visitors and marked declines during shoulder seasons. The facilities, services, and staff levels required between these peak and non-peak seasons are vastly different. Airport managers are forced to make difficult logistical decisions about how to meet seasonal highs while maintaining expensive facilities and appropriate staff and service levels during the interim months.

4.4. Fuels Types and Availability

Economic Sustainability

Fuel availability and type is an important factor for pilots and aircraft owners when considering where to base their aircraft or conduct itinerant operations. Because fuel sales are one of the primary revenue-producing activities at many airports, those that do not sell fuel through either a fixed base operator (FBO) or self-serve station generally have access to significantly fewer resources than those that do. Airports without Jet A fuel are at a particularly acute disadvantage. Jet A is required by the turbine engines that power aircraft associated with business/corporate aviation, wildland firefighting, and some aerial applicator and medical activity. As a result, airports without this type of fuel cannot support the aviation activities with the most significant economic and quality-of-life benefits for their communities.

Airports reported that fuel farm development is limited by on-airport space, funding, and an overall inability to promote their facility as a viable location for business development to support use of Jet A fuel regularly enough to make it viable. Yuma Municipal (2V6), Central Colorado Regional (AEJ), and Lamar Municipal (LAA) airports all reported similar concerns. In several other cases, airports have fuel infrastructure, but that infrastructure is either outdated or too small to meet the needs of airport users. Glenwood Springs Municipal (GWS), for example, reported both its AvGas and Jet A systems are “old and in-need of an upgrade. The Jet A system needs a larger tank to meet the demands of larger aircraft.” The availability of AvGas (100LL used in the piston engines of many GA aircraft) and/or Jet A is inherently tied to an airport’s economic security and is discussed further in Section 4.10. Revenue Generation and Funding.

Jet A fuel truck at La Junta Municipal Airport

It is interesting to note that while airports identified a need for AvGas facilities and it continues to be the most commonly used fuel by piston aircraft, the future of 100LL is uncertain. 100LL is the only leaded fuel used in U.S. transportation today. Due to its harmful environmental effects, the FAA and the U.S. Environmental Protection Agency (EPA) have partnered to remove lead from aviation fuel. The FAA continues to research alternative fuels with industry partners, and several potentially viable solutions have emerged. Aircraft engines designed to operate on diesel, jet, and varying grades of unleaded motor fuel (MOGAS) are also being tested. Lower supplies of leaded products and more

stringent regulations on the distribution of leaded fuels have caused the price of AvGas to rise, further increasing pressure to develop a viable alternative for GA pilots.

4.5. Hangar Availability

Access and Mobility

Economic Sustainability

Twenty of Colorado's 66 system airports cited the need for additional hangar space as one of their top three concerns. In some cases, airports require additional storage capacity to keep pace with growing demands, while others currently have no hangar space available for lease. Erie Municipal (EIK) noted the issue straightforwardly, commenting, "Airport hangars are at capacity. Need additional hangar space." Airports face various challenges associated with hangar development in terms of available space and capital investment costs. Kit Carson County (ITR) has "a number of interested parties that would like to build hangars, but the city cannot afford to build the infrastructure (i.e., taxiways and apron space) to support them." In another type of development challenge, Boulder Municipal (BDU) cited city regulation as the biggest hindrance to development: "land leasing causes people to be uninterested in building hangars and making improvements."

While some airports lack the resources for hangar construction, others are hindered by a lack of available land to expand their current facilities. Blake Field (AJZ) has "filled up the hangar expansion space on [its] west side, tripling the number of hangars in the last 13 years. Once the golf course road access is changed, [AJZ] can continue building on that side." Erie Municipal (EIK), Limon Municipal (LIC), and Vance Brand (LMO) airports find themselves in similar positions.

Several airports specifically commented upon the need for conventional hangars suitable for jet aircraft, particularly those serving visiting skiers in the mountains northwest of Denver. Illustrating the ability of hangars to catalyze additional growth, the Glenwood Springs Municipal (GWS) commented,

> *We have a hangar waitlist of approximately 50 people. There is a demand for hangars, but also a demand for businesses at the airport. If we had more space to operate and the land to build more hangars, we could see businesses such as a flight school, a fully staffed FBO, skydiving operations, and more. A community hangar would be a huge plus and provide a location for local events and education.*

Winter operations at Rifle Garfield County Airport (Brian Condie)

In addition to the economic benefits associated with hangar development, emergency service providers recognized their importance in supporting safety and access. During snowy conditions, Rural Partners in Medicine may drop medical personnel off at one airport, then fly the aircraft to a second airport with transient hangar availability. The aircraft returns to the first airport to pick up staff when they have completed their tasks. The additional costs incurred by the inefficient logistics is passed on to hospitals and patients. In fact, the need for transient hangars to assist with winter operations at small airports was one of the key issues identified during the emergency service provider workshop. These stakeholders specifically identified a need for hangar space and/or deicing equipment at Wray Municipal (2V5),

Yuma Municipal (2V6), Walden-Jackson County (33V), Rangely (4V0), Holyoke (HEQ), Julesburg Municipal (7V8), and Astronaut Kent Rominger (RCV) airports, and reported that Erie Municipal (EIK) and Vance Brand (LMO) along the Front Range currently have 10-year hangar waitlists.

The ubiquity of this concern indicates that additional study is warranted to determine if CDOT Division of Aeronautics can provide further support to airports to meet the need for hangars across the state. Hangar development is not excluded from CDOT Division of Aeronautics' Colorado Discretionary Aviation Grant (CDAG) Program; however, economic development projects (capital projects to create revenue through leases) are not traditionally the highest priority for funding.[6] Revenue-producing projects can be funded via the State Infrastructure Bank (SIB) Loan Program, a low-interest revolving loan fund supported by the Colorado Transportation Commission. Additional information about the SIB is available in Section 4.10. Revenue Generation. Airports should also carefully consider the need for future hangar development/expansion during the master planning process.

4.6. Infrastructure Needs

Over half of the airports in Colorado report that they need facility improvements to optimally support airport users. Some airports need improvements to support growing demand, while other airports need improvements to maintain viability for usage over time. Airport and aviation stakeholders most commonly cited the following factors as potentially hindering the operational capabilities of Colorado airports over the 20-year planning horizon of the CASP:

- Runway design
- Taxiway design
- Pavement conditions
- Instrument approach capability

4.6.1. Runway Design

An airport's design is primarily driven by the operational and physical characteristics of the most demanding aircraft that generally operate at the facility (at least 500 operations per year, excluding touch-and-go operations). Jets, for example, generally require a minimum 5,000-foot-long runway (or greater depending on the elevation of the airport and the actual aircraft's operating characteristics) to safely accommodate take-offs, landings, and accelerate stop distances. For Colorado, elevation and mean temperature during the hottest months are critical factors that affect runway length requirements, and the range of temperatures and elevations found in Colorado necessitate individualized runway length analyses for each airport.

During the airport inventory process, some managers reported a disconnect between runway length and the aircraft that generally use them. Vance Brand (LMO), for example, noted that its runway "does not meet [FAA] standards (too short)." This indicates that additional analysis may be warranted to determine the type and extent of facility improvements that may be needed to better accommodate

[6] CDOT Division of Aeronautics. (2019). Programs and Procedures Manual v6.3 (approved January 28, 2019). Available online at www.codot.gov/programs/aeronautics/ProgramProcManual/view (accessed May 2019).

existing operational activities. Rural Partners in Medicine commented that runway length in high-altitude communities is "always" an issue for them.

Jet aircraft at Steamboat Springs Airport (Stacy Fain)

Similarly, runway improvements were cited as a significant need to allow larger aircraft to use many of the airports in the future. Fremont County (1V6) noted, "Runway length prohibits jet customers from utilizing the airport." Mineral County (C24) commented, "Need to increase runway and build taxiway for future growth, as the area grows every year with interest from charters to make this a featured stop." That airport similarly cited a need to increase the weight limit of its existing runway to support larger aircraft. Emergency service providers reported that aircraft used for aerial firefighting are becoming larger. The Colorado firefighting "arsenal" now includes P-3 Orions (four-engine turboprops) and B747 SuperTankers. These aircraft require stronger runway, taxiway, and ramp load-bearing capacities to operate.

Jet activity is associated with revenue generation and economic growth. Yet because those benefits come coupled with the need for more land, increased airport design standards, and the potential for additional noise concerns and environmental impacts, the decision about providing the infrastructure to facilitate jet activity requires detailed analyses. Jet activity could provide a significant economic boost to the communities where these airports are located (assuming the demand exists to regularly support it); however, there are additional costs other than just providing a long enough runway to support regular use by jet aircraft.

Several airports reported issues with hot spots—safety-related problem areas that present an increased risk to pilots and aircraft loss of separation during surface operations. The FAA defines a hot spot as a "location on an airport movement area with a history of potential risk of collision or runway incursion, and where heightened attention by pilots and drivers is necessary." In many cases, hot spots arise due to the airport layout (e.g., confusing runway/taxiway geometry); airport marking, signage and lighting; or situational awareness or training needs. According to the 2019 FAA hot spot report, Colorado has 16 hot spots at seven airports including Aspen-Pitkin County (ASE), Colorado Springs Municipal (COS), Centennial (APA), Denver International (DEN), Rocky Mountain Metropolitan (BJC), Eagle County (EGE), and Grand Junction Regional (GJT).[7] While not identified on the FAA's list for hot spots, Rangely (4V0) reported that its "taxiway/runway separation do not meet B-II standards," which is also an airport design concern (although not a hot spot issue).

It is important that airports examine their geometry in accordance with the latest FAA guidance and evaluate potential changes needed to meet current standards (FAA Advisory Circular 150/5300-13A, Change 1, *Airport Design*). Airports should then work with the FAA to take all reasonable steps to address non-standard conditions. Areas of concern must be clearly identified on airport diagrams, and

[7] FAA. (2019). *Runway Safety Hot Spots List: Airport Diagrams-Hot Spots*. Available online at aeronav.faa.gov/afd/25Apr2019/SW_hotspot.pdf (accessed May 2019).

aircraft surface movements should be properly planned and coordinated with air traffic controllers (where available) and pilots to reduce the potential for incursions.

4.6.2. Taxiway and Ramp Conditions

Airport ramps and taxiways are planned to meet the operational usage of an airport in terms of the type and size of based or itinerant aircraft that are using the airport on a regular basis. If operations exceed what an airport was originally designed to support, the facility can no longer operate at maximum efficiency and may lose operations to nearby facilities. Like runway needs, airports reported the need to expand taxiways and ramps to support growing demand and larger aircraft. Blake Field (AJZ) is actively working to increase business/corporate activity: "With our growth, [AJZ] will need to expand the ramp areas for more and larger aircraft. [It] will additionally need to finish the partial length taxiway to keep the runway clear and rebuild our main ramp." Ramps at airports with high seasonal usage, such as Steamboat Springs (SBS), reach maximum capacity during peak times and have identified ramp expansions as a key need to support existing operations and future growth.

Airports along the Front Range commonly cited congested ramps during firefighting season, which can negatively impact efficient operations during this lifesaving aviation activity. "Ramp expansion for fixed-wing and rotary aircraft including a separate ramp area for a firebase" was one of Central Colorado Regional's (AEJ) primary issues. Fremont County (1V6) also reported that the "ramp becomes too congested during fire activities. More space is needed."

Monte Vista Municipal Airport

In addition to these operational concerns, safety issues can arise as aircraft move in constrained areas. In 2012, the FAA released revised taxiway design standards in AC 150/5300-13A, change 1, *Airport Design* (**Chapter 4. Taxiway and Taxiway Design**) which outlined three primary issues concerning taxiway geometry: three-node, indirect access, and wide expanses of pavement. Each of these concepts are intended to aid in the safe and efficient conveyance of aircraft between parking areas and the runway by promoting pilot awareness to reduce incursions. These and other types of taxiway design issues are reported in the FAA's hot spot report, which notes that 11 of the 16 hot spots in Colorado are related to taxiways and ramps (2019). Hot spot issues range from inadequate distances from ramp to taxiway, congested taxiway intersections resulting in high-volume crossing points, high-density parking areas on ramps, and taxiways being too close to runways. These issues underline the importance of properly planned aircraft movement areas that integrate runways, ramps, and taxiways and allow an airport to safely function at an optimal capacity. Additionally, compliance with the FAA's 2012 taxiway design standard revisions is being addressed during ongoing and planning projects, including master plans.

4.6.3. Pavement Conditions

Airports across Colorado, such as Eads Municipal (9V7), Lamar Municipal (LAA), Monte Vista Municipal (MVI), and Stevens Field (PSO), reported that runway, taxiway, and/or ramp pavement conditions are issues of major concern. Emergency service providers specifically commented that runway resurfacing is necessary at Craig-Moffat (CAG) and specifically the crosswind runway at Lamar Municipal (LAA);

large tankers have difficulty on certain pavements at Rocky Mountain Metro (BJC); and single engine air tanker (SEAT) aircraft have a concern with a dip in the runway at Fremont County (1V6). Pavement condition is critical to safe and efficient aircraft operations, and its upkeep is often one of the most significant capital investments an airport makes. To avoid costly reconstructions or rehabilitations, airfield pavement must be regularly inspected, and preventative maintenance should be conducted at the appropriate time during the pavement's lifecycle. The condition of runway pavement is particularly important due to the speed at which aircraft operate in these areas. Pavement condition is a significant factor in airport safety, and poorly-maintained pavement can damage aircraft as well as increase the need and cost to reconstruct pavements.

To assist in this process, CDOT Division of Aeronautics conducts triennial Pavement Condition Index (PCI) inspections at all Colorado airports that are eligible for CDOT Division of Aeronautics support. The results are used to develop comprehensive airport pavement maintenance plans utilized by CDOT Division of Aeronautics and the FAA in determining capital improvement funding needs and priorities. Maintenance of existing airfield pavement is eligible for Colorado Discretionary Aviation Grant (CDAG) funding which prioritizes airfield movement area pavements. Airports can also utilize CDOT Division of Aeronautics Crack Fill Program that provides financial support to airports who purchase and apply pavement crack fill materials to help offset maintenance costs. Additional information about CDOT Division of Aeronautics' grant programs is available in Section 4.10. Revenue Generation and Funding.

4.6.4. Instrument Approach Capability

An instrument approach procedure (IAP) is a series of predetermined maneuvers for the orderly transfer of an aircraft under instrument flight conditions from the beginning of the initial approach to a landing or the point at which the landing may be conducted visually. Because visual approaches cannot be conducted during Instrument Meteorological Conditions (IMC), IAPs provide all-weather airport access and extend an airport's operability during poor weather. Airports without an IAP cannot support critical services such as emergency access, medical evacuation, and search and rescue operations during inclement weather conditions. An IAP requires specialized airport instrumentation, as well as redundant electrical systems and improved approach area, runway, and taxiway lighting systems in many cases.[8]

Winter military operations at Steamboat Springs Airport (Stacy Fain)

Due to their role in airport safety and resiliency, emergency service providers identified the implementation of instrument approach procedures and the installation of approach lighting as a key priority to facilitate effective and efficient emergency services in Colorado. Airports that identified an IAP as a significant need include Limon Municipal (LIC) and Steamboat Springs (SBS). These two airports plus Harriet Alexander Field (ANK) were also noted during the emergency service provider workshop as needing instrument approach procedures. Rural Partners in Medicine also recognized the need to improve airports'

[8] FAA. (2016). United State Standard for Terminal Instrument Procedures (TERPS), Order 8260.3C. Available online at www.faa.gov/documentLibrary/media/Order/FAA_Order_8260.3C.pdf (accessed 30 April 2019).

operability during inclement weather. However, the organization observed that this issue may be mitigated as airports adopt the FAA's ADS-B NextGen requirements, which will reduce associated visibility minimums.

For additional information about NextGen, as well as obstacles that some rural airports may face during deployment, see Section 4.11. Technology.

4.7. Land Use Planning and Encroachment

As population and industry continue to grow, so too does the demand for land development. As new residents move into an area, residential and commercial developments generally sprawl outward. Housing, schools, medical facilities, roads, retail establishments, and many other types of institutions are constructed or expanded to meet the new population's needs, governed by land use regulations generally designed to ensure capability between adjoining or nearby types of development. It is up to a city, county, or other jurisdictional authority to ensure that activities on one parcel of land do not negatively impact activities occurring in its vicinity in terms of safety, nuisance, or otherwise.

Airport land use compatibility practices are designed to promote the safety of aircraft, their passengers, and the people and property on the ground, as well as mitigate the potential nuisance associated with overhead aircraft operations. The FAA has established airport compatible land use guidelines that consider the unique safety and noise issues inherent to incompatible development within the vicinity of an airport. The Transportation Research Board's (TRB) *Airport Cooperative Research Program (ACRP) Report 27: Enhancing Airport Land Use Compatibility, Volume 1: Land Use Fundamentals and Implementation Resources* provides guidance to help protect airports from incompatible land uses that impair current and future airport and aircraft operations and safety. *Volume 2: Land Use Survey and Case Study Summaries* includes 15 case studies targeting a wide range of airports and land use issues covering a geographically diverse set of large commercial service, military, and GA airports.[9] While airport land use compatibility guidelines are well established, the authority to codify into regulation and enforcement falls to the local level. An airport is faced with land use compatibility issues when development occurs in its vicinity that does not align with the best practices identified by the FAA and TRB, or when adjacent development simply leaves no space for the airport to expand. Land use incompatibility can lead to degraded airport operations, limited economic development opportunities, lost value of public investment, decline in transportation access, and increased safety risks.

Airports throughout Colorado report that they are losing the potential for growth because of encroachment from residential and commercial properties spurred by the state's population increases and shifting migration patterns. Most notably, airports in the Front Range are simultaneously losing their ability to expand while facing increased pressure to meet the growing demands for aviation

[9] Both ACRP documents are available online at www.trb.org/Publications/Blurbs/163344.aspx (accessed July 2019).

services in their region. Major developments planned for the Front Range include large residential growth around airports, which could in turn hinder their abilities to expand operations. As Centennial (APA) notes, "Continued robust economic activity will drive growth at Centennial for years to come but at a price: residential encroachment requires compatible land use planning to remain successful." Lands surrounding Colorado Springs Municipal (COS) and Meadow Lake (FLY) airports are being rapidly converted to residential development, prompting significant concerns by the airports, CDOT Division of Aeronautics, and local government officials.

Colorado Springs Municipal Airport

In December 2018, the Pikes Peak Area Council of Governments (PPACG) released the Colorado Springs Regional Joint Land Use Study (JLUS) which recognizes the multiple jurisdictions and mixed land uses found within the area.[10] A collaborative effort between the communities within El Paso, Fremont, Pueblo, and Teller counties including five military installations (U.S. Air Force Academy, Fort Carson, Peterson AFB, Cheyenne Mountain Air Station, and Schriever AFB), the study identified multiple land use and safety compatibility issues between civilian and military activities. Many of these issues relate to navigable airspace and other flight operations. The JLUS implementation strategies include (but are not limited to) the need for increased communications and collaboration between military and civilian stakeholders, additional mapping and data tools to manage encroachment issues, and formalized policies to minimize incompatible land uses and development affected by military flight operations.

While seemingly ubiquitous in Colorado's urban core, this issue can arise in any area where aviation activities and nearby land uses come into conflict. A recently constructed hospital adjacent to Meeker/Coulter Field (EEO) has raised concerns about the airport's future expansion potential, as well as noise and safety issues specific to hospitals.

Local governments can take an active role in land use planning and control by enacting and enforcing airport-compatible height and land use zoning. Colorado Revised Statutes (CRS) Section 43-10-113, *Safe Operating Areas Around Airports - Establishment* directs government agencies with zoning and building permit authority to protect land areas from height obstructions into navigable airspace as defined in 14 Code of Federal Regulations (CFR) Part 77, *Safe, Efficient Use, and Preservation of Navigable Airspace*. CRS Section 43-10-103, *Division of Aeronautics - Duties*, directs CDOT Division of Aeronautics to assist the FAA and local governments in identifying and controlling these potential obstructions. Airports can also access SIB Loan Program funds to acquire land to protect from incompatible land uses.[11] Additional information about airport compatible land use and control is provided in **Chapter 3. Supplemental System Context**.

[10] PPACoG. (2018). *Colorado Springs JLUS*. Available online at www.ppacg.org/jlus-study-report/ (accessed July 2019).
[11] CDOT Aeronautics. (28 January 2018). *Program and Procedures Manual, v6.3*. p. 41. Available online at www.codot.gov/programs/aeronautics/ProgramProcManual/view (accessed July 2019).

4.8. Pilot / Aviation Workforce Shortage

As the demand for air travel increases, so too does the need for qualified aviation professionals including pilots, mechanics, air traffic controllers, and others. Over the past 60 years, the overall U.S. labor pool has been on the decline, and fewer former military personnel are available for transition from military to civilian employment to fill positions in the aviation industry. At the same time, the global economy is growing and increasingly competitive, exacerbating the demand for skilled workers.[12] Additionally, other changes, such as the need for some college, military experience, and/or specialized training and licensure, can deter or prevent a potential student or professional from pursuing a career in aviation. With a demanding workplace and little room for error, "the complexities of the system require a workforce that is highly educated, trained, and experienced."[13]

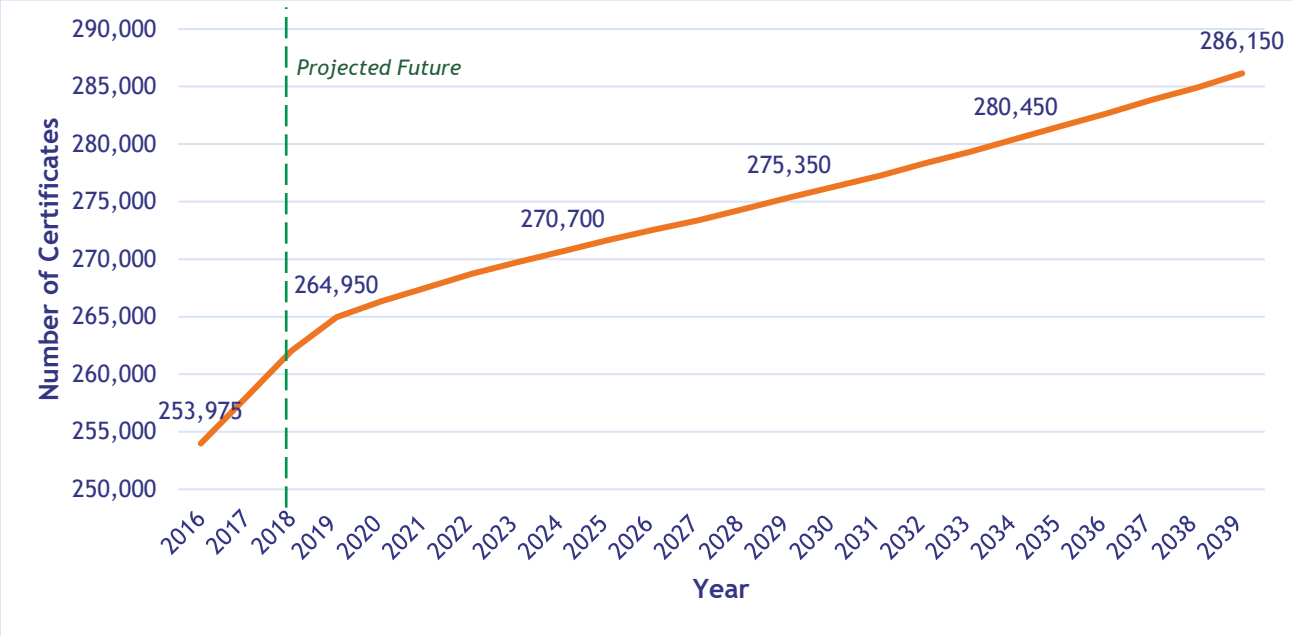
4.8.1. Pilots

Nearly all CASP stakeholders identified the international pilot shortage as an issue of major concern for the Colorado aviation system. By 2022, nearly 20,000 U.S. airline pilots will reach the FAA's mandatory retirement age of 65, causing ripple effects throughout the entire U.S. economy.[14] The industry has faced a number of challenges over the last several decades, including new regulations that increased flight time requirements for commercial pilots, fewer military-trained pilots entering a civilian aviation career, and high educational costs coupled with low starting salaries for new pilots. As a result of these and other issues, student pilots are not matriculating quickly enough to fill commercial pilot positions. Further exacerbating the issue, the need for pilots continues to grow as demand for aviation services increases domestically and abroad. This issue was noted by several airports and 11 of the 20 respondent groups interviewed as part of the CASP, including the PAC.

While demands are not currently being met, the FAA's *Aerospace Forecast Fiscal Year 2019-2039* indicates that the impending crisis may by waning: The number of all pilot certificates except rotorcraft- and recreation-only certificates is rising.[15] Most pertinently, the number of commercial and air transport pilots (ATP) has increased over the last two years and is anticipated to continue to do so through the 2039 forecast horizon. **Figure 4.3** depicts the historical and future number of commercial and ATP certifications in the U.S.

[12] TRB. (July – August 2016). *The Aviation Workforce of Tomorrow*. Available online at onlinepubs.trb.org/Onlinepubs/trnews/trnews304feature.pdf (accessed July 2019).
[13] Ibid. p. 8.
[14] Aviation Week Network. (2015). *The Coming U.S. Pilot Shortage is Real*. Available online at aviationweek.com/commercial-aviation/coming-us-pilot-shortage-real (accessed May 2019).
[15] FAA. (2019). *Aerospace Forecasts: FY 2019-2039*. Available online at www.faa.gov/data_research/aviation/aerospace_forecasts/media/FY2019-39_FAA_Aerospace_Forecast.pdf (accessed May 2019).

Figure 4.3. Historical and Projected Future U.S. Commercial and ATPs (2016 – 2039)



Source: FAA Aerospace Forecast 2019-2039

Indications likewise suggest that the number of student pilot certificates are growing, although the FAA's student pilot forecast is currently suspended. The number of student pilots has been affected by two recent regulatory changes (in 2010 and 2016), which have cumulatively resulted in significant growth in the number of student pilots from 119,119 in 2010 to 167,804 in 2018. It is important to note that the 2016 change removed the expiration date on new student pilot certificates and effectively broke the link between students and advanced certificate levels of private pilot or higher. The FAA reports that the 2016 change is too new to perform a reliable forecast for student pilots.

4.8.2. Maintenance Technicians

Critical for the safe continued operation of aircraft, aircraft maintenance technicians must complete 18 months of practical work experience applicable to either an airframe or power plant rating. If a technician wants to earn both ratings, they must complete a certified aviation maintenance program or demonstrate 30 months of applicable experience. Each rating requires 400 hours of general course work and 750 hours related to airframe or power plant technology. This education can be obtained at several collegiate programs across the country that offer two-year technical degrees in aircraft maintenance. Not only are airlines and aircraft maintenance, repair and overhaul (MRO) firms hiring technician graduates, other industries (such as the automobile industry) are also hiring graduates creating competition for a limited technician workforce.

4.8.3. Air Traffic Controllers

Strict medical and psychological screening, age, educational, and work experience requirements limit the potential pool of future air traffic controllers. A required retirement from active duty at age 56 also contributes to the need for a new generation of controllers, while controllers are not able to start

after age 31. It is expected that nearly 12,000 of the 14,000 current controller workforce will be lost by 2026.[16]

4.8.4. Airport Operators

The operational requirements of each airport facility vary based on the type of operations supported. For example, airports that serve air carrier operations must meet a variety of strict operational requirements to maintain certification. An airport operator must undergo training in a variety of focus areas including airfield inspections, pavement maintenance, wildlife control, security, snow and ice control, and more.

4.8.5. Colorado Response

CNCC students at the Rangely Airport

While recent trends show positive growth in terms of student and matriculated pilots, it is essential that federal and state government officials, airports, educational institutions, and private industry work to mitigate the financial and other barriers for students considering a career in aviation. Colorado has developed some interesting pilot training programs that are affordable and incentivize pilots to stay within the region upon receiving their license. Colorado Northwestern Community College (CNCC) conducts its Aviation Technology Flight program from the Rangely Airport (4V0). Students can receive a range of certifications from Private Pilot to Certified Flight Instructor. Additionally, CNCC's partnership with Metropolitan State University at Denver (MSU) allows students to conduct their flight training portion of a Bachelor of Arts in aerospace from MSU at the CNCC facility. This partnership allows for the costs of the program to be among the lowest in the nation. CNCC also offers the Aviation Maintenance Technology Program, a 21-month, FAA-certified (FAR Part 147) training for aircraft mechanics. CDOT Division of Aeronautics also currently partners with Colorado airports to support internship programs as well as supporting various aviation education efforts through the Aviation Education Grant Program. These programs support aviation education as prescribed by CDOT Division of Aeronautics' enabling legislation, CRS Section 43-10.[17] With programs like these, Colorado is on the leading edge of addressing one of the biggest potential threats facing the aviation industry in the coming decades.

The Metropolitan State University of Denver (MSU) Department of Aviation and Aerospace Science is one of the nation's most prestigious aviation education programs and is the largest program in Colorado. MSU Denver Aviation has approximately 650 enrolled students that can choose from eight unique degrees. MSU operates the Aeronautics and Aerospace Systems Laboratories, which offers simulation technology for flight training, air traffic control, satellite engineering, aerospace operations and unmanned aerial systems (UAS). MSU Denver is focused on professional development and maintains strong relationships with seven airlines, three international aerospace contractors, multiple professional organizations, Denver International Airport, and the CDOT Division Of Aeronautics.

[16] TRB. (July – August 2016). p. 10.
[17] CDOT Aeronautics. (2018). 2018 Annual Report. Available online at www.codot.gov/programs/aeronautics/PDF_Files/AnnualReports/2018-annual-report (accessed July 2019).

4.9. Public Engagement / Government Support

System Viability

Economic Sustainability

Publicly owned airports depend on the support of their communities which, in turn, drives the support and engagement of local and state policymakers. A level of understanding into the value of aviation is required to justify the funding necessary for major capital improvements and operating costs, as well as the regulations needed to ensure that airports can operate safely and efficiently with neighboring development. This is particularly important at airports without robust revenue streams, as local matches are required for both state and federal funding (see Section 4.10.1 for additional information). With community buy-in and local government support, it is more likely that airports will receive financial support during local budget preparations.

Community aviation expo flyer, Glenwood Springs Municipal Airport

Some airport managers and stakeholders find it difficult to demonstrate the value of aviation to the community. Without that demonstrable value, community members and local government agencies can be dismissive of their airport's needs. The Colorado Aviation Business Association notes that there is a general negative perception of the aviation system, particularly non-commercial aviation, amongst citizens and local officials. Furthermore, some local officials see airports as an expensive nuisance that takes funding away from other items in the transportation budget. The Colorado Pilot's Association cited cases in which municipal officials have become unfriendly toward their local airports; that hostility has led to funding reprioritizations that put airports at a disadvantage. CNCC pointed out that many communities do not see the value of their local GA airport unless there is an emergency. Despite such examples, bright spots do exist: OEDIT specifically lauded the support that the aviation industry receives across the Front Range, which is a well-established aviation hub in the state. The western and southwestern slopes, on the other hand, may need more community and local government support to ensure continued aviation development in those regions.

It is likely that the relationship between local officials and airports is less based on hostility than a lack of understanding of the economic and quality-of-life benefits that airports bring to their communities. Recognizing the importance of communicating the value of airports to local communities and the entire state, CDOT Division of Aeronautics prepared the Colorado Aviation Economic Impact Study (CEIS) in 2008, 2013, and an update is currently underway in conjunction with the CASP. The CEIS includes development of airport-specific outreach materials that identify the qualitative and quantitative benefits of airports to their specific communities. These materials include information for key target audiences such a policymakers and community members whose lives have been enhanced through aviation. A new program put together by CDOT Division of Aeronautics will also offer an educational "Governance 101" class for elected officials in communities with airports. Furthermore, CDOT Division of Aeronautics proactively partners with state agencies and local communities to ensure that the state's aviation system supports the broader transportation system for all Colorado residents, businesses, and visitors.

4.10. Revenue Generation and Funding Challenges

More than one-third of airports and CASP participants reported revenue generation and funding challenges as one of the most important issues facing the Colorado aviation system. Most of the other issues reported can be traced back to a lack of resources available to provide the facilities and services required to meet all aviation user needs. System airports face two interrelated obstacles when trying to obtain adequate resources: public funding and revenue generation. Each of these issues are discussed in turn in the sections that follow.

4.10.1. Public Funding Sources

In general, airport funding is available through the federal Airport Improvement program (AIP); state and local grants; and airport operating revenue from tenant lease agreements, fuel sales, landing fees, and other revenue-generating activities. Access to these various sources depends on several factors including but not limited to airport ownership, inclusion in the FAA's National Plan of Integrated Airport Systems (NPIAS), and eligibility for various state and local funding sources. Project eligibility can likewise differ by funding source. As a result, many airports are faced with funding shortfalls, especially as existing facilities no longer align with shifting demands over time and major capital improvements are required.

The AIP provides federal grants for planning and development to airports included in the NPIAS, and funding is usually limited to improvements related to aircraft operations. Revenue-producing projects, such as hangar storage and fuel farms, are eligible for AIP funding; however, funding is only available after higher priority pavement projects are completed—which is almost never the case. NPIAS airport sponsors who accept AIP grants must also accept 39 grant assurances regarding future airport operations. If an airport is unable to comply with these obligations through the life of the project, the sponsor is required to pay the grant amount back to the FAA.

While there may be some disadvantages when accepting AIP funds such as the grant assurance requirements, these federal entitlements and discretionary funds provide an important and ongoing funding source to NPIAS airports. This is especially the case for GA airports that do not provide scheduled commercial service. Capital improvement projects can be undertaken with only a minor local match ranging from just five percent at certain economically disadvantaged communities to a maximum of 30 percent with 10 percent being the norm for most airports.[18] Most of Colorado's 49 NPIAS airports rely on AIP funding, yet these dollars rarely signify that all of an airport's needs have been met. Pueblo Memorial (PUB) commented, "Current federal funding methods are skewed toward passenger enplanement numbers," explaining that a relatively low percentage of the airport's 20,000 annual operations are scheduled commercial service. Because funding is based on enplanements, current funding mechanisms are inadequate to address the unique needs of their facility: "To put this

[18] Congressional Research Service. (2019). *Financing Airport Improvements*. Available online at fas.org/sgp/crs/misc/R43327.pdf (accessed May 2019).

in perspective, the fixed base operator [FBO] provides more revenue to the airport than commercial operations."

Cortez Municipal Airport

Colorado's 17 non-NPIAS publicly owned airports exclusively rely on non-federal funding sources to ensure their facilities remain in safe operating conditions for the flying public. Without access to federal entitlement or discretionary funds, non-NPIAS airports are at a notable disadvantage in terms of keeping pace with both ongoing maintenance needs and improvements to enhance capacity. CDOT Division of Aeronautics provides funding to all Colorado airports owned by a public agency regardless of inclusion in the NPIAS, as well as privately owned NPIAS facilities. To be used "solely for aviation purposes," these funds are disbursed via the CDAG Program, statewide initiatives, and fuel tax disbursements, pursuant to the program-specific eligibility requirements defined in CRS 43-10-103(4), 43-10-105, 43-10-108.5(2), 43-10-108.5(5), and 43-10-110.[19]

The CDAG Program is the primary vehicle for state discretionary funding and is designed to maintain and improve the statewide aviation system. To qualify for this type of discretionary funding, the proposed project must be consistent with the airport's role in the CASP and included in its five-year capital improvement plan (CIP). Like the NPIAS, airport sponsors must agree to certain state grant assurances to "encourage the safe and efficient operations of airports" for the expected lifetime of the project. In general, AIP-funded projects at NPIAS airports receive 90 percent federal funding with the remainder being split between the state and local sponsor. CDAG-funded airport project costs are shared between the state and local airport sponsors via a 90/10 percent split. While many factors influence grant awards, projects with a higher percent local match are more likely to receive funding.[20]

This brief overview of federal and state funding availability highlights the major challenges that some small GA and non-NPIAS airports face when trying to secure funding for facility improvements or expansions. Since non-NPIAS airports do not receive federal funding, and local sponsors are responsible for a higher percentage match on CDAG-funded projects as compared with their NPIAS counterparts who may receive state matching grants to help offset federal grant match requirements, the non-NPIAS airports struggle to come up with local funding that is the primary source for funding many projects. This issue can be exacerbated at airports that receive little or no local community support. Residents and policymakers may undervalue the benefits of GA, lack funds for a local match, or, in some cases, be actively working to close the airport.

Local matching dollars are simply not available in many economically disadvantaged, often rural, areas of the state. These communities find it difficult to set aside money for the local match and deferred maintenance needs may grow over time. The Colorado OEDIT expressed a similar concern, noting that there is an overall lack of funding to support improvements for rural airports. Cortez Municipal (CEZ)

[19] CDOT Division of Aeronautics. (2019). Programs and Procedures Manual v6.3 (approved January 28, 2019). Available online at www.codot.gov/programs/aeronautics/ProgramProcManual/view (accessed May 2019).
[20] Ibid. p. 13.

articulated the issues clearly: "Small airport means small revenue. Entirely reliant upon federal involvement for capital improvements. Only the smallest of projects can be handled at a local level, and they must be with the help of the [CDAG] Program."

In addition to airports' abilities to access public funding through these various funding sources, each mechanism defines the type of project eligible to receive grant money. Airports such as Centennial (APA), Durango-La Plata County (DRO), and Grand Junction Regional (GJT) have unmet needs due to project ineligibility. Secondary and crosswind runways, additional ramp space, and other projects were all reported as either ineligible for FAA funding or too low in the priority rating system—leaving unmet needs at airports across the state.

On a broad scale, Colorado's significant growth has left airports struggling to keep pace with growing demands. Echoing the sentiments of many airports, Durango-La Plata County (DRO) commented,

> *DRO has seen its enplanements more than double in the past 15 years, and demand continues to grow. Facilities must be expanded to meet this demand, but the cost of development is outpacing the funding mechanisms available to many regional airports. A rigid Passenger Facility Charge (PFC) cap and stagnant AIP funding have resulted in deferred projects at DRO. Non-aeronautical revenue, which is a key driver of capital investment funding, can be difficult to generate outside of high-volume markets.*

Funding issues prompted Denver International (DEN) to pursue a 34-year public-private partnership (P3) contract for the massive Great Hall project valued at approximately $1.8 billion. The renovation will expand capacity of the terminal to support 80 million passengers annually, modernize and relocate the security screening areas, consolidate the airlines' ticket counters, and create additional revenue-producing concession areas. As part of the partnership, Ferrovial Aeropuertos and its partners will make a total investment of an estimated $378 billion to be paid back over time through a combination of payments and a 20 percent share of concession revenues for 30 years.[21] The deal has provided a solution to the airport's capacity concerns and funding shortfalls, but the deal has brought some criticism due to the loss of revenue for the airport, particularly over the long term.[22] The airport had evaluated other options and determined that this P3 was the best option to get the project underway in the near term to provide the needed capacity.

Fuel at Craig-Moffat Airport

Like many types of public infrastructure, public funding will likely always be a challenge for airports. The complexity of the Colorado aviation system with its strong urban/rural divide and mountainous terrain only increases the challenge of prioritizing funding to the various airport capital improvement needs. Airports, funding agencies and other aviation stakeholders should regularly monitor communities' abilities to equitably

[21] "Denver airport P3 approved." (18 August 2017). Available online at www.infrapppworld.com/news/megaproject-991-denver-airport-p3-approved (accessed July 2019).
[22] Murray, Jon. (2017). "As vote looms on $1.8 billion Denver International Airport project, a question hangs in the air: Is it a good deal?." Available online at www.denverpost.com/2017/08/06/denver-international-airport-terminal-partnership-renovation-city-council-vote/ (accessed July 2019).

access federal and state funding, so all regions and communities can safely access the economic and quality of life benefits provided by aviation.

4.10.2. Revenue Generation

Some airports generate revenue via on-airport activities such as land leases for aeronautical and non-aeronautical purposes and fuel flowage and landing fees. Self-sufficiency is a goal of most airports, and local sponsors are constantly working to find innovative ways to generate revenue in support of their operations. Revenue generation is particularly important for GA airports, as they do not collect PFCs and non-NPIAS airports do not receive federal AIP entitlements or discretionary funds (as described above). Because revenue-generating projects are often ineligible for federal funding, local sponsors are typically responsible for making initial capital investments. CDOT Division of Aeronautics does have the ability to fund revenue-generating projects which provides an opportunity to assist airports, however, it is dependent on available state funding and other priorities. Alternatively, airports can partner with third-party private investors (often via a ground lease) to provide the amenities that draw pilots and aircraft owners such as hangar space, fuel, and FBOs and other aviation-related businesses. The ultimate return on these partnerships may not be as lucrative as self-funded revenue-enhancing endeavors, although associated risks may be lower.

Solar array at Rifle Garfield County Airport

In addition to aviation-related activities, airports can also implement non-aviation-related strategies such as providing parking, ground transportation, or rental cars; offering concessions and retail opportunities; selling advertising space; leasing land for renewable energy production; and promoting compatible commercial development such as office buildings, business parks, and hotels.

The viability of these strategies is highly dependent on location, with more opportunities generally available to urban airports and those located within close proximity to tourism destinations (e.g., ski areas), as well as obtaining FAA consensus for NPIAS airports.

During the inventory process and stakeholder interviews of the CASP, three key trends emerged closely associated with available funding and revenue generation: the ability to support larger aircraft, hangar availability, and fuel availability. As aviation stakeholders consistently recognized these items as critical to the ability of the system to support existing and future needs, each has been discussed separately in the body of this chapter (see sections 4.3, 4.5, and 4.4 respectively).

4.11. Technology

Technological changes designed to make the country's skies safer, more secure, and better able to meet current demands are impacting all facets of the aviation industry. This section discusses the two main technological advancements most predominately cited by Colorado aviation system stakeholders as being of highest concern: UAS and NextGen.

4.11.1. Unmanned Aerial Systems

While UAS are relatively new to the U.S. airspace system, they have become immensely popular for recreational, commercial, and governmental use. The Colorado Oil and Gas Association, for example, uses drones to inspect oil fields. One operator at a Colorado airport reported using his drone to count remote cattle herds. The FAA has established some regulations governing the use of drones, including mandating recreational users fly at or below 400 feet when in uncontrolled (i.e., Class G) airspace and outlawing flight near most airports. In May 2019, the FAA implemented a new rule that requires drone operators to obtain preauthorization before flying in controlled airspace around airports. This new requirement replaces an old requirement that simply mandated that drone operators notify the airport operator and ATCT prior to flying within five miles. Preauthorization will eventually be available through the Low Altitude Authorization and Notification Capability (LAANC) system; until that system is operational recreational flyers who want to operate in controlled airspace may only do so at fixed sites. Recreational flyers must also pass an aeronautical knowledge and safety test before flying.[23] Despite these steps, some aviation stakeholders believe that current rules are insufficient and UAS operators are either unaware of or noncompliant with them.

The Colorado Agricultural Aviation Association (CAAA) is particularly concerned about the threat of mid-air collision during low-altitude agricultural application. The CAAA is not alone in this concern; in fact, the Colorado Pilots Association, CNCC, the UCAR Research Aviation Facility, and emergency services providers all noted serious concerns about unregulated drones interfering in shared airspace and associated safety concerns for regulated aircraft operations. It is interesting to note that no airport in the Colorado system reported UAS as an issue of significant concern, although many had implemented communications procedures so operators could inform airport administrations of ongoing operations near their airfields.[24] To further investigate the potential impacts of UAS in Colorado, CDOT Division of Aeronautics is preparing to conduct the Urban Air Mobility (UAM) study. This study will assess how UAS may impact airspace operations, as well as demand for air taxi and scheduled commercial services.

UAS Colorado is a non-profit business league that supports and promotes the safe integration of UAS into the aerospace industry by working together with public agencies, private firms, and government entities to establish designated flight testing areas around the state. Two such areas are located in Chaffee County near Buena Vista and in the San Luis Valley north of Alamosa. The San Luis Valley testing area encompasses 8,100 square miles of operational airspace up to 15,000 feet while the Chaffee County testing area allows UAS to fly in the Arkansas Valley outside a five-mile radius from Harriet Alexander Field (ANK) in Salida and Central Colorado Regional Airport (AEJ).

[23] FAA. (16 May 2019). "FAA Highlights Changes for Recreational Drones." Available online at www.faa.gov/news/updates/?newsId=93769 (accessed July 2019).
[24] Airport sponsors and ATCTs are no longer authorized to give permission for UAS to operate in their vicinity per the FAA's most recent (May 2019) rule mandated under the FAA's Reauthorization Act of 2018 as described in the preceding paragraph.

4.11.2. NextGen Air Transportation System

NextGen is a long-term plan by the FAA to transform the way the U.S. air transportation system operates. Very broadly, it aims to shift air navigation from a ground-based to a satellite-based system through the modernization of aircraft tracking, communication, and weather-monitoring and forecasting systems. The benefits of this transformation include shorter flight routes, increased operational efficiencies, reduced fuel consumption, reduced congestion and delay, reduced environmental impacts, airport and airspace capacity maximization, and greater aircraft safety.

Despite the many positives associated with NextGen implementation, there are equity concerns when considering the roll-out of new technology. The most pressing current issue associated with NextGen deployment is the upcoming Automatic Dependent Surveillance-Broadcast (ADS-B) requirements. The FAA has mandated that all aircraft operating in airspace defined in 14 CFR Section 91.225 become ADS-B out equipped by January 1, 2020. This requires the installation of a specialized out transmitter and a compatible global positioning system (GPS) position source. While the deadline is looming, a small percentage of aircraft have met this requirement. An insufficient number of aviation professionals are available for installation and many older aircraft may be challenged to adapt to the new technology.

Beyond the requirements for aircraft, some airports may struggle to adapt to the changing technologies of NextGen. As has been discussed, there is a strong urban/rural divide in Colorado, with many rural and GA airports throughout the state struggling to maintain existing facilities. If this pattern of uneven development continues, significant discrepancies may arise during NextGen deployment. If smaller GA operators at airports do not have the means to acquire NextGen technology, these airports may be at a further disadvantage within the system and GA operations could further decrease. NextGen may be a promising technological advancement in many ways for the aviation industry, but it will be important to closely monitor how these technological advancements have the potential to impact the Colorado aviation system in the long-term.

4.12. Summary

In the coming decades, Colorado is anticipated to outpace much of the rest of the nation in terms of population and economic growth, and the state already sits on the cutting edge of technological advancements that will shape the future of our nation's airspace. CDOT Division of Aeronautics, airports, and the many users who rely on the state's aviation system must continue to take a proactive planning approach to keep pace with these rapid evolutions. Because many of the trends identified by this study affect urban and rural areas differently, strategies should be identified to ensure equitable access to all aviation services in the coming decades. These issues will be carefully considered during the development of the CASP's final recommendations and highlighted when relevant to specific performance measures analyzed in subsequent phases of this study.