



3 Facility Requirements

Proper airport planning requires the translation of forecasted aviation demand into the specific types and quantities of facilities that can adequately serve the identified demand. This chapter analyzes the existing capacities of facilities at Gainesville Municipal Airport (GLE). The existing capacities are then compared to the forecasted activity levels prepared in Chapter Two to determine the adequacy of the existing facilities and identify whether deficiencies currently exist or may be expected to materialize in the future. This chapter presents the following elements:

- Planning horizon activity levels
- Airfield capacity
- Airport physical planning criteria
- Airside and landside facility requirements

This exercise is intended to identify the adequacy of existing airport facilities, outline what new facilities may be needed, and determine when new facilities may be needed to accommodate forecasted demand. After establishing these facility requirements, alternatives for providing these facilities will be evaluated in the next chapter to determine the most practical, cost-effective, and efficient means for implementation.

The facility requirements for GLE were evaluated using guidance contained in several Federal Aviation Administration (FAA) publications, including the following:

- FAA Advisory Circular (AC) 150/5300-13B, *Airport Design*, Change 1
- AC 150/5060-5, *Airport Capacity and Delay*
- AC 150/5325-4B, *Runway Length Requirements for Airport Design*
- Federal Aviation Regulation (FAR) Part 77, *Objects Affecting Navigable Airspace*
- FAA Order 5090.5, *Formulation of the National Plan of Integrated Airport Systems (NPIAS) and the Airports Capital Improvement Plan (ACIP)*

DEMAND-BASED PLANNING HORIZONS

An updated set of aviation demand forecasts for GLE was established and detailed in Chapter Two. These activity forecasts include annual aircraft operations, based aircraft, aircraft fleet mix, and peaking characteristics. With this information, specific components of the airfield and landside system can be evaluated to determine their capacity to accommodate future demand. The forecasts were submitted to TxDOT – Aviation for review and approval and were subsequently approved in January 2026 (see **Appendix B**).

Cost-effective, efficient, and orderly development of an airport should be based more on actual demand at an airport than on a time-based forecast figure. To develop a master plan that is demand-based, rather than time-based, a series of planning horizon milestones has been established that takes into consideration the reasonable range of aviation demand projections. The planning horizons are the short term (years 1-5), the intermediate term (years 6-10), and the long term (years 11-20).

It is important to consider that the actual activity at the airport may be higher or lower than what the annualized forecast portrays. By planning according to activity milestones, the resultant plan can accommodate unexpected shifts or changes in the area’s aviation demand by allowing airport management the flexibility to make decisions and develop facilities based on need generated by actual demand levels, rather than dates in time. The demand-based schedule provides flexibility in development, as development schedules can be slowed or expedited according to demand at any given time over the planning period. The resultant plan provides airport officials with a financially responsible and needs-based program. **Table 3A** presents the short-, intermediate-, and long-term planning horizon milestones for each aircraft activity level forecasted in Chapter Two.

TABLE 3A | Aviation Demand Planning Horizons

	Base Year (2024)	Short Term (1-5 Years)	Intermediate Term (6-10 Years)	Long Term (11-20 Years)
BASED AIRCRAFT				
Single-Engine	92	98	106	122
Multi-Engine	15	14	10	7
Turboprop	2	4	6	10
Jet	5	7	10	16
Helicopter	1	3	4	6
Other	0	0	2	5
Total Based Aircraft:	115	126	138	166
ANNUAL OPERATIONS				
Itinerant				
Air Carrier	0	0	0	0
Air Taxi	279	300	300	400
General Aviation	28,319	30,000	31,200	34,000
Military	15	100	100	100
Total Itinerant	28,613	30,400	31,600	34,500
Local				
General Aviation	85,383	91,400	95,900	106,000
Military	0	0	0	0
Total Local	85,383	91,400	95,900	106,000
Total Annual Operations:	114,451	121,800	127,500	140,500

Source: Coffman Associates analysis

AIRFIELD CAPACITY

An airport’s airfield capacity is expressed as annual service volume (ASV), which is a reasonable estimate of the maximum level of aircraft operations that can be accommodated in a year without incurring significant delay factors. As aircraft operations near or surpass the ASV, delay factors exponentially increase. The airport’s ASV was examined utilizing FAA AC 150/5060-5, *Airport Capacity and Delay*.

FACTORS AFFECTING ANNUAL SERVICE VOLUME

This analysis takes into account specific factors about the airfield in order to calculate the airport’s ASV. These various factors are depicted in **Exhibit 3A**. The following describes the input factors as they relate to GLE, including airfield layout, weather conditions, aircraft mix, and operations.

- Runway Configuration** | The existing airfield configuration consists of two runways in a crosswind configuration. Primary Runway 18-36 is 6,000 feet long and 100 feet wide. Crosswind Runway 13-31 is 4,307 feet long and 75 feet wide. Runway 36 has published instrument approach visibility minimums down to ¾-mile, and Runway 18 provides instrument approach minimums down to ⅞-mile. Runway 13-31 is not equipped with instrument approach procedures.

- Runway Use** | Runway use in capacity conditions is controlled by wind and/or airspace conditions. For GLE, the direction of takeoffs and landings is typically determined by the speed and direction of the wind. It is generally safest for aircraft to take off and land into the wind, avoiding crosswind (wind blowing perpendicular to the travel of the aircraft) or tailwind components during these operations. Runway usage data sourced from the airport’s Virtower ADS-B data is summarized in **Table 3B**. The runway usage data show that most arrivals and departures utilize Runway 18, followed by Runway 36.

TABLE 3B | Runway Usage

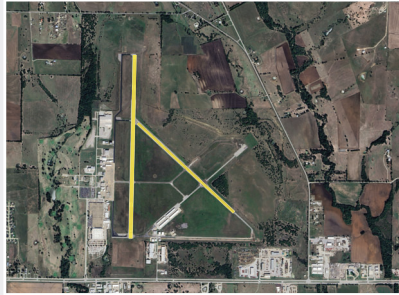
	Takeoffs	Landings
Runway 18	58%	63%
Runway 36	32%	31%
Runway 13	7%	1%
Runway 31	3%	5%

Source: Virtower, data available between June 1, 2024, and May 31, 2025

- Exit Taxiways** | Exit taxiways have a significant impact on airfield capacity because the number and locations of exits directly determine the occupancy time of an aircraft on the runway. The airfield capacity analysis gives credit to taxiway exits located within the prescribed range from a runway’s threshold. This range is based on the mix index of the aircraft that use the runways. Based on mix, only exit taxiways between 2,000 feet and 4,000 feet from the landing threshold count in the exit rating at GLE. The exits must be at least 750 feet apart to count as separate exit taxiways. Utilizing these criteria, Runway 18-36 and Runway 13-31 are each credited with one exit taxiway.
- Weather Conditions** | Weather conditions can have a significant impact on airfield capacity. Airport capacity is usually highest in clear weather when flight visibility is at its best. Airfield capacity is diminished as weather conditions deteriorate and cloud ceilings and visibility are reduced. As weather conditions deteriorate, the spacing of aircraft must increase to provide allowable margins of safety and air traffic vectoring. The increased distance between aircraft reduces the number of aircraft that can operate at the airport during any given period, thus reducing overall airfield capacity.

AIRFIELD LAYOUT

Runway Configuration



Runway Use



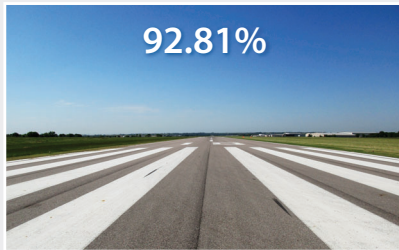
Number of Exits



WEATHER CONDITIONS

VMC (VFR)

Visual Meteorological Conditions



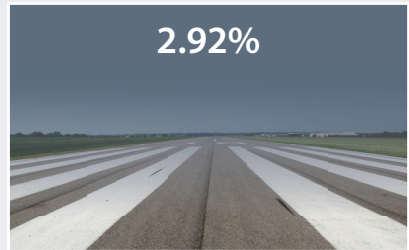
IMC (IFR)

Instrument Meteorological Conditions



PVC

Poor Visibility Conditions



AIRCRAFT MIX

Category A & B Aircraft



Category C Aircraft



Category D Aircraft



OPERATIONS

Arrivals



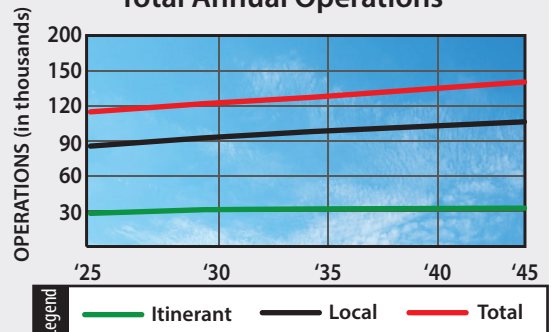
Departures



Touch-and-Go Operations



Total Annual Operations



According to local meteorological data, the airport operates under visual meteorological conditions (VMC) approximately 92.81 percent of the time. VMC exist whenever the cloud ceiling is greater than 1,000 feet above ground level (AGL) and visibility is greater than three statute miles. Instrument meteorological conditions (IMC) are defined when cloud ceilings are between 500 and 1,000 feet AGL or visibility is between one and three miles. Poor visibility conditions (PVC) apply for cloud ceilings below 500 feet and visibility minimums below one mile. **Table 3C** summarizes the weather conditions experienced at the airport over a 10-year period.

TABLE 3C | Weather Conditions

Condition	Cloud Ceiling	Visibility	% of Total
VMC	≥ 1,000' AGL	≥ 3 statute miles	92.81%
IMC	≥ 500' AGL and < 1,000' AGL	≥ 1 to < 3 statute miles	4.27%
PVC	< 500' AGL	< 1 statute mile	2.92%
AGL = above ground level		PVC = poor visibility conditions	
IMC = instrument meteorological conditions		VMC = visual meteorological conditions	

Source: Gainesville Municipal Airport, TX Station ID 72255293929, observations from 1/1/2015 through 12/31/2024

- Aircraft Mix** | The aircraft mix for the capacity analysis is defined in terms of four aircraft classifications. Classes A and B consist of small- and medium-sized propeller aircraft and some jet aircraft, all of which weigh 12,500 pounds or less. These aircraft are primarily associated with general aviation activity but include some air taxi, air cargo, and commuter aircraft. Class C consists of aircraft that weigh between 12,500 pounds and 300,000 pounds. These aircraft include most business jets and some turboprop aircraft that utilize the airport on a regular basis. Class D consists of aircraft that weigh more than 300,000 pounds.

Most operations at GLE are by aircraft in Classes A, B, and C. According to Virtower ADS-B data collected from June 2024 through May 2025, there were approximately 700 total operations by Class C aircraft at GLE, which represents approximately 0.6 percent of all operations. Class D aircraft do not operate at GLE; therefore, remaining operations are within Classes A and B, which represent 99.4 percent of total operations. It is anticipated that operations by Class C aircraft will represent approximately 2.3 percent of total operations by 2045.

- Percent Arrivals** | The percentage of arrivals as they relate to total operations of the airport is important in determining airfield capacity. Under most circumstances, the lower the percentage of arrivals, the higher the hourly capacity will be. The aircraft arrival/departure percentage split at general aviation airports is typically 50/50, which is the case at GLE.
- Touch-and-Go Activity** | A touch-and-go operation involves an aircraft making a landing and then an immediate takeoff without coming to a full stop or exiting the runway. As previously discussed in Chapter Two, these operations are normally associated with general aviation training activity and are classified as local operations. A high percentage of touch-and-go traffic normally results in a higher operational capacity because one landing and takeoff occurs within a shorter period than individual operations. Touch-and-go operations at GLE accounted for approximately 75 percent of total operations in 2025. This percentage is anticipated to remain generally steady over the planning period.

- Peak Period Operations** | Average daily operations and average peak hour operations during the peak month are utilized for the airfield capacity analysis and are based on operational data collected from Virtower. Operations activity is important in the calculation of an airport’s ASV, as peak demand levels occur sporadically. The peak periods used in the capacity analysis are representative of normal operational activity and can be exceeded at various times throughout the year. The forecasts for this master plan identified current average daily operations at 376 operations and current peak hour operations at 49 operations. By the long term, average daily operations are projected to grow to 451, and peak hour operations are projected to increase to 60. This results in an annual operations to average daily demand ratio of 312 through the planning period. The ratio of average daily operations to peak hour operations is 7.5 through the planning period.

CALCULATION OF ANNUAL SERVICE VOLUME

The preceding information was used in conjunction with the airfield capacity methodology developed by the FAA to determine airfield capacity for GLE.

Hourly Runway Capacity

The first step in determining ASV involves the computation of the hourly capacity of the runway configuration. The percentage use of the runways, the amount of touch-and-go activity, and the number and locations of runway exits are the most important factors in determining hourly capacity.

As the operational mix of aircraft at the airport changes to include a higher percentage of Class C aircraft that weigh over 12,500 pounds, the hourly capacity of the system slightly declines. This is a result of the additional spacing and time required by larger aircraft in the traffic pattern and on the runway.

The current and future weighted hourly capacities are presented in **Table 3D**. Weighted hourly capacity is the measure of the maximum number of aircraft operations that can be accommodated on the airfield in a typical hour. It is a composite of estimated hourly capacities for different airfield operating configurations adjusted to reflect the percentage of time in an average year that the airfield operates under each specific configuration. The current weighted hourly capacity on the airfield is 131 operations; the capacity is expected to decline slightly to 128 operations by the long-term horizon.

TABLE 3D | Airfield Capacity Summary

	Base Year (2025)	Short Term (1-5 Years)	Intermediate Term (6-10 Years)	Long Term (11-20 Years)
Operational Demand				
Annual	114,451	121,800	127,500	140,500
Capacity				
Annual Service Volume	308,000	307,000	303,000	299,000
Percent Capacity	37.2%	39.7%	42.1%	47.0%
Weighted Hourly Capacity	131	131	130	128

Sources: FAA AC 150/5060-5, Airport Capacity and Delay; Coffman Associates analysis

Annual Service Volume

The ASV is determined by the following equation:

Annual Service Volume = C x D x H	
C	= weighted hourly capacity
D	= ratio of annual demand to the average daily demand during the peak month
H	= ratio of average daily demand to the design hour demand during the peak month

The current ASV for the airfield has been estimated at 308,000 operations. **The increasing percentage of larger Class C aircraft over the planning period will contribute to a decline in ASV**, lowering it to a level of approximately 299,000 operations by the end of the planning period. With 2025 operations at 114,451, the airport is currently at 37.2 percent of its ASV. Long-range annual operations are forecasted to reach 140,500, which would equate to 47.0 percent of the airport’s ASV.

Table 3D compares the airport’s ASV and projected annual operations over the short-, intermediate-, and long-range planning horizons.

AIRCRAFT DELAY

The effect the anticipated ratio of demand to capacity will have on users of GLE can be measured in terms of delay. As the number of annual aircraft operations approaches the airfield’s capacity, increasing operational delays begin to occur. Delays for arriving and departing aircraft occur in all weather conditions. Arriving aircraft delays result in aircraft holding outside the airport traffic pattern area. Departing aircraft delays result in aircraft holding at the runway end until they can safely take off.

Aircraft delays can vary depending on different operational activities at an airport. At airports where large air carrier aircraft dominate, delay can be greater, given the amount of time these aircraft require in the traffic pattern and on approach to land. For airports that accommodate primarily general aviation aircraft, such as GLE, experienced delay is typically lower because these aircraft are more maneuverable and require less time in the airport traffic pattern.

Table 3E summarizes the potential aircraft delay for GLE. Estimates of delay provide insight into the impacts steady increases in aircraft operations have on the airfield and signify the airport’s ability to accommodate projected annual aircraft operations. The delay per operation represents an average delay per aircraft. It should be noted that delays of five to 10 times the average could be experienced by individual aircraft during peak periods. As an airport’s percent capacity increases toward the ASV, delay increases exponentially. Furthermore, complexities in the airspace system that surrounds an airport can also factor into additional delay experienced at the facility.

TABLE 3E | Airfield Delay Summary

	Base Year (2025)	Short Term (1-5 years)	Intermediate Term (6-10 years)	Long Term (11-20 years)
Percent Capacity	37.2%	39.7%	42.1%	47.0%
Delay				
Per Operation (Seconds)	12	14	15	18
Total Annual (Hours)	382	474	531	703

Sources: FAA AC 150/5060-5, Airport Capacity and Delay; Coffman Associates analysis

Current annual delay is estimated at 12 seconds per aircraft operation, or 382 total annual hours. Analysis of delay factors for the long-term planning horizon indicates that annual delays can be expected to reach 18 seconds per aircraft operation, or 703 annual hours.

CAPACITY ANALYSIS CONCLUSION

FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems*, indicates that improvements for airfield capacity purposes should be considered when operations reach 60 to 75 percent of the ASV. This is an approximate level to begin the detailed planning of capacity improvements. When 80 percent of the ASV is reached, capacity improvement projects should become higher-priority capital improvements. According to this analysis, GLE's weighted hourly capacity, which will range between 131 and 128 operations over the planning period, is well above projected peak hour operations, which are expected to range between 49 and 60 operations. By the long term, projected operations will represent 47 percent of the airport's calculated ASV. As such, significant capacity enhancements at GLE are not warranted. However, options to improve airfield efficiency (such as additional exit taxiways) will still be considered as part of this master plan.

AIRSIDE FACILITY REQUIREMENTS

Airside facilities are related to the arrival, departure, and ground movement of aircraft. Airside facility requirements are primarily based on the runway design code (RDC) for each runway. Analysis in Chapter Two identified an existing and ultimate RDC for each runway. Primary Runway 18-36 was evaluated under three scenarios: general aviation, commercial service, and air cargo. Based on current activity levels as recorded in the FAA's Traffic Flow Management System Count (TFMSC), **the existing RDC for Runway 18-36 is established as B-II-4000**. Given the potential for larger jets to utilize the airport in the future, especially if commercial service and/or air cargo materializes, the master plan has established a future and an ultimate RDC. The **future RDC of C-II-4000** applies primarily to general aviation aircraft but also encompasses some commercial service aircraft, such as an Embraer 135/145. An **ultimate RDC of C-IV-2400** is considered for long-term planning purposes to support air cargo potential. ***It should be clearly noted that the ultimate scenario is not currently justified and is included for conceptual planning purposes only. Additional evaluation and justification would be required to support capital projects based on this design standard.***

The existing and ultimate RDC for crosswind Runway 13-31 has been established as B-I-VIS.

RUNWAYS

Runway conditions (such as orientation, length, width, and pavement strength) were analyzed at GLE. From this information, requirements for runway improvements were determined for the airport.

Runway Orientation

The orientation for wind coverage and the operational capacity of the runway system are important considerations in the runway configuration of an airport. FAA AC 150/5300-13B, *Airport Design*, Change 1, recommends that a crosswind runway be made available when the primary runway orientation provides less than 95 percent crosswind component coverage for an airplane design group.

The all-weather wind rose for the airport is depicted on **Exhibit 3B** and shows that the orientation of Runway 18-36 provides 97.31 percent coverage for the 10.5-knot component and greater than 98 percent coverage for 13-, 16-, and 20-knot components in all weather conditions. In instrument flight rule (IFR) conditions, Runway 18-36 provides greater than 97 percent coverage for each crosswind component. Together, Runway 18-36 and Runway 13-31 provide over 99 percent coverage in all crosswind components (in both all-weather and IFR conditions). Because Runway 18-36 (the primary runway at GLE) provides greater than 95 percent crosswind coverage in all-weather and IFR conditions, a crosswind runway is not needed to meet FAA recommendations for crosswind coverage; however, the *FAA Reauthorization Act of 2024* allows for the reconstruction or rehabilitation of an existing crosswind runway, regardless of the wind coverage of the primary runway, if the crosswind runway qualifies as a “legacy” crosswind runway. A legacy crosswind runway is one that has been previously funded to function as a crosswind runway that is not parallel to the primary runway, when the primary runway alone achieves greater than 95 percent wind coverage. Runway 13-31 is shown on the 2007 GLE ALP set and has previously been maintained using federal grant funds; therefore, Runway 13-31 is eligible to be maintained to A/B-I-5000 design standards. However, analysis in the next chapter will also consider options that include the closure of crosswind Runway 13-31.

Runway Designations

A runway’s designation is based on its magnetic headings, which are determined by the magnetic declination for the area. Runway 18-36 has a true heading of 181°/001°. Adjusting for the magnetic declination, the current magnetic heading of Runway 18-36 is 178°/358°. The true heading of Runway 13-31 is 133°/313° and its magnetic heading is 130°/310°. The existing runway designations for each runway meet the ideal designation now and for the next 10+ year period; therefore, no runway designation change is required for either the primary or the crosswind runway.

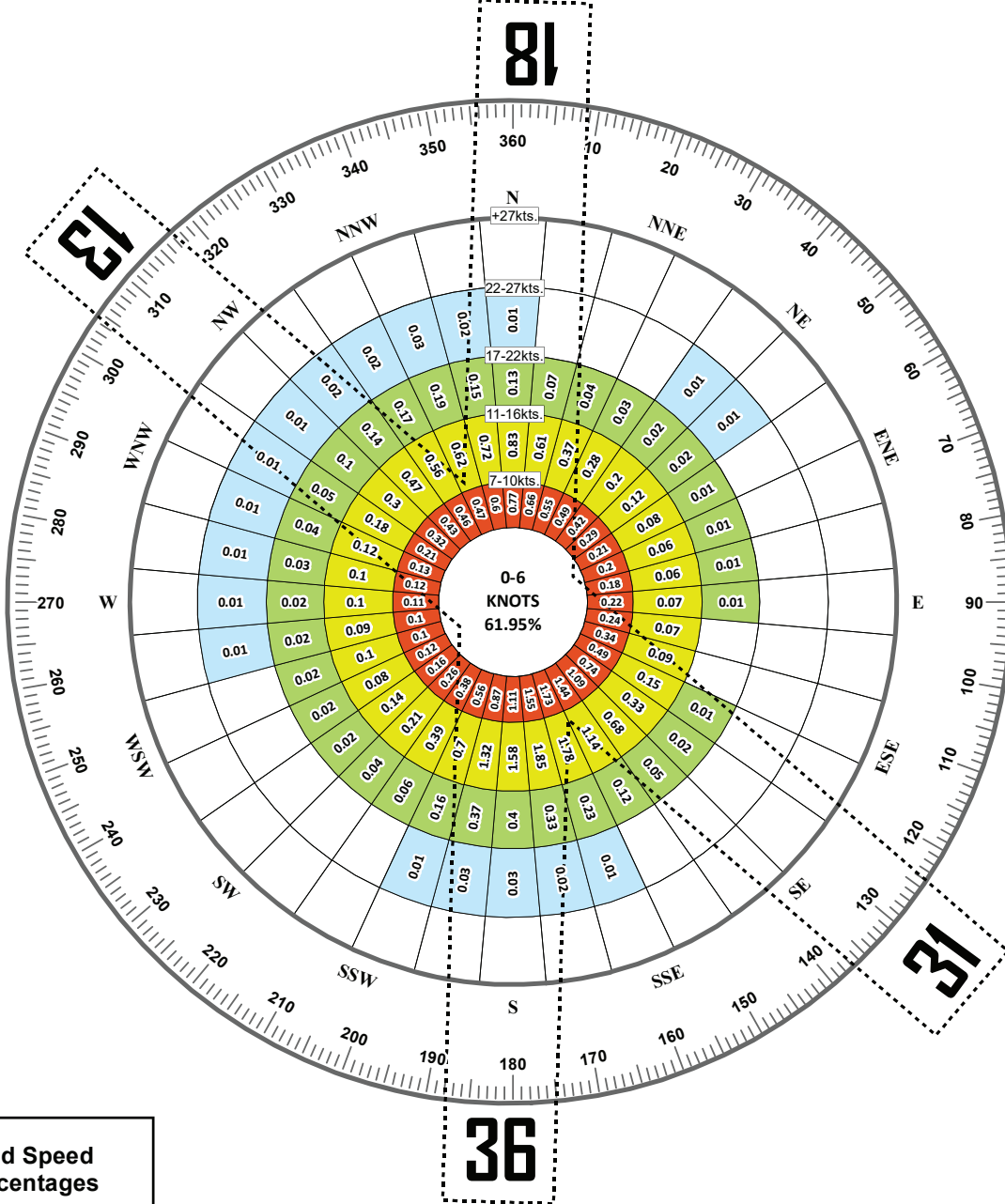
Runway Length

AC 150/5325-4B, *Runway Length Requirements for Airport Design*, provides guidance for determining runway length needs. The determination of runway length requirements for the airport is based on five primary factors:

- Mean maximum temperature of the hottest month
- Airport elevation
- Runway gradient
- Critical aircraft type expected to use the runway
- Stage length of the longest nonstop destination (specific to larger aircraft)

ALL WEATHER WIND COVERAGE

Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 18-36	97.31%	98.79%	99.65%	99.92%
Runway 13-31	92.89%	96.64%	99.12%	99.86%
All Runways	99.18%	99.69%	99.91%	99.99%



Wind Speed Percentages

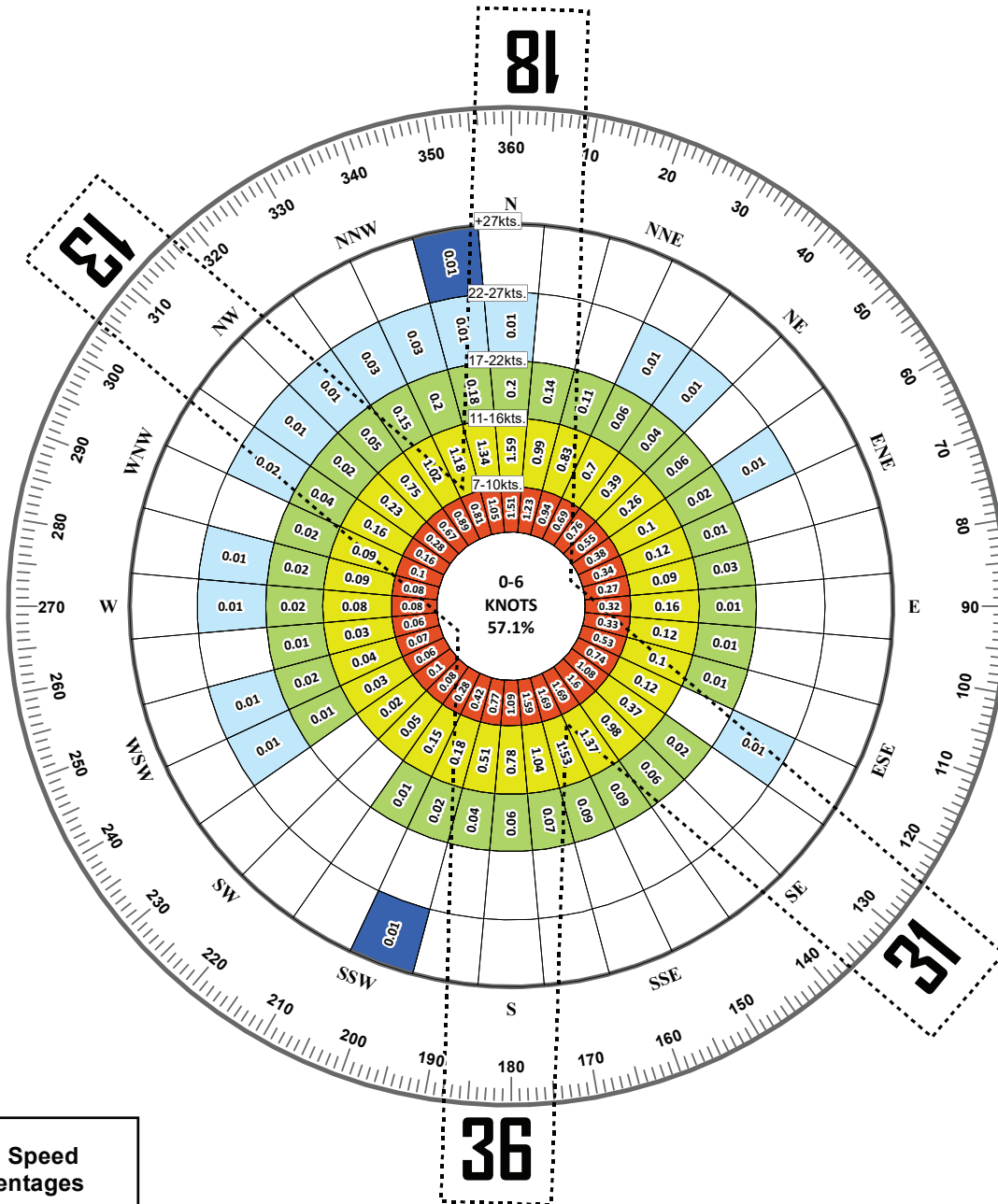
- 7 - 10 kts.
- 11 - 16 kts.
- 17 - 22 kts.
- 23 - 27 kts.
- + 27 kts.

SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Gainesville Municipal Airport
Gainesville, Texas

OBSERVATIONS:
241,054 All Weather Observations
Jan. 1, 2015 - Dec. 31 2024

IFR WIND COVERAGE

Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 18-36	97.45%	98.89%	99.69%	99.92%
Runway 13-31	93.96%	97.29%	99.42%	99.91%
All Runways	99.20%	99.70%	99.92%	99.99%



Wind Speed Percentages

- 7 - 10 kts.
- 11 - 16 kts.
- 17 - 22 kts.
- 23 - 27 kts.
- + 27 kts.

SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Gainesville Municipal Airport
Gainesville, Texas

OBSERVATIONS:
18,605 IFR Observations
Jan. 1, 2015 - Dec. 31 2024

The mean maximum daily temperature of the hottest month for Gainesville Municipal Airport is 94.3 degrees Fahrenheit (°F), which occurs in August. The airport elevation is 846 feet mean sea level (MSL). Primary Runway 18-36 has a longitudinal gradient of 0.88 percent.

Airplanes operate on a wide variety of available runway lengths. Many factors govern the sustainability of runway lengths for aircraft, such as elevation, temperature, wind, aircraft weight, wing flap settings, runway condition (wet or dry), runway gradient, vicinity airspace obstructions, and any special operating procedures. Airport operators can pursue policies that maximize the sustainability of the runway length. Policies such as area zoning and height and hazard restricting can protect an airport’s runway length. Airport ownership (fee simple easement) of land leading to the runway ends reduces the possibility of natural growth or human-made obstructions. Planning for runways should include an evaluation of aircraft types expected to use the airport now and in the future. Future planning should be realistic, supported by the FAA-approved forecasts, and based on the critical aircraft (or family of aircraft).

General Aviation Aircraft

Most operations occurring at Gainesville Municipal Airport are conducted using smaller general aviation (GA) aircraft that weigh less than 12,500 pounds. Following guidance from AC 150/ 5325-4B, to accommodate 95 percent of these small aircraft with fewer than 10 passenger seats, a runway length of 3,400 feet is recommended. For 100 percent of these small aircraft, a runway length of 4,000 feet is recommended. For small aircraft with 10 or more passenger seats, 4,400 feet of runway length is recommended.

The airport is also utilized by aircraft that weigh more than 12,500 pounds, including small- to medium-sized business jet aircraft. Runway length requirements for business jets that weigh less than 60,000 pounds have also been calculated. These calculations take into consideration the runway gradient and landing length requirements for contaminated (wet) runways. Business jets tend to need greater runway length when landing on wet surfaces because of their increased approach speeds. AC 150/5325-4B stipulates that runway length determination for business jets should consider a grouping of airplanes with similar operating characteristics. The AC provides two separate family groupings of airplanes, each of which is based on its representative percentage of aircraft in the national fleet. The first grouping is those business jets that comprise 75 percent of the national fleet, and the second grouping is those that comprise 100 percent of the national fleet. **Table 3F** presents a partial list of common aircraft in each aircraft grouping. A third grouping considers business jets that weigh more than 60,000 pounds. Runway length determination for these aircraft must be based on the performance characteristics of the individual aircraft.

TABLE 3F | Business Jet Categories for Runway Length Determination

Aircraft	MTOW (lbs.)
75 Percent of the National Fleet	
Lear 35	20,350
Lear 45	20,500
Cessna 550	14,100
Cessna 560XL	20,000
Cessna 650 (VII)	22,000
IAI Westwind	23,500
Beechjet 400	15,800
Falcon 50	18,500
75-100 Percent of the National Fleet	
Lear 55	21,500
Lear 60	23,500
Hawker 800XP	28,000
Hawker 1000	31,000
Cessna 650 (III/IV)	22,000
Cessna 750 (X)	36,100
Challenger 604	47,600
IAI Astra	23,500
Greater than 60,000 Pounds	
Gulfstream II	65,500
Gulfstream IV	73,200
Gulfstream V	90,500
Global Express	98,000
Gulfstream 650	99,600

MTOW = maximum takeoff weight

Source: FAA AC 150/5325-4B, Runway Length Requirements for Airport Design

Table 3G presents the results of the runway length analysis for business jets that was developed following the guidance provided in AC 150/5325-4B. To accommodate 75 percent of the business jet fleet at 60 percent useful load, a runway length of 5,500 feet is recommended. This length is derived from a raw length of 4,855 feet, which is adjusted (as recommended) for runway gradient and consideration of landing length needs on a contaminated (wet and slippery) runway. To accommodate 100 percent of the business jet fleet at 60 percent useful load, 6,400 feet is the recommended runway length.

Utilization of the 90 percent category for runway length determination is generally not considered by the FAA unless there is a demonstrated need at an airport, such as documented activity by a business jet operator that flies out frequently with heavy loads. To accommodate 75 percent of the business jet fleet at 90 percent useful load, a runway length of 7,600 feet is recommended. To accommodate 100 percent of business jets at 90 percent useful load, a runway length of 9,800 feet is recommended.

TABLE 3G | Runway Length Requirements – Aircraft Between 12,500 and 60,000 Pounds

Fleet Mix Category	TAKEOFF LENGTHS		LANDING LENGTHS	Final Runway Length
	Raw Runway Length from FAA AC	Runway Length with Gradient Adjustment (+360')	Wet Surface Landing Length for Jets (+15%)*	
75% of Fleet at 60% Useful Load	4,855'	5,385'	5,500'	5,500'
100% of Fleet at 60% Useful Load	5,875'	6,405'	5,500'	6,400'
75% of Fleet at 90% Useful Load	7,050'	7,580'	7,000'	7,600'
100% of Fleet at 90% Useful Load	9,223'	9,753'	7,000'	9,800'

*Max. 5,500' for 60% useful load and max. 7,000' for 90% useful load in wet condition

Source: FAA AC 150/5325-4B, Runway Length Requirements for Airport Design

Another method to determine runway length requirements for aircraft at GLE is to examine aircraft flight planning manuals under conditions specific to the airport. Several aircraft were analyzed for takeoff length requirements at a design temperature of 94.3°F and a field elevation of 846 feet MSL with a 0.88 percent runway grade. **Table 3H** provides a detailed runway length analysis for some of the most common turbine aircraft in the national fleet. This data was obtained from UltrNAV software, which computes operational parameters for specific aircraft based on flight manual data. The analysis includes the maximum takeoff weight (MTOW) allowable and the percent useful load from 60 percent to 100 percent.

TABLE 3H | Business Aircraft Takeoff Length Requirements

			TAKEOFF LENGTH REQUIREMENTS				
			Useful Load				
Aircraft Name	ARC	MTOW	60%	70%	80%	90%	100%
Pilatus PC-12	A-II	9,921	2,202	2,384	2,576	2,776	2,985
King Air C90GTi	B-II	10,100	2,668	2,860	3,069	3,278	3,487
King Air 200 GT	B-II	12,500	3,494	3,613	3,738	3,870	4,003
Citation CJ3	B-II	13,870	3,296	3,567	3,647	4,192	4,538
Citation V (Model 560)	B-II	15,900	3,355	3,643	3,956	4,287	4,638
Citation (525A) CJ2	B-II	12,375	3,566	3,820	4,150	4,502	4,791
King Air 350	B-II	15,000	3,710	3,897	4,101	4,430	4,844
Citation Encore	B-II	16,630	3,417	3,802	4,157	4,638	5,125
Citation 560 XLS	B-II	20,200	3,881	4,206	4,552	4,908	5,329
King Air 1900D	B-I	17,120	4,460	4,754	5,088	5,471	5,854
Beechjet 400A	B-I	16,300	4,353	4,695	5,040	5,431	5,940
Lear 31A	B-I	17,000	4,394	4,779	5,200	5,655	6,147
Citation Bravo	B-II	14,800	4,540	4,888	5,275	5,719	6,210
Global 5000	C-III	92,500	4,641	5,174	5,732	6,316	6,926
Gulfstream 450	D-II	74,600	4,792	5,292	5,847	6,442	7,093
Falcon 900EX	C-II	49,200	4,490	5,060	5,770	6,490	7,130
Challenger 300	C-II	38,850	5,053	5,546	6,053	6,589	7,145
Challenger 604/605	C-II	48,200	5,319	5,895	6,547	7,241	7,945
Gulfstream 650	C-III	99,600	5,242	5,772	6,393	7,114	7,959
Citation X	C-II	35,700	5,555	6,079	6,692	7,340	8,108
Embraer 135	C-II	49,604	5,948	6,583	6,922	7,484	8,231
Lear 45	C-I	21,500	5,189	5,715	5,934	6,945	8,272
Gulfstream 550	D-III	91,000	4,933	5,641	6,398	7,257	8,322
CRJ-200	D-II	53,000	5,408	6,042	6,764	7,599	8,572
Challenger 601	C-II	45,100	5,440	6,080	6,800	7,920	9,230
Citation (525) CJ1	B-I	10,600	5,014	6,001	7,180	8,551	10,000

Note: Green cell values are less than or equal to the length of the primary runway at GLE; orange cell values are greater than the length of the primary runway at GLE.
 MTOW = maximum takeoff weight

Source: UltrNAV software

The majority of the aircraft analyzed are capable of departing at MTOW on the existing runway length of 6,000 feet during hot weather with useful loads up to 80 percent. Roughly half can take off with useful loads up to 90 percent, beyond which the aircraft analyzed become more weight-restricted.

Table 3J presents the runway length required for landing under three operational categories: Title 14 Code of Federal Regulations (CFR) Part 91, Part 135, and Part 91k. Part 91 operations are those conducted by private individuals or companies that own their aircraft. Part 135 applies to all for-hire charter operations, including most fractional ownership operations, while Part 91k includes operations in fractional ownership that utilize their own aircraft under direction of pilots specifically assigned to said aircraft. Part 91k and Part 135 have rules regarding landing operations that require an operator to land at the destination airport within 60 percent of the effective runway length. An additional rule allows for an operator to land within 80 percent of the effective runway length if the operator has an approved destination airport analysis in the airport’s program operating manual. The landing length analysis accounts for both scenarios, as shown in the table.

TABLE 3J | Business Aircraft Landing Length Requirements

Aircraft Name	ARC	MLW	LANDING LENGTH REQUIREMENTS					
			Dry Runway Condition			Wet Runway Condition		
			Part 91	80% Rule	60% Rule	Part 91	80% Rule	60% Rule
Embraer 135	C-II	40,785	2,733	3,416	4,555	2,977	3,721	4,962
King Air 350	B-II	15,000	2,665	3,331	4,442	3,065	3,831	5,108
Global 5000	C-III	78,600	2,711	3,389	4,518	3,118	3,898	5,197
King Air 1900D	B-I	16,765	2,807	3,509	4,678	3,228	4,035	5,380
Lear 45	C-I	19,200	2,848	3,560	4,747	3,636	4,545	6,060
Citation (525A) CJ2	B-II	11,500	2,777	3,471	4,628	3,766	4,708	6,277
Challenger 300	C-II	33,750	3,200	4,000	5,333	3,840	4,800	6,400
Citation Bravo	B-II	13,500	2,735	3,419	4,558	4,084	5,105	6,807
Citation (525) CJ1	B-I	9,800	2,849	3,561	4,748	4,117	5,146	6,862
Lear 31A	B-I	16,000	3,027	3,784	5,045	4,238	5,298	7,063
Canadair 601-3A/R	C-II	36,000	2,727	3,409	4,545	4,239	5,299	7,065
Falcon 900EX	C-II	44,500	3,732	4,665	6,220	4,292	5,365	7,153
Challenger 604/605	C-II	38,000	2,875	3,594	4,792	4,342	5,428	7,237
Citation CJ3	B-II	12,750	2,332	2,915	3,887	4,470	5,588	7,450
Gulfstream 550	D-III	75,300	2,821	3,526	4,702	4,495	5,619	7,492
Citation Encore	B-II	15,200	3,055	3,819	5,092	4,518	5,648	7,530
Citation V (Model 560)	B-II	15,200	3,091	3,864	5,152	4,572	5,715	7,620
Gulfstream 650	C-III	83,500	3,576	4,470	5,960	4,755	5,944	7,925
CRJ-200	D-II	47,000	2,539	3,174	4,232	4,867	6,084	8,112
Gulfstream 450	D-II	66,000	3,316	4,145	5,527	5,117	6,396	8,528
Beechjet 400A	B-I	15,700	3,703	4,629	6,172	5,351	6,689	8,918
Citation X	C-II	31,800	3,776	4,720	6,293	5,359	6,699	8,932
Citation 560 XLS	B-II	18,700	3,426	4,283	5,710	5,390	6,738	8,983
King Air C90GTi	B-II	9,600	1,416	1,770	2,360	No Data	No Data	No Data
King Air 200 GT	B-II	12,500	1,231	1,539	2,052	No Data	No Data	No Data
Pilatus PC-12	A-II	9,921	2,285	2,856	3,808	No Data	No Data	No Data

Note: Green cell values are less than or equal to the length of the primary runway at GLE; orange cell values are greater than the length of the primary runway at GLE.
 MLW = maximum landing weight
 N/A = not applicable; some turboprop aircraft landing lengths are not adjusted for wet runway conditions

Source: UltrNAV software

The analysis shows that nearly all of the aircraft analyzed can land on the runway length currently available at GLE during dry runway conditions. During wet (or contaminated) runway conditions, all of the aircraft analyzed can land when operating under Part 91, and most can land under the 80 percent rule. However, only four of the aircraft evaluated can land under the 60 percent rule.

Commercial Service/Air Cargo Aircraft

Given the potential for commercial service or air cargo activity, takeoff lengths for several of these types of aircraft were also calculated using aircraft planning manuals. As shown in **Table 3K**, only about half of the aircraft analyzed can depart at 60 percent useful loads, and the majority are weight-restricted or unable to operate on the existing 6,000 feet of runway. The Embraer 135¹, which is utilized by JSX, can

¹ Data for the Embraer 145, another model used by JSX, was not available.

only operate at 60 percent of its useful load on the existing 6,000 feet, and the Boeing 767-300, a large cargo airplane that is serving as the representative aircraft in the ultimate RDC C-IV scenario, is unable to operate. To accommodate this aircraft at its maximum takeoff weight, a runway length of approximately 9,300 feet would be necessary.

TABLE 3K | Commercial Service/Air Cargo Aircraft Takeoff Length Requirements

Aircraft Name	ARC	MTOW	TAKEOFF LENGTH REQUIREMENTS				
			Useful Load				
			60%	70%	80%	90%	100%
Pilatus PC-12*	A-II	9,921	2,202	2,384	2,576	2,776	2,985
Embraer 170	C-III	79,344	3,700	4,200	4,400	4,900	5,400
Boeing 767-200	C-IV	315,000	4,300	4,500	5,200	6,000	6,500
Boeing 737-Max 8	D-III	181,200	6,000	6,400	6,700	7,000	7,500
Boeing 757-200	C-IV	240,000	5,000	5,500	6,300	7,100	8,000
Boeing 757-300	D-IV	255,000	5,100	5,500	6,500	7,200	8,200
Embraer 135*	C-II	49,604	5,948	6,583	6,922	7,484	8,231
CRJ-200*	D-II	53,000	5,408	6,042	6,764	7,599	8,572
Boeing 737-800	D-III	174,200	5,300	6,000	6,800	7,800	8,800
Boeing 737-Max 9	D-III	194,700	7,100	7,800	8,200	8,900	9,200
Boeing 767-300	C-IV	350,000	7,400	8,200	8,600	8,900	9,300
Boeing 737-900	D-III	174,200	6,100	7,000	8,000	9,000	10,300
Boeing 737-700	C-III	154,500	5,000	5,800	6,900	7,800	10,500

Note: Green cell values are less than or equal to the length of the primary runway at GLE; orange cell values are greater than the length of the primary runway at GLE.
 MTOW = maximum takeoff weight
 *Ultranav software utilized for these aircraft; all other takeoff lengths were calculated using aircraft planning manuals.

Source: Ultranav software; Aircraft Planning Manuals

Runway Length Summary

Many factors are considered when determining an appropriate runway length for safe and efficient operations of aircraft. GLE should strive to accommodate turbine aircraft to the greatest extent possible, as demand dictates. According to the FAA calculations detailed in **Table 3G**, a length of 5,500 feet is recommended to accommodate 75 percent of the business jet fleet (aircraft that weigh between 12,500 and 60,000 pounds) at 60 percent of their useful load. To accommodate 100 percent of the fleet at 60 percent useful load, a length of 6,400 feet is recommended. As previously mentioned, the FAA will not typically support the 90 percent useful load category unless there is a documented need for an operator to regularly depart with higher payloads.

The supplemental runway length analysis shows that the available length of 6,000 feet on Runway 18-36 largely accommodates larger business jet aircraft up to 60 and 70 percent useful loads but becomes progressively limiting at higher useful loads. Approximately half of the commercial service and air cargo aircraft that were analyzed can operate on the existing runway length; however, the majority are weight restricted or unable to operate. Notably, the Falcon 900 and the Embraer 135, both of which fall into the future RDC scenario of C-II, are weight-restricted beyond 80 percent and 70 percent useful loads, respectively. The Boeing 767, which serves as the representative aircraft in the ultimate RDC C-IV scenario, is unable to operate on the current runway length. As such, the alternatives in the next chapter will consider several options for a longer primary runway.

The airport's crosswind runway, Runway 13-31, is currently 4,307 feet long, which makes it capable of accommodating 100 percent of small aircraft, as well as some of the smaller turboprops and business jets; therefore, extension options for Runway 13-31 will not be considered.

Runway Width

Runway width standards are primarily based on the critical aircraft but can also be influenced by the visibility minimums of published instrument approach procedures. For primary Runway 18-36, existing RDC B-II-4000 design criteria stipulate a width of 75 feet, while 100 feet is necessary to meet future C-II-4000 design standards. Runway 18-36 is currently 100 feet wide, meeting the future design standard. If the ultimate condition of C-IV-2400 is achieved, the standard runway width increases to 150 feet.

The existing/ultimate RDC for crosswind Runway 13-31 has been established as B-I-VIS, which dictates a width of 60 feet. Runway 13-31 is 75 feet wide, exceeding the recommended width.

The alternatives in the next chapter will evaluate several scenarios regarding the width of each runway, including a no-action option where each runway's current width is maintained, as well as options to increase the width of the primary runway and decrease the width of the crosswind runway.

Pavement Strength

An important feature of airfield pavement is its ability to withstand repeated use by aircraft of varying weights. Primary Runway 18-36 has a weight-bearing capacity of 30,000 pounds single wheel loading (S) and 50,000 pounds dual wheel loading (D). Crosswind Runway 13-31 is rated at 15,000 pounds S and does not have a rating for dual-wheel aircraft. The strength rating of a runway does not preclude aircraft that weigh more than the published strength rating from using the runway. All federally obligated airports must remain open to the public, and it is typically up to the pilot of an aircraft to determine if a runway can safely support the aircraft. An airport sponsor cannot restrict an aircraft from using the runway simply because its weight exceeds the published strength rating; however, the airport sponsor has an obligation to properly maintain and protect the useful life of the runway (typically for 20 years).

The strength rating of a runway can change over time. Regular usage by heavier aircraft can decrease the strength rating, while periodic runway resurfacing can increase the strength rating. The current runway strength rating for primary Runway 18-36 is adequate to accommodate most aircraft utilizing the airport regularly, including the future critical aircraft, as the Falcon 900 and the Embraer 135 both have MTOWs of less than 50,000 pounds on dual wheel main landing gear. As operations by larger/heavier aircraft increase over time, it may become beneficial to increase the pavement strength to a rating of 100,000 pounds D, which would accommodate some of the largest business jets in the national fleet, including the Gulfstream G650, which has a MTOW of 99,600 pounds. Further, if air cargo using heavier equipment is established at the airport, the pavement should be strengthened to accommodate that particular aircraft.

The current strength rating of Runway 13-31 is adequate for small aircraft and should be maintained.

Blast Pads

Runway blast pads provide resistance to jet blast erosion beyond runway ends. Under existing B-II and future C-II design standards, blast pads are not a design requirement; however, the construction of blast pads could be considered if the airport experiences significant erosion of soil adjacent to the runway ends due to increased jet traffic. The recommended blast pad dimensions are 150 feet long and 120 feet wide to meet C-II standards. At ultimate C-IV design standards, blast pads are required at a dimension of 200 feet by 200 feet. Runway 18-36 is not currently equipped with blast pads; however, consideration should be given to their construction in the future, as dictated by need.

Runway 3-21 is not planned to accommodate regular jet operations, negating the potential need for blast pads.

SAFETY AREA DESIGN STANDARDS

The FAA has established several imaginary surfaces to protect aircraft operational areas and keep them free from obstructions, including the runway safety area (RSA), runway object free area (ROFA), runway obstacle free zone (ROFZ), and runway protection zone (RPZ).

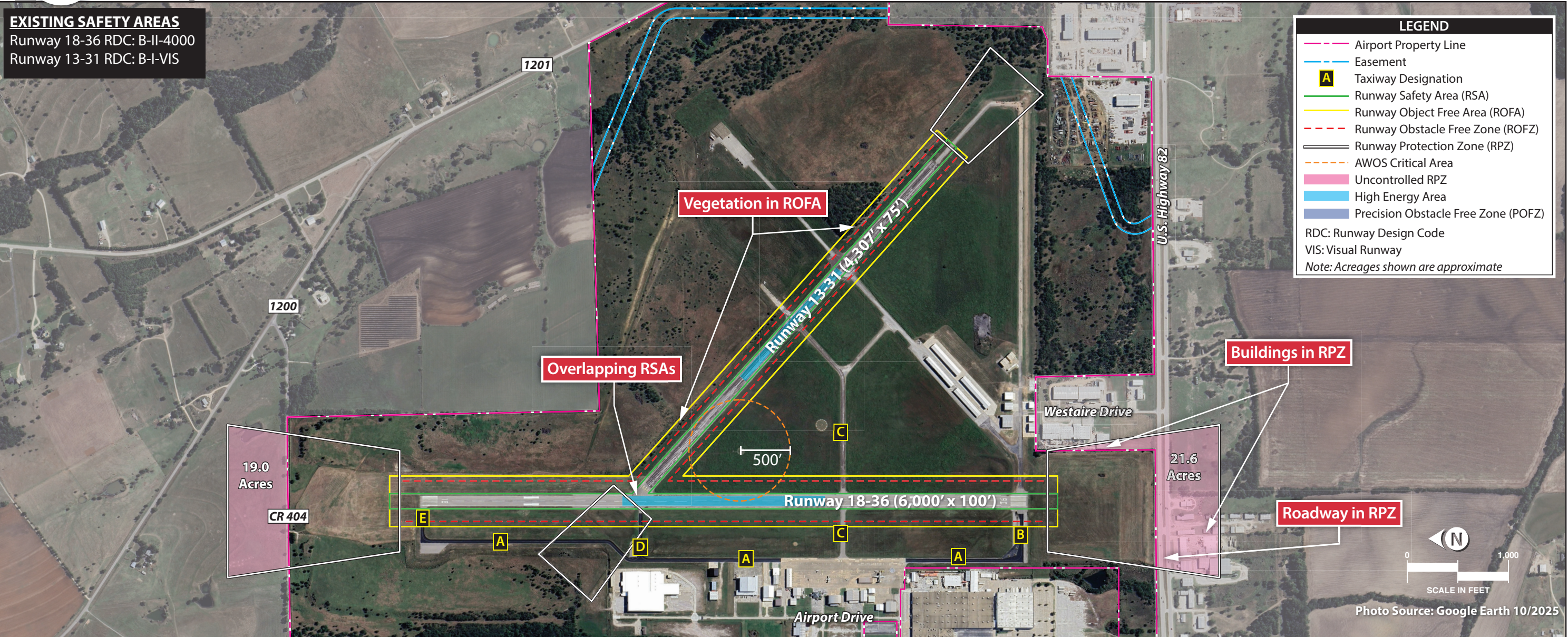
The entire RSA, ROFA, and ROFZ must be under the direct ownership of the airport sponsor to ensure these areas remain free of obstacles and can be readily accessed by maintenance and emergency personnel. RPZs should also be under airport ownership. Alternatives to outright ownership of the RPZ include purchasing aviation easements (acquiring control of designated airspace within the RPZ) or having sufficient land use control measures in place that ensure the RPZ remains free of incompatible development. The various airport safety areas and their dimensions (as sourced from FAA AC 150/5300-13B, *Airport Design*, Change 1) are presented graphically on **Exhibit 3C**.

Runway Safety Area

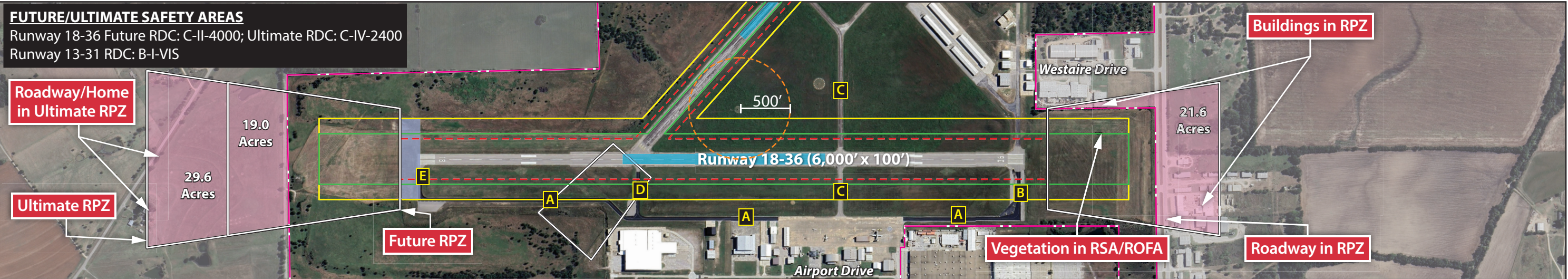
The RSA is defined in FAA AC 150/5300-13B, *Airport Design*, Change 1, as a “defined area surrounding the runway consisting of a prepared surface suitable for reducing the risk of damage to aircraft in the event of undershoot, overshoot, or excursion from the runway.” The RSA is centered on the runway and dimensioned in accordance with the approach speed of the critical aircraft using the runway. The FAA requires the RSA to be cleared and graded, drained by grading or storm sewers, capable of accommodating the critical aircraft and fire and rescue vehicles, and free of obstacles that are not fixed by navigational purpose (such as runway edge lights or approach lights).

The FAA places high significance on maintaining adequate RSAs at all airports. The FAA established the Runway Safety Area Program under Order 5200.8 (effective October 1, 1999). The Order states: “The objective of the Runway Safety Area Program is that all RSAs at federally obligated airports...shall conform to the standards contained in AC 150/5300-13B, Change 1, *Airport Design*, to the extent practicable.” Each Regional Airports Division of the FAA is obligated to collect and maintain data on the RSAs for all runways and perform airport inspections.

EXISTING SAFETY AREAS
 Runway 18-36 RDC: B-II-4000
 Runway 13-31 RDC: B-I-VIS



FUTURE/ULTIMATE SAFETY AREAS
 Runway 18-36 Future RDC: C-II-4000; Ultimate RDC: C-IV-2400
 Runway 13-31 RDC: B-I-VIS



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Table 3L summarizes the standard RSA dimensions in the existing, future, and ultimate conditions and whether these standards are met in each scenario. **Exhibit 3C** graphically depicts this safety area in each condition.

TABLE 3L | RSA Standards

		Primary Runway 18-36		
		Existing RDC B-II-4000	Future RDC C-II-4000	Ultimate RDC C-IV-2400
RSA Dimensions		300' beyond runway x 150' wide	1,000' beyond runway ¹ x 500' wide	1,000' beyond runway ¹ x 500' wide
Meets Standard? ²		Overlapping RSAs	No; vegetation present in RSA south of Runway 36	No; vegetation present in RSA south of Runway 36
		Crosswind Runway 13-31		
		Existing/Ulimate RDC B-I-VIS		
RSA Dimensions		240' beyond runway x 120' wide		
Meets Standard? ²		Overlapping RSAs		
¹ RSA length is 1,000' beyond the departure end of the runway, but only a 600' length is needed prior to the threshold ² RSA evaluation based on available imagery; updated data being collected as part of this master plan will determine if other obstacles are present and if gradient standards are met. Any deviation from standard will be noted later in this report.				

Sources: FAA AC 150/5300-13B, Airport Design; Coffman Associates analysis

As shown in the table and on the exhibit, the existing, future, and ultimate RSAs for each runway are controlled by the airport and are generally free of obstructions; however, there are non-standard conditions. Currently, the RSAs of each runway overlap at the convergence of Runway 13 with Runway 18-36. When two runways converge but do not intersect, safety risks are introduced along with potential operational limitations. The runway ends should be reconfigured to allow taxiing and holding aircraft to remain clear of all RSAs. Moreover, runway ends should be configured to allow holding aircraft to be perpendicular to the runway centerline. The current configuration of Runway 13 does not allow for perpendicular holding. It should also be noted that in the future and ultimate scenarios for Runway 18-36, the increased dimensions of the RSA results in vegetation being located within the RSA south of Runway 36.

Runway Object Free Area

The ROFA is “a clear area limited to equipment necessary for air and ground navigation and provides wingtip protection in the event of an aircraft excursion from the runway.” The ROFA is a two-dimensional ground area surrounding a runway and its associated taxiways and taxilanes that is clear of objects, except objects with locations that are fixed by function (e.g., airfield lighting). The ROFA does not have to be graded and level like the RSA; instead, the primary requirement for the ROFA is that no object in the ROFA penetrates the lateral elevation of the RSA. The ROFA is centered on the runway and extends out in accordance with the critical aircraft utilizing the runway.

Table 3M summarizes the standard ROFA dimensions in the existing, future, and ultimate conditions and whether these standards are met in each scenario. **Exhibit 3C** graphically depicts this safety area.

TABLE 3M | ROFA Standards

	Primary Runway 18-36		
	Existing RDC B-II-4000	Future RDC C-II-4000	Ultimate RDC C-IV-2400
ROFA Dimensions	300' beyond runway x 500' wide	1,000' beyond runway ¹ x 800' wide	1,000' beyond runway ¹ x 800' wide
Meets Standard? ²	Yes	No; vegetation present in ROFA south of Runway 36	No; vegetation present in ROFA south of Runway 36
	Crosswind Runway 13-31		
	Existing/Ultimate RDC B-I-VIS		
ROFA Dimensions	240' beyond runway x 400' wide		
Meets Standard? ²	No; vegetation present in ROFA on the runway's northeast side		

¹ ROFA length is 1,000' beyond the departure end of the runway, but only a 600' length is needed prior to the threshold

² ROFA evaluation based on available imagery; updated data collected as part of this master plan will determine if other obstacles are present. Any deviation from standard will be noted later in this report.

Sources: FAA AC 150/5300-13B, Airport Design; Coffman Associates analysis

As shown in the table and on the exhibit, the ROFA associated with each runway in all planning conditions is located on airport property and controlled by the airport. There is vegetation present in the Runway 18-36 ROFA in the future and ultimate conditions, and in the Runway 13-31 ROFA in the existing and ultimate conditions.

Obstacle Free Zone

The runway obstacle free zone (ROFZ) is an imaginary surface that precludes object penetrations, including taxiing and parked aircraft. The only allowance for ROFZ obstructions is navigational aids mounted on frangible bases that are fixed in their locations by function (such as airfield signs). The ROFZ is established to ensure the safety of aircraft operations. If the ROFZ is obstructed, the airport's approaches could be removed, or the approach minimums could be increased.

For all runways serving aircraft over 12,500 pounds, the ROFZ is 400 feet wide, centered on the runway, and extends 200 feet beyond the runway ends. This standard applies to Runway 18-36 at GLE. There are no known obstructions or incompatibilities within the Runway 18-36 ROFZ.

Runway 13-31 is designed to accommodate small aircraft under 12,500 pounds but with approach speeds greater than or equal to 50 knots. The Runway 13-31 ROFZ measures 250 feet wide and extends 200 feet beyond the runway ends. There are no known obstructions or incompatibilities within the Runway 13-31 ROFZ. **Table 3N** summarizes the ROFZ dimensions for each runway and whether these standards are met in each scenario. **Exhibit 3C** graphically depicts this safety area.

TABLE 3N | ROFZ Standards

		Primary Runway 18-36		
		Existing RDC B-II-4000	Future RDC C-II-4000	Ultimate RDC C-IV-2400
ROFZ Dimensions	200' beyond runway x 400' wide			
Meets Standard? ¹	Yes			
		Crosswind Runway 13-31		
		Existing/Ultimate RDC B-I-VIS		
ROFZ Dimensions	200' beyond runway x 250' wide			
Meets Standard? ²	Yes			
¹ ROFZ evaluation based on available imagery; updated data collected as part of this master plan will determine if other obstacles are present. Any deviation from standard will be noted later in this report.				

Sources: FAA AC 150/5300-13B, Airport Design; Coffman Associates analysis

A precision obstacle free zone (POFZ) is defined for runway ends with a ½-mile visibility precision approach. The POFZ is 800 feet wide, centered on the runway, and extends from the runway’s threshold for 200 feet. The POFZ is in effect when the following conditions are met:

- a) The runway supports a vertically guided approach.
- b) Reported ceiling is below 250 feet or visibility is less than ¾-mile.
- c) An aircraft is on final approach within two miles of the runway threshold.

When the POFZ is in effect, the wing of an aircraft holding on a taxiway may penetrate the POFZ; however, neither the fuselage nor the tail may infringe on the POFZ. Currently, there are no published instrument approaches at GLE with minimums below ¾-mile; however, in the ultimate C-IV-2400 scenario, the potential for this type of approach is considered for Runway 18 (the runway end most commonly used for arrivals).

Runway Protection Zone

An RPZ is a trapezoidal area centered on the extended runway centerline beginning 200 feet from the end of the runway. This safety area is established to protect the end of the runway from airspace penetrations and incompatible land uses. The RPZ dimensions are based on the established RDC and the approach visibility minimums serving the runway. While the RPZ is intended to be clear of incompatible objects or land uses, some land uses are permitted with conditions and other land uses are prohibited. According to AC 150/5300-13B, Change 1, the following land uses are permissible within the RPZ:

- Farming that meets the minimum buffer requirements
- Irrigation channels, as long as they do not attract birds
- Airport service roads, as long as they are not public roads and are directly controlled by the airport operator
- Underground facilities, as long as they meet other design criteria, such as RSA requirements, as applicable
- Unstaffed navigational aids (NAVAIDs) and facilities, such as those required for airport facilities that are fixed by function regarding the RPZ
- Aboveground fuel tanks associated with backup generators for unstaffed NAVAIDs

In September 2022, the FAA published AC 150/5190-4B, *Airport Land Use Compatibility Planning*, which states that airport owner control over RPZs is preferred. Airport owner control over RPZs may be achieved through the following methods:

- Ownership of the RPZ property in fee simple
- Possessing sufficient interest in the RPZ property through easements, deed restrictions, etc.
- Possessing sufficient land use control authority to regulate land use in the jurisdiction that contains the RPZ
- Possessing and exercising the power of eminent domain over the property
- Possessing and exercising permitting authority over proponents of development within the RPZ (e.g., where the sponsor is a state)

AC 150/5190-4B further states that “control is preferably exercised through acquisition of sufficient property interest and includes clearing RPZ areas (and keeping them clear) of objects and activities that would impact the safety of people and property on the ground.” The FAA recognizes that land ownership, the environment, geography, and other considerations can complicate land use compatibility within RPZs; regardless, airport sponsors must comply with FAA grant assurances, including (but not limited to) Grant Assurance 21, *Compatible Land Use*. Sponsors are expected to take appropriate measures to “protect against, remove, or mitigate land uses that introduce incompatible development within RPZs.”

For a proposed project that would shift an RPZ into an area with existing incompatible land uses, such as a runway extension or the construction of a new runway, the sponsor is expected to have or secure sufficient control of the RPZ, ideally through fee simple ownership. Where existing incompatible land uses are present, the FAA expects sponsors to “seek all possible opportunities to eliminate, reduce, or mitigate existing incompatible land uses” through acquisition, land exchanges, right-of-first refusal to purchase, agreement with property owners on land uses, easements, or other such measures. These efforts should be revisited during master plan or ALP updates, and periodically thereafter, and should be documented to demonstrate compliance with FAA grant assurances. If a new or proposed incompatible land use impacts an RPZ, the FAA expects the airport to take the above actions to control the property within the RPZ and adopt a strong public stance opposing the incompatible land use.

For a new incompatible land use that results from a sponsor-proposed action (e.g., an airfield project like a runway extension, a change in the critical aircraft that increases the RPZ dimension, or lower minimums that increase the RPZ dimension), the airport sponsor is expected to conduct an alternatives evaluation. The intent of the alternatives evaluation is to “proactively identify a full range of alternatives and prepare a sufficient evaluation to be able to draw a conclusion about what is ‘appropriate and reasonable’.” For incompatible development off-airport, the sponsor should coordinate with the FAA Airports District Office (ADO) as soon as the sponsor learns of the development, and the alternatives evaluation should be conducted within 30 days of the sponsor’s first awareness of the development within the RPZ. The following items are typically necessary in an alternatives evaluation:

- Sponsor’s statement of the purpose and need of the proposed action (airport project, land use change, or development)
- Identification of any other interested parties and proponents

- Identification of any federal, state, and/or local transportation agencies involved
- Analysis of sponsor control of the land within the RPZ
- Summary of all alternatives considered, including the following:
 - Alternatives that preclude introducing the incompatible land use within the RPZ (e.g., zoning action, purchase, and design alternatives, such as implementation of declared distances or displaced thresholds, runway shift or shortening, raising minimums, etc.)
 - Alternatives that minimize the impact of the land use in the RPZ (e.g., rerouting a new roadway through less of the RPZ, etc.)
 - Alternatives that mitigate risk to people and property on the ground (e.g., tunnelling, depressing, and/or protecting a roadway through the RPZ, implementing operational measures to mitigate any risks, etc.)
- Narrative discussion and exhibits or figures depicting the alternative
- Rough order of magnitude cost estimates associated with each alternative, regardless of potential funding sources
- Practicability assessment based on the feasibility of the alternative in terms of constructability, cost, operational impacts, and other factors

Once the alternatives evaluation has been submitted to the ADO, the FAA will determine whether the sponsor has made an adequate effort to pursue and consider appropriate and reasonable alternatives. **The FAA will not approve or disapprove the airport sponsor's preferred alternative; rather, the FAA will evaluate whether an acceptable level of alternatives analysis has been completed before the sponsor makes the decision to allow or disallow the proposed land use within the RPZ.**

In summary, the RPZ guidance published in September 2022 shifts the responsibility of protecting the RPZ to the airport sponsor. The airport sponsor is expected to take action to control the RPZ or demonstrate that appropriate actions have been taken. The decision to permit or disallow existing or new incompatible land uses within an RPZ is ultimately up to the airport sponsor, with the understanding that the sponsor still has grant assurance obligations, and the FAA retains the authority to review and approve or disapprove portions of the ALP that would adversely impact the safety of people and property within the RPZ.

RPZs have been further designated as approach and departure RPZs. The approach RPZ is a function of the aircraft approach category (AAC) and approach visibility minimums associated with the approach runway end. The departure RPZ is a function of the AAC and departure procedures associated with the runway. For a particular runway end, the more stringent RPZ requirements (usually associated with the approach RPZ) will govern the property interests and clearing requirements the airport sponsor should pursue. None of the runways at GLE have displaced thresholds, so the approach and departure RPZs on each runway occur in the same location 200 feet from the end of each runway. For planning purposes, the approach RPZ was used to create the most restrictive condition. The existing, future, and ultimate RPZs at GLE are presented on **Exhibit 3C** and detailed further in **Table 3P**.

TABLE 3P | RPZ Summary

Runway	Visibility Minimums	RPZ Dimensions	Uncontrolled RPZ	Notes/Potential Incompatibilities
RUNWAY 18-36 EXISTING/FUTURE CONDITION				
Runway 18	½-mile	1,700' length 1,000' inner width 1,510' outer width	19.0 acres	The majority of the existing/future Runway 18 RPZ is located on airport property; however, approximately 19.0 acres of the outer portion of the RPZ are not controlled by the airport.
Runway 36	¾-mile	1,700' length 1,000' inner width 1,510' outer width	21.6 acres	The majority of the existing/future Runway 36 RPZ is located on airport property; however, approximately 21.6 acres are not controlled by the airport. Additionally, the RPZ contains commercial buildings and is traversed by U.S. Highway 82.
RUNWAY 18-36 ULTIMATE CONDITION				
Runway 18	½-mile	2,500' length 1,000' inner width 1,750' outer width	48.6 acres	Approximately 48.6 acres of land within the ultimate Runway 18 RPZ is not owned/controlled by the airport. County Road 404 also traverses the ultimate RPZ, and there is one residence located within the RPZ.
Runway 36	¾-mile	1,700' length 1,000' inner width 1,510' outer width	21.6 acres	The majority of the ultimate Runway 36 RPZ is located on airport property; however, approximately 21.6 acres are not controlled by the airport. Additionally, the RPZ contains commercial buildings and is traversed by U.S. Highway 82.
RUNWAY 13-31 EXISTING/ULTIMATE CONDITION				
Runway 13	Visual	1,000' length 500' inner width 700' outer width	N/A	The existing/ultimate Runway 13 RPZ is located on airport property and does not contain incompatible land uses.
Runway 31	Visual	1,000' length 500' inner width 700' outer width	N/A	The existing/ultimate Runway 31 RPZ is located on airport property and does not contain incompatible land uses.

Note: Acreages are approximate.

Source: Coffman Associates analysis

SEPARATION STANDARDS

Several other standards are related to separation distances from runways and taxiways. Each is designed to enhance the safety of the airfield.

Runway/Taxiway Separation

The design standard for the separation between runways and parallel taxiways is a function of the critical aircraft and the instrument approach visibility minimum. The separation standard for Runway 18-36 in the existing condition (RDC B-II-4000) is 240 feet from the runway centerline to the parallel taxiway centerline. The separation standard increases to 300 feet in the future C-II-4000 condition and increases to 400 feet in the ultimate C-IV-2400 condition. Parallel Taxiway A is separated from the runway by 400 feet on the north end (prior to Taxiway D) and 600 feet south of Taxiway D. As such, the location of Taxiway A meets the minimum separation standard for each condition and should be maintained.

Runway 13-31 is not currently served by a parallel taxiway; however, it should be noted that the B-I-VIS runway/taxiway separation standard is 225 feet.

Hold Line Position Separation

Hold line position markings are placed on taxiways leading to runways. Pilots are instructed to stop short of the holding position marking line to visually confirm that the runway environment is clear of traffic. The existing design standards for Runway 18-36 call for holding positions to be separated from the runway centerline by 200 feet; the separation standard increases to 250 feet in the future condition and 263 feet in the ultimate condition². The existing hold lines associated with Runway 18-36 are situated at a 250-foot separation distance, meeting the future condition standard. These markings should be maintained, unless the ultimate planning standard of C-IV-2400 is realized.

The existing and ultimate design standards for Runway 13-31 call for holding positions to be separated from the runway centerline by 200 feet. Only one exit taxiway (Taxiway C) serving Runway 13-31 is marked with a holding position, which is separated from the runway by 250 feet.

Aircraft Parking Area Separation

According to FAA AC 150/5300-13B, Change 1, aircraft parking positions should be located to ensure aircraft components (wings, tail, and fuselage) do not:

1. Conflict with the object free area for the adjacent runway or taxiways:
 - a. Runway object free area (ROFA)
 - b. Taxiway object free area (TOFA)
 - c. Taxilane object free area (TLOFA)or
2. Violate any of the following aeronautical surfaces and areas:
 - a. Runway approach or departure surface
 - b. Runway visibility zone (RVZ)
 - c. Runway obstacle free zone (ROFZ)
 - d. Navigational aid equipment critical areas

There are no existing conflicts between the aircraft parking areas at GLE and the safety areas or aeronautical surfaces listed above. In the ultimate C-IV-2400 condition, several of the marked aircraft parking positions would penetrate the TOFA. The alternatives in the next chapter will examine options to ensure the TOFA is unobstructed in all planning scenarios.

² The hold line separation standard for RDC C-IV-2400 is established at 250 feet; however, this is increased by one foot for every 100 feet above sea level. GLE's elevation is 846 feet mean sea level (MSL), which would result in a separation standard 263 feet in the ultimate planning condition.

TAXIWAYS

The design standards associated with taxiways are determined by the taxiway design group (TDG) or airplane design group (ADG) of the airport’s critical aircraft. As previously determined, ADG II standards apply to primary Runway 18-36 in the existing and future conditions, and ADG IV standards would apply in the ultimate condition; ADG I standards apply to Runway 13-31 in the existing and ultimate conditions. **Table 3Q** presents the various taxiway design standards related to the aforementioned ADGs. The table also shows the taxiway design standards related to TDG. The TDG standards are based on the main gear width (MGW) and cockpit to main gear (CMG) distance of the critical aircraft expected to use those taxiways. Different taxiway and taxilane pavements can and should be planned to the most appropriate TDG design standards, based on usage.

TABLE 3Q | Taxiway Dimensions and Standards

STANDARDS BASED ON WINGSPAN	ADG I	ADG II	ADG IV
Taxiway and Taxilane Protection			
Taxiway Safety Area Width (TSA)	49'	79'	171'
Taxiway Object Free Area Width (TOFA)	89'	124'	243'
Taxilane Object Free Area Width (TLOFA)	79'	110'	224'
Taxiway and Taxilane Separation			
Taxiway Centerline to Parallel Taxiway Centerline	70'	101.5'	207'
Taxiway Centerline to Fixed or Moveable Object	44.5'	62'	121.5'
Taxilane Centerline to Parallel Taxilane Centerline	64'	94.5'	197.5'
Taxilane Centerline to Fixed or Moveable Object	39.5'	55'	112'
Wingtip Clearance			
Taxiway Wingtip Clearance	20'	22.5'	36'
Taxilane Wingtip Clearance	15'	15.5'	26.5'
STANDARDS BASED ON TDG	TDG 1A/B	TDG 2A/B	TDG 5
Taxiway Width Standard	25'	35'	75'
Taxiway Edge Safety Margin	5'	7.5'	14'
Taxiway Shoulder Width	10'	15'	30'
All dimensions are in feet. ADG = airplane design group TDG = taxiway design group			

Source: FAA AC 150/5300-13B, *Airport Design, Change 1*

Based on TFMSC data, the current design standard for all taxiways at GLE is TDG 2A, which dictates a width of 35 feet. All taxiways are 35 feet wide, except for Taxiway C which is 40 feet wide. For taxiways that exceed the current design standard, TxDOT and/or the FAA may elect not to fund regular pavement maintenance for the portions of taxiway pavement that exceed the standard. If the airport chooses to maintain the taxiways at their current widths, the costs may need to come from a local funding source, rather than federal or state grant monies. Certain portions of the landside area that are utilized exclusively by small aircraft should adhere to TDG 1A/1B standards.

Taxiway and Taxilane Design Considerations

FAA AC 150/5300-13B, *Airport Design, Change 1*, provides guidance on recommended taxiway and taxilane layouts to enhance safety by avoiding runway incursions. A runway incursion is defined as “any

occurrence at an airport involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the landing and takeoff of aircraft.” The following is a list of the FAA’s taxiway design guidelines and the basic rationale behind each recommendation included in the current AC, as well as previous FAA safety and design recommendations.

1. *Taxiing Method*: Taxiways are designed for cockpit-over-centerline taxiing with pavement that is wide enough to allow a certain amount of wander. On turns, sufficient pavement should be provided to maintain the edge safety margin from the landing gear. When constructing new taxiways, existing intersections should be upgraded to eliminate judgmental oversteering, which is when a pilot must intentionally steer the cockpit outside the marked centerline to ensure the aircraft remains on the taxiway pavement.
2. *Curve Design*: Taxiways should be designed so the nose gear steering angle is no more than 50 degrees, which is the generally accepted value to prevent excessive tire scrubbing.
3. *Three-Path Concept*: To maintain pilot situational awareness, taxiway intersections should provide a pilot with a maximum of three choices of travel. Ideally, these are right, left, and a continuation straight ahead.
4. *Channelized Taxiing*: To support visibility of airfield signage, taxiway intersections should be designed to meet standard taxiway width and fillet geometry.
5. *Designated Hot Spots and Runway Incursion Mitigation (RIM) Locations*: A hot spot is a location on the airfield with elevated risk of collisions or runway incursions. Mitigation measures should be prioritized for areas the FAA designates as hot spots or RIM locations. **GLE does not have any FAA-designated taxiway hot spots or RIM locations.**
6. *Intersection Angles*: Turns should be designed to be 90 degrees, wherever possible. For acute-angle intersections, standard angles of 30, 45, 60, 120, 135, and 150 degrees are preferred.
7. *Runway Incursions*: Taxiways should be designed to reduce the probability of runway incursions.
 - *Increase Pilot Situational Awareness*: Pilots who know where they are on the airport are less likely to enter a runway improperly. Complexity leads to confusion. Taxiway systems should be kept simple by using the three-path concept.
 - *Avoid Wide Expanses of Pavement*: Wide pavements require placement of signs far from a pilot’s eye. This is especially critical at runway entrance points. Where a wide expanse of pavement is necessary, direct access to a runway should be avoided.
 - *Limit Runway Crossings*: The taxiway layout can reduce the opportunity for human error. The benefits are twofold: through a simple reduction in the number of occurrences and a reduction in air traffic controller workload.
 - *Avoid High-Energy Intersections*: These are intersections in the middle thirds of runways. By limiting runway crossings to the first and last thirds of a runway, the portion of the runway where a pilot can least maneuver to avoid a collision is kept clear.
 - *Increase Visibility*: Right-angle intersections between taxiways and runways provide the best visibility. Acute-angle runway exits provide greater efficiency in runway usage but

should not be used as runway entrance or crossing points. A right-angle turn at the end of a parallel taxiway is a clear indication of approaching a runway.

- *Avoid Dual-Purpose Pavements:* Runways used as taxiways and taxiways used as runways can lead to confusion. A runway should always be clearly identified as a runway, and only a runway.
- *Avoid Direct Access:* Taxiways should not be designed to lead directly from an apron to a runway. Such configurations can lead to confusion when a pilot typically expects to encounter a parallel taxiway.
- *Mitigate Hot Spots:* Confusing intersections near runways are more likely to contribute to runway incursions. These intersections must be redesigned when the associated runway is subject to reconstruction or rehabilitation. Other hot spots should be corrected as soon as practicable.

8. *Runway/Taxiway Intersections:*

- *Right Angle:* Right-angle intersections are the standard for all runway/taxiway intersections, except where there is a need for an acute-angled exit. Right-angle taxiways provide the best visual perspective to a pilot approaching an intersection with the runway to observe aircraft in both the left and right directions. They also provide optimal orientation of the runway holding position signs so the signage is visible to pilots.
- *Acute Angle:* Acute angles should not be larger than 45 degrees from the runway centerline. A 30-degree taxiway layout should be reserved for high-speed exits. The use of multiple intersecting taxiways with acute angles creates pilot confusion and improper positioning of taxiway signage. The construction of high-speed exits is typically only justified for runways that experience regular use by jet aircraft in approach categories C and above.
- *Large Expanses of Pavement:* A taxiway must never coincide with the intersection of two runways. Taxiway configurations with multiple taxiway and runway intersections in a single area create large expanses of pavement, which make it difficult to provide proper signage, marking, and lighting.

9. *Taxiway/Runway/Apron Incursion Prevention:* Apron locations that allow direct access to a runway should be avoided. Taxiways should be designed in a manner that increases pilot situational awareness by forcing pilots to consciously make turns. Taxiways that originate from aprons and form straight lines across runways at mid-span should be avoided.

- *Wide Throat Taxiways:* Wide throat taxiway entrances should be avoided because such large expanses of pavement may cause pilot confusion and can make lighting and marking more difficult.
- *Direct Access from Apron to Runway:* Taxiway connectors that cross over a parallel taxiway and directly onto a runway should be avoided. A staggered taxiway layout or a no-taxi island that forces pilots to make a conscious decision to turn should be considered.
- *Apron to Parallel Taxiway End:* Direct connection from an apron to a parallel taxiway at the end of a runway should be avoided.

The taxiway system at GLE generally provides for the efficient movement of aircraft, and there are no FAA-designated hot spots or RIM locations. There are, however, several instances of direct access and one aligned taxiway which serves Runway 13, as shown on **Exhibit 3D**. An aligned taxiway is one whose centerline coincides with a runway centerline, which introduces a safety risk as a taxiing aircraft may be in direct line with another aircraft landing or departing on the runway. In the ultimate C-IV-2400 scenario, the TOFA associated with Taxiway A is also obstructed at various points by buildings and marked aircraft parking.

Taxilane Design Considerations

Taxilanes are distinguished from taxiways in that they do not provide direct access to or from the runway system. Taxilanes typically provide access to hangar areas and can be planned to varying design standards, depending on the type(s) of aircraft that utilize the taxilane, as previously described.

HOLDING BAYS

Holding bays are designated areas for pilots to conduct pre-flight checks and allow for aircraft to bypass one another. There are two holding bays on the airfield at GLE. One is located on the north end of Taxiway A to serve aircraft departing Runway 18. The second holding bay is adjacent to Taxiway D and is intended to serve aircraft departing Runway 13. Consideration should be given to marking the holding bays with centerlines to provide a visual cue to pilots on where to position their aircraft to ensure there are no penetrations to the TOFA.

NAVIGATIONAL AND APPROACH AIDS

Navigational aids are devices that provide pilots with guidance and position information when utilizing the runway system. Systems that provide electronic and visual guidance to arriving aircraft enhance the safety and capacity of the airfield. Such facilities are vital to the success of an airport and provide additional safety to pilots and passengers using the air transportation system. While instrument approach aids are especially helpful during poor weather, they are often used by pilots conducting flight training and operating larger aircraft when visibility is good.

Instrument Approach Aids

GLE has two published instrument approaches, including two area navigation (RNAV) global positioning system (GPS) instrument approaches with vertical guidance (LPV) to Runways 18 and 36. The approach to Runway 18 provides for visibility minimums down to $\frac{7}{8}$ -mile, while the approach to Runway 36 provides for minimums as low as $\frac{3}{4}$ -mile. Runway 13-31 does not have published instrument procedures.

The current approach capability at GLE is considered sufficient for the existing and future planning scenarios; however, if the airport were to transition to the ultimate RDC C-IV-2400 scenario at some point, consideration should be given to the potential for visibility minimums down to $\frac{1}{2}$ -mile. If

implemented, this would result in an increase to the RPZ dimensions for the affected runway, as shown previously on the bottom portion of **Exhibit 3C**. Runway 18 is the runway most commonly used for arrivals in both VFR and IFR conditions, and it also has fewer constraining factors in terms of major roadways and buildings, neither of which are recommended to be located within an RPZ. To establish an approach with visibility minimums down to ½-mile, the airport would need to acquire the non-controlled property (approximately 48.6 acres) and remove the residence located within the ultimate RPZ and install an approach lighting system, at a minimum. Consideration would also need to be given to potentially relocating the two impacted roadways, FM 1200 and CR 404. The alternatives in the next chapter will further explore this potential and depict options for achieving improved instrument approach procedures, should the need arise.

Visual Approach Aids

In most instances, the landing phase of any flight must be conducted in visual conditions. Electronic visual approach aids are commonly used at airports to provide pilots with visual guidance information during landings on runways. Both ends of Runway 18-36 are currently equipped with two-box precision approach path indicator (PAPI-2) systems. As more turbine aircraft begin to operate at the airport, consideration should be given to upgrading the PAPI-2 to a PAPI-4 (four-box system) on each runway end.

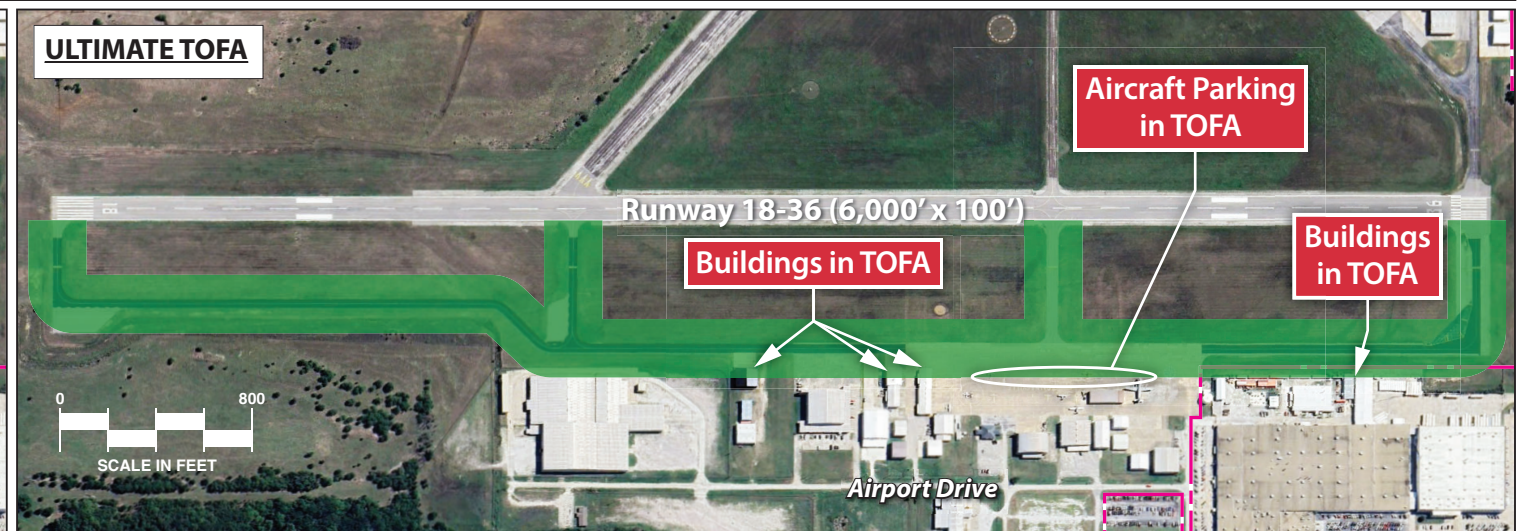
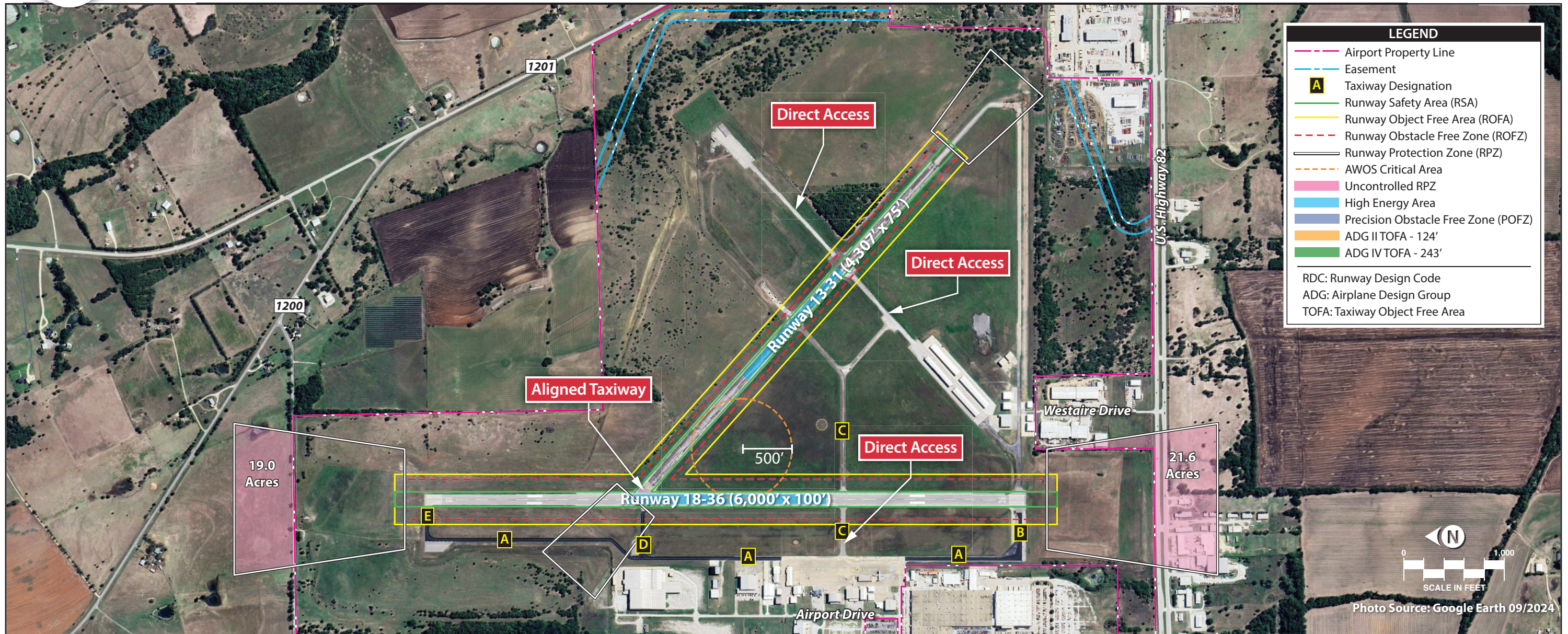
Runway end identifier lights (REIL) are flashing lights located at a runway threshold end that facilitate rapid identification of the runway end at night and during poor visibility conditions. REILs provide pilots with the ability to identify the runway thresholds and distinguish the runway end lighting from the other lighting on the airport and in the approach areas. The FAA indicates that REILs should be considered for all lighted runway ends not planned for more sophisticated approach lighting systems. Both ends of primary Runway 18-36 are equipped with REILs, which should be maintained. If an approach lighting system is installed on Runway 18 to support an instrument approach with reduced minimums, as discussed in the previous section, the REILs serving that runway end would no longer be necessary.

Crosswind Runway 13-31 is not equipped with any visual approach aids. Consideration should be given to installing PAPI-2 systems and REILs at each runway end.

Weather Reporting Aids

GLE has a lighted wind cone and segmented circle, which are centrally located between the two runways. These aids provide information to pilots regarding wind speed and direction and should be maintained through the planning period. A segmented circle is often co-located with an airport's primary wind cone and is a system of visual indicators designed to provide traffic pattern information to pilots.

The airport is also equipped with an automated weather observation station (AWOS), which provides weather observations 24 hours per day. The system updates weather observations every minute, continuously reporting significant weather changes as they occur in real time. This information is transmitted via a designated radio frequency at regular intervals. FAA siting criteria indicate that the AWOS should be located between 1,000 and 3,000 feet from the runway threshold and between 500 and



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1,000 feet perpendicular to the runway centerline. The AWOS has a 500-foot radius critical area that must be kept free of obstructions that could interfere with its sensors. The AWOS should be maintained throughout the planning period.

AIRFIELD LIGHTING, MARKING, AND SIGNAGE

Several lighting and pavement marking aids serve pilots using the airport. These aids assist pilots in locating the airport and runway at night or in poor visibility conditions. They also serve aircraft navigating the airport environment on the ground when transitioning to/from aircraft parking areas to the runway.

Airport Identification Lighting | GLE's rotating beacon is located north of the terminal building. The beacon should be maintained through the planning period.

Runway and Taxiway Lighting | Runway 18-36 is equipped with a medium intensity runway lighting (MIRL) system, which is adequate and should be maintained. Runway 13-31 is not equipped with any edge lighting, and consideration should be given to the installation of MIRL. The taxiway system is equipped with centerline reflectors; the airport sponsor should consider an upgrade to medium intensity taxiway edge lighting (MITL).

Airfield Signs | Airfield identification signs assist pilots in identifying their locations on the airfield and directing them to their desired locations. The signage system at GLE includes lighted runway and taxiway designations, as well as directional signage (some of the directional signage is unlit). All signs should be maintained through the planning period, with consideration given to lighting any signage that is unlit.

It should be noted that many airports are transitioning to light-emitting diode (LED) systems. LEDs have many advantages, including lower energy consumption, longer lifespan, increased durability, reduced size, greater reliability, and faster switching. While a larger initial investment is required up front, the energy savings and reduced maintenance costs outweigh any additional costs over time. When signage systems at GLE are upgraded or replaced, LED systems should be considered.

Pavement Markings | Runway markings are typically designed to the type(s) of instrument approach(es) available on a runway. FAA AC 150/5340-1K, *Standards for Airport Markings*, provides the guidance necessary to design airport markings. Runway 18-36 is equipped with non-precision markings and Runway 13-31 is equipped with basic markings plus aiming points. These markings are adequate for the available instrument approach capabilities and should be maintained. The markings on Runway 13-31 are in poor condition and should be reapplied. If an instrument approach procedure with visibility minimums lower than $\frac{3}{4}$ -mile is implemented to Runway 18, as previously discussed, the markings on this runway would need to be upgraded to precision markings. This would include the addition of touchdown zone markings, which are a series of markings that indicate the optimal landing area and provide distance cues in 500-foot increments from the threshold.

AIRPORT TRAFFIC CONTROL TOWER

GLE does not currently have an airport traffic control tower (ATCT). All traffic is coordinated through the local UNICOM radio frequency, which is monitored by airport staff. The current level of operations at the airport may indicate that airport safety could be enhanced if there were an ATCT. The following presents the process and initial analysis for justifying a federally funded ATCT.

Guidance for the establishment of an ATCT is provided in the following documents:

- FAA Advisory Circular 150/5300-13B, *Airport Design*
- FAA Order 6480.7D, *Airport Traffic Control Tower and Terminal Radar Approach Control Facility Design Guidelines*
- FAA Order 6480.4B, *Airport Traffic Control Tower Siting Process*
- FAA Order 8260.3D, *United States Standard for Terminal Instrument Procedures (TERPS)*
- FAA Handbook 7031.2C, *Airway Planning Standard Number One - Terminal Air Navigation Facilities and Air Traffic Control Services*
- Federal Aviation Regulations (FAR) Part 170, *Establishment and Discontinuance Criteria for Air Traffic Control Services and Navigational Facilities*
- FAA Report No. APO 90-7, *Establishment and Discontinuance Criteria for Air Traffic Control Towers*

Establishment Criteria

ATCTs are established at airports to provide for a safe, orderly, and expeditious flow of traffic on, and in the vicinity of, an airport. Class D airspace surrounding the airport from the surface to 2,500 feet above the airport elevation (charted in mean sea level) is usually established in conjunction with a new ATCT. Many of the new control towers are part of the Federal Contract Tower Program.

The FAA has the authority to establish control towers or discontinue control tower services through the National Airspace System when activity levels and safety considerations merit such action. Criteria for establishing a control tower was initially developed and published in 1951. Current guidelines are established by the FAA Office of Aviation Policy and Plans (APO-200).

According to FAR Part 170.13, the following criteria, along with general facility establishment standards, must be met before an airport can qualify for a control tower:

1. The airport, whether publicly or privately owned, must be open to and available for use by the public as defined in the *Airport and Airway Improvement Act of 1982*;
2. The airport must be part of the NPIAS;
3. The airport owners/authorities must have entered into appropriate assurances and covenants to guarantee that the airport will continue in operation for a long enough period to permit the amortization of the control tower investment;
4. The FAA must be furnished appropriate land without cost for construction of the control tower; and

5. The airport must meet the benefit-cost ratio criteria utilizing three consecutive FAA annual counts and projections of future traffic during the expected life of the tower facility. (An FAA annual count is a fiscal year or a calendar year activity summary. Where actual traffic counts are unavailable or not recorded, adequately documented FAA estimates of the scheduled and nonscheduled activity may be used.)

The FAR specifically states that an airport is not guaranteed to receive a control tower, even if all the criteria listed above met. However, the FAA, responding to an airport sponsor's request for an air traffic control tower, can elect to establish a contract tower. The FAA will fund the operating costs of an ATCT included in the contract tower program, depending on the results of the benefit-cost analysis. Typically, the airport sponsor is responsible for the cost of construction of the tower. Recent changes to Federal legislation have made some funds available for ATCT construction. Additionally, the Infrastructure Investment and Jobs Act (IIJA), which was passed in 2022, has allotted \$5 billion to construction and improvements associated with air traffic facilities, including towers. As such, there is the potential for GLE to obtain some level of federal funding support should an ATCT be justified through a benefit-cost analysis.

Benefit-Cost Ratio

The FAA prescribes benefit-cost-based criteria for establishment and discontinuance of control tower facilities as part of its mission to maximize safety and efficiency throughout the airport and airway system consistent with available resources. Decisions to establish and operate control towers have been, and will continue to be, based on benefits exceeding costs of such actions.

The criteria and computation methods used in determining the eligibility of terminal locations for VFR tower establishment and discontinuance is based on economic analysis of the costs and benefits of a control tower. The criterion compares the present value of VFR tower benefits (BPV) at a site with the present value of VFR tower costs (CPV) over a 15-year timeframe. A location is eligible for a control tower when the benefits derived from operating the tower exceed the installation and operation costs. This is the same as saying that value of benefits exceeds costs, or **BPV/CPV \geq 1.00**.

Site-specific activity forecasts are used to estimate three categories of tower benefits:

- Benefits from prevented collisions between aircraft;
- Benefits from other prevented accidents; and
- Benefits from reduced flying time.

Explicit dollar values are assigned to the prevention of fatalities and injuries and time saved. Tower establishment costs include:

- Annual operating costs, including staffing, maintenance, equipment, supplies, and leased services; and
- Investment costs, including facilities, equipment, and operational start-up.

The Federal Contract Tower (FCT) Program

The FCT has been in place since 1982 and currently provides for the contract operation of air traffic control (ATC) services at over 250 airports. Through the program, the FAA contracts air traffic control services to the private sector at visual flight (VFR) airports. The primary advantages of the program are enhanced safety and significant cost savings to the federal government. FAA contract towers receive continuous oversight and monitoring by the FAA, and all contract controllers are certified by the agency.

Initial Analysis

The establishment of a new ATCT follows a two-phase process as outlined in FAA Order 7031.2C, *Airway Planning Standard Number One - Terminal Air Navigation Facilities and Air Traffic Control Services*. The first phase involves identifying possible candidacy through analysis of operational levels at the airport. The formula presented in **Table 3R** has been utilized as an initial operational screening test to determine if it is reasonable for the airport to request a full benefit-cost analysis from the FAA.

TABLE 3R | ATCT Eligibility Calculations

Formula	Function	PLANNING YEAR			
		2025	2030	2035	2045
Air Carrier Operations/38,000	+	0.0000	0.0000	0.0000	0.0000
Air Taxi Operations/90,000	+	0.0031	0.0033	0.0033	0.0044
GA Itinerant Operations/160,000	+	0.1770	0.1875	0.1950	0.2125
GA Local Operations/280,000	+	0.3066	0.3264	0.3425	0.3786
Military Itinerant Operations/48,000	+	0.0003	0.0021	0.0021	0.0021
Military Local Operations/90,000	+	0.0000	0.0000	0.0000	0.0000
Total	=	0.4870	0.5193	0.5429	0.5976

Source: Coffman Associates

Experience at airports with similar annual operations to GLE has shown that when the initial results of the formula are above 0.5, there is a possibility that the FAA benefit-cost ratio may be above 1.0 because it considers many additional factors, not just operations, with varying degrees of weight applied. Should the City of Gainesville choose, they may notify the FAA of a desire to be included in the ATCT program so that a benefit-cost analysis can be conducted.

The second phase involves complex analysis of the benefits and costs of the establishment of an ATCT. The benefits, which derive from operating the tower, must exceed the installation and operation costs. The costs would include such items as construction, installation, salaries, and maintenance. The analysis applies values to the benefits, which include accident prevention and increases in efficiency.

Should a benefit-cost analysis be conducted, and it is found that the ratio is below 1.0, then under the contract tower cost-sharing program, the airport could qualify for ongoing operational FAA funding equal to the benefit-cost ratio. For example, if a benefit-cost ratio of 0.76 results, then the airport could be expected to receive funding to cover 76 percent of the annual operations cost. The city would then be responsible for the remaining 24 percent of the annual operating costs.

Since the airport has not been served by an ATCT and current operational counts are derived from a third party, the FAA may require further justification of operational counts. In the past, the FAA has supported the use of acoustical counts or even established a temporary tower to obtain a more accurate operational count. Fuel sales records and manual monitoring of activity can also aid the FAA benefit-cost analysis.

Whether a positive benefit-cost ratio is realized in the short or long term, it is important to identify and reserve an appropriate location on the airport for a new ATCT. The alternatives chapter will include a basic site analysis for locating a new ATCT.

ADVANCED AIR MOBILITY AND EVTOL CONSIDERATIONS

Since the turn of the decade, private companies have been developing and testing advanced air mobility (AAM) technologies. AAM is a new concept of air transportation that uses electric vertical takeoff and landing (eVTOL) aircraft to move people and cargo between places that are not easily or currently served by surface or air modes. A common example is the air taxi, in which a person or small group of people could travel within or between metropolitan areas, including airports, using small eVTOL aircraft. Development of infrastructure in support of AAM is currently underway in test cities across the country, and AAM is expected to become a key component of the nation’s air transportation network. Images are provided below of several different AAM/eVTOL aircraft that are currently in development.



Various eVTOL Aircraft in Development (Courtesy of VoloCopter, Joby, and Lilium)

GUIDELINES FOR VERTIPORT FACILITIES

This section reviews applicable guidelines established by the FAA regarding the design of vertiports for eVTOL aircraft. A vertiport is defined as an aviation facility with the primary purpose of supporting eVTOL aircraft. As previously stated, AAM is still a developing technology. The FAA Office of Airports and Technical Center recently solicited aircraft design information from AAM developers. Nine companies responded to the inquiry with varying levels of cooperation, including aircraft design and specifications, operational concepts, infrastructure design, and takeoff and landing profiles. As a result of the feedback, the FAA was able to finalize a document on the design of vertiports, titled Engineering Brief (EB) 105, *Vertiport Design*, published in December 2024.

REFERENCE AIRCRAFT

The design criteria established in *Vertiport Design* are intended for eVTOL aircraft that meet the performance criteria and design characteristics of the reference aircraft. The reference aircraft denotes an eVTOL aircraft that integrates certain performance and design features of the nine previously mentioned emerging aircraft. These aircraft models are evolving rapidly, and manufacturers are approaching aircraft certification with a wide range of designs. Furthermore, new eVTOL aircraft have not yet received FAA airworthiness certification and do not have established safety records. This makes it impractical for the FAA to categorize these aircraft the way fixed-wing and helicopter aircraft have been; however, the feedback from eVTOL manufacturers revealed common characteristics, which the FAA used to produce *Vertiport Design*. These preliminary design characteristics, expected performance capabilities, and assumptions regarding takeoff and landing area design for eVTOL aircraft are summarized in **Table 3S** and on **Exhibit 3E**.



Exhibit 3E – Reference Aircraft

TABLE 3S | Reference Aircraft

DESIGN CHARACTERISTICS	CRITERIA
Propulsion	Electric battery driven, utilizing distributed electric propulsion
Propulsive Units	3 or more
Battery Systems	2 or more
Maximum Takeoff Weight (MTOW)	12,500 pounds (5,670 kg) or less
Controlling Dimension	50 feet (15.2 meters) or less
Flight Control	Highly augmented stability and control
Operating Conditions	
Operation Location	Land-based (ground or elevated) – no amphibian or float operations
Pilot	On board
Flight Conditions	VFR
Performance	
Hover	Hover out of ground effect (HOGE) in normal operations
Takeoff	Vertical
Landing	Vertical from a steady state hover

Source: FAA Engineering Brief 105, *Vertiport Design*

DESIGN STANDARDS FOR VERTIPORTS

Once the reference aircraft is determined, the design dimensions for the vertiport can be established. A vertiport may consist of several facilities, including aircraft charging and storage, a passenger terminal, and takeoff and landing areas. The landside facilities of a vertiport will be specific to and determined by the unique AAM company that chooses to establish a presence in the study area. The airside facilities are the focus of EB 105. The takeoff and landing area design and geometry contained in *Vertiport Design* include the TLOF, the FATO, and the Safety Area, which are defined in detail below.

- **Final Approach and Takeoff Area (FATO) |** The FATO is a defined load-bearing area over which the aircraft completes the final phase of the approach to a hover or landing, and from which the aircraft initiates takeoff. The FATO is similar to the total surface of a helipad.
- **Touchdown and Liftoff Area (TLOF) |** The TLOF is a load-bearing, generally paved area centered in a FATO on which the aircraft performs a touchdown or liftoff. The TLOF is analogous to the center “H” of a helipad.
- **Safety Area |** The Safety Area is a defined area surrounding the FATO that is intended to reduce the risk of damage to aircraft accidentally diverging from the FATO. The vertiport safety area is identical in purpose to a runway or taxiway safety area.
- **Downwash/Outwash Caution Area (DCA) |** Downwash is airflow created by the propulsion units on the aircraft. It flows down, then outwards when it meets the ground, which can be dangerous to people and property. A DCA that extends beyond the Safety Area and functions as a restricted area during VTOL operations should be provided.

The dimensions for these areas are presented in **Table 3T** and are based on the controlling dimension (D) or rotor diameter (RD) of the design VTOL. The RD is the largest length of all the rotors from tip to tip and must also incorporate all landing gear and surface touch points. The controlling dimension is the diameter of the smallest circle enclosing the entire VTOL aircraft projection on a horizontal plane, including all possible configurations with rotors/propellers turning.

Each element is centered within the subsequent element: the TLOF is located in the center of the FATO, which is centered within the Safety Area, as shown by **Exhibit 3F**. The heliport identification marking (H) and vertiport identification marking (VTL) identify the location as a vertiport. Both the TLOF and FATO are expected to be located on level terrain or a structure, be clear of penetrations and obstructions, and support the weight of the design eVTOL aircraft. The TLOF may be circular, square, or rectangular in shape. A study conducted in 2011 found that a square is the preferred visual cue by emergency medical service (EMS) helicopter pilots. The square was rated higher than a circle, triangle, or octagon. Regardless of the shape, the FATO and Safety Area will have the same shape.

TABLE 3T | Takeoff and Landing Area Dimensions

Element	Length
TLOF	1 × RD
FATO	2 × RD
Safety Area	2.5 × RD

FATO = final approach and takeoff area
TLOF = touchdown and liftoff area

Sources: FAA EB 105, Vertiport Design (Table 2-1)

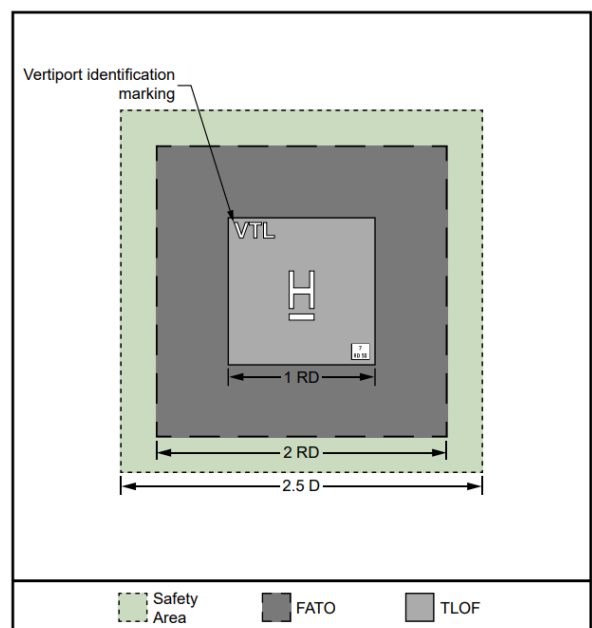


Exhibit 3F – Takeoff and Landing Area

APPROACH PROFILES

Imaginary Surfaces

The imaginary surfaces defined for heliports in Title 14 Code of Federal Regulations (CFR) Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace*, are applicable to vertiports and include the primary surface, approach, and transitional surfaces. Section 77.23 defines these surfaces for heliports, and they have been adopted for use and presented in *Vertiport Design*.

- **Primary Surface** | The primary surface is the same size and shape as the FATO. This surface is a horizontal plane at the established vertiport elevation.
- **Approach Surface** | This surface begins at each end of the vertiport's primary surface, has the same width as the primary surface, and extends outward and upward for a horizontal distance of 4,000 feet, where its width is 500 feet. The slope of this surface is 8:1 and it doubles as the departure surface.
- **Transitional Surface** | The transitional surface extends outward and upward from the lateral boundaries of the primary and approach surfaces at a slope of 2:1 for 250 feet horizontally from the centerline of the primary and approach surfaces.

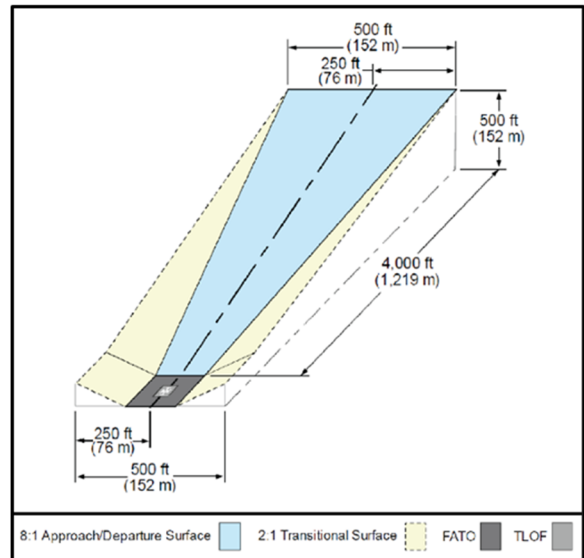


Exhibit 3G – Vertiport Imaginary Surfaces

The primary, approach, and transitional surfaces should remain clear of penetrations whenever possible, unless an FAA analysis determines the penetrations to any Part 77 surface not to be hazardous. **Exhibit 3G** is a visual representation of the imaginary surfaces as they apply to vertiports.

VERTIPORT SUMMARY

eVTOLs and AAM represent an emerging, yet unproven, aviation market. Testing and initial adoption are likely to occur in large metropolitan areas and then expand to mid-sized and smaller markets. Full integration of eVTOL into the national airspace system may not occur for many more years; however, it is prudent for this planning study to consider the potential for such activity at GLE. The alternatives analysis will include options for a potential future vertiport on airport property. Electrical infrastructure will be needed at the vertiport to provide power and recharging capabilities for the aircraft. Initial estimates from manufacturers range between 500-kilowatt (kW) to 1.0-megawatt (MW) power supply per charger.

A summary of the airside facilities at GLE is presented on **Exhibit 3H**.

CATEGORY	EXISTING	FUTURE	ULTIMATE	EXISTING/ULTIMATE
Runways	18-36	18-36	18-36	13-31
Runway Design Code (RDC)	B-II-4000	C-II-4000	C-IV-2400	B-I-VIS
Dimensions	6,000' x 100'	Consider extension; maintain width	Consider extension; increase width to 150'	4,307' x 75' (Maintain width if feasible)
Pavement Strength	30,000 lbs S	Maintain	100,000 lbs D	15,000 lbs S
	50,000 lbs D	Maintain		
Blast Pads	N/A	150' x 120'	200' x 200'	N/A
Safety Areas				
RSA	Overlapping RSA; consider mitigation options	Vegetation present; remove	Vegetation present; remove	Overlapping RSA; consider mitigation options
ROFA	Standard ROFA	Vegetation present; remove	Vegetation present; remove	Vegetation present; remove
ROFZ	Standard ROFZ	Standard ROFZ	Standard ROFZ	Standard ROFZ
RPZ	Portion of RPZ (18, 36) uncontrolled; incompatible uses (36); consider mitigation options	Portion of RPZ (18, 36) uncontrolled; incompatible uses (36); consider mitigation options	Portion of RPZ (18, 36) uncontrolled; incompatible uses (36); consider mitigation options	Standard RPZ (13, 31)
Taxiways				
Design Group	TDG 2A	TDG 2A/B	TDG 5	TDG 2A
Parallel Taxiway	Taxiway A	Maintain	Maintain	N/A
Parallel Taxiway Separation from Runway	400' - 600'	Maintain	Maintain	N/A
Widths	35' - 40'	Maintain width	75'	35'
Holding Position Separation	250'	Maintain	263'	200'
Notable Conditions	Direct access; consider corrective measures	Maintain standard taxiway geometry	Maintain standard taxiway geometry	Aligned taxiways; consider corrective measures
Navigational and Weather Aids				
Instrument Approaches	LPV GPS (18, 36)	Maintain	Implement improved approach to Runway 18	Visual only
Weather Aids	AWOS, wind cones, segmented circle, rotating beacon	Maintain equipment; upgrade to LED if necessary		
Approach Aids	PAPI-2 (18, 36), REILS (18, 36)	Consider upgrade to PAPI-4; maintain REILS	Install approach lighting system (18) if minimums are reduced	Install PAPI-2 and REILs
Lighting and Marking				
Runway Lighting	MIRL	Maintain	HIRL	Install MIRL system
Runway Marking	Non-precision	Maintain	Upgrade to precision marking	Basic
Taxiway Lighting	Centerline reflectors	Install MITL	Maintain MITL	

KEY	AWOS - Automated Weather Observing System	LPV - Localizer Performance with Vertical Guidance	REIL - Runway End Identification Lights	RSA - Runway Safety Area
	D - Dual Wheel	MIRL - Medium Intensity Runway Lighting	ROFA - Runway Object Free Area	S - Single Wheel Loading
	GPS - Global Positioning System	PAPI - Precision Approach Path Indicator	ROFZ - Runway Obstacle Free Zone	TDG - Taxiway Design Group
	HIRL - High Intensity Runway Lighting	RDC - Runway Design Code	RPZ - Runway Protection Zone	VIS - Visual Runway

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GENERAL AVIATION LANDSIDE FACILITY REQUIREMENTS

Landside facilities are necessary for the handling of aircraft and passengers while on the ground. These facilities provide the essential interface between the air and ground transportation modes. The capacity of the various components of each element was examined in relation to projected demand to identify future landside facility needs. For GLE, this includes the following components for general aviation needs:

- General aviation terminal facilities and auto parking
- Aircraft storage hangars
- Aircraft parking aprons
- Airport support facilities

Projections made for aircraft storage hangars, aircraft parking aprons, and marked parking positions are based on the number of aircraft currently based and forecasted to base on the airport property through the 20-year planning horizon. Terminal facilities, auto parking, and other airport support facilities are based on the annual number of operations projected to occur over the planning period.

A summary of the overall general aviation landside facilities is presented on **Exhibit 3J**.

GENERAL AVIATION TERMINAL SERVICES

The general aviation terminal facilities at an airport often provide corporate officials and visitors with their first impressions of the community. General aviation terminal facilities at an airport can provide space for passenger waiting, a pilots' lounge, flight planning, concessions, management, storage, and many other needs. This space is not necessarily limited to a single, separate terminal building and can include space offered by fixed base operators (FBO) and other specialty operators for these functions and services. At GLE, general aviation terminal services are provided in the 3,500-square-foot (sf) general aviation terminal building. This facility was constructed in 1996, accommodates typical general aviation terminal services, and serves as a focal point for itinerant traffic at the airport.

The methodology used to estimate general aviation terminal facility needs was based on the number of airport users expected to utilize general aviation facilities during the design hour. This methodology is a general airport planning practice and is not considered exacting, as each airport terminal serves unique functions. The space requirements for terminal building facilities were based on providing 125 sf per design hour itinerant passenger. A multiplier of 2.5 in the short term, increasing to 5.0 in the long term, was also applied to terminal facility needs to better determine the number of passengers associated with each itinerant aircraft operation. This increasing multiplier indicates an expected increase in operations by larger aircraft through the planning period.

Table 3U outlines the space requirements for general aviation terminal services at GLE through the long-term planning period. The 3,500-sf general aviation terminal building is adequately sized for current operations levels; however, additional terminal space may become necessary as the levels of operations grow beyond the intermediate-term period. The alternatives in the next chapter will consider options for expansion of general aviation terminal services at GLE.

Available

Short Term

Intermediate
Term

Long Term



AIRCRAFT STORAGE HANGAR REQUIREMENTS

Aircraft to be Hangared	115	126	138	166
T-Hangar Area (sf)	103,600	109,300	115,300	133,600
Executive/Conventional Hangar Area (sf)	186,600	205,600	228,100	273,100
Total Hangar Storage Area (sf)	290,200	314,900	343,400	406,700



AIRCRAFT PARKING APRON

Aircraft Parking Positions	13	39	44	50
Total Public Apron Area (sy)	30,000	29,800	34,300	40,000



GENERAL AVIATION TERMINAL FACILITIES AND PARKING

Building Space (sf)	3,500	1,875	2,250	4,375
Terminal and Tenant Vehicle Parking	26	47	53	77



AIRCRAFT FUELING

14-Day 100LL Fuel Storage (gal)	12,000	4,679	4,875	5,305
14-Day Jet A Fuel Storage (gal)	12,000	12,581	17,164	31,916

TABLE 3U | General Aviation Terminal Area Facilities

	Currently Available	Short-Term Need	Intermediate-Term Need	Long-Term Need
Input Data				
General Aviation Itinerant Design Hour Operations	–	6	6	7
Passenger Multiplier	–	2.5	3.0	5.0
Design Hour Passengers	–	15	18	35
Terminal Service Space Requirements				
Space per Design Hour Passenger (sf)	–	125	125	125
Terminal Building Need (sf)	3,500	1,875	2,250	4,375
Terminal Vehicle Parking Requirements				
Terminal Visitor Vehicle Space Need	–	25	32	45
Based Aircraft Space Need	–	25	28	36
Total Terminal/Tenant Visitor Vehicle Parking	26	47	53	77

Source: Coffman Associates analysis

General aviation vehicle parking demands have also been determined for GLE. Space determinations for passengers were based on an evaluation of existing airport use, as well as standards set forth to help calculate projected terminal facility needs. Currently, 26 marked individual vehicle spaces are provided at the general aviation terminal, along with 105 marked tenant parking spaces associated with various hangars. Vehicle parking lot needs at the terminal building were determined based on a combination of the calculated design hour passengers and an estimated need to accommodate 25 percent of based aircraft owners/operators for each planning period. This analysis shows a potential need to increase the number of available parking spaces for terminal visitors and/or tenants. The next chapter will include new dedicated vehicle parking to accommodate airport tenants and users throughout the landside areas.

AIRCRAFT HANGARS

Utilization of hangar space varies as a function of local climate, security, and owner preference. The trend in general aviation aircraft is toward more sophisticated (and, consequently, more expensive) aircraft; therefore, many aircraft owners prefer enclosed hangar space over outside tiedowns.

The demand for aircraft storage hangars is dependent on the number and type(s) of aircraft expected to be based at the airport in the future. For planning purposes, it is necessary to estimate hangar requirements based on forecasted operational activity; however, hangar development should be based on actual demand trends and financial investment conditions.

While most aircraft owners prefer enclosed aircraft storage, some will still use outdoor tiedown spaces, usually due to lack of available hangar space, high hangar rental rates, or operational needs; therefore, enclosed hangar facilities do not necessarily need to be planned for each based aircraft.

Hangar types vary greatly in size and function. T-hangars are popular with aircraft owners who need to store individual private aircraft. These hangars typically provide individual spaces within a larger structure or in portable standalone buildings. There is approximately 103,600 sf of total T-hangar storage space, including 77 individual T-hangar storage units, at GLE. For determining future aircraft storage needs, it is assumed that owners of new single-engine, multi-engine, and other aircraft (ultralights, gliders, etc.)

will prefer T-hangar storage space. Planning standards of 1,200 sf per single-engine piston and other aircraft and 1,500 sf per multi-engine piston aircraft are utilized for this hangar type.

Box and conventional hangars are open-space facilities with no interior supporting structures. Box hangars can vary in size from 1,500 and 2,500 sf to nearly 10,000 sf. They are typically able to house single-engine, multi-engine, turboprop, and jet aircraft, as well as helicopters. Conventional hangars provide bulk aircraft storage and are often utilized by airport businesses, such as FBOs or aircraft maintenance operators. Conventional hangars are generally larger than executive box hangars and can range in size from 10,000 sf to more than 20,000 sf. There is approximately 186,600 sf of space for box and conventional hangars at GLE. For future planning, standards of 3,000 sf per turboprop, 5,000 sf per jet, and 1,500 sf per helicopter are utilized for box and conventional hangars. Future hangar requirements for the airport are summarized in **Table 3V**.

TABLE 3V | Aircraft Hangar Requirements

	Currently Available	Short-Term Need	Intermediate-Term Need	Long-Term Need	Difference
Total Based Aircraft	115	126	138	166	+51
Hangar Area Requirements					
T-Hangar Area (sf)	103,600	109,300	115,300	133,600	+30,000
Box/Conventional Hangar Area (sf)	186,600	205,600	228,100	273,100	+86,500
Total Hangar Area (sf)	290,200	314,900	343,400	406,700	+116,500

Source: Coffman Associates analysis

Because most based aircraft owners prefer enclosed hangar space, it is assumed that all based aircraft will occupy hangar spaces, as opposed to tying down on the apron. The analysis shows that future hangar requirements indicate a potential need for approximately 116,500 sf of new hangar storage capacity through the long-term planning period. This includes a mixture of hangar types; the largest need is projected in the box/conventional hangar category. Due to the projected increase in based aircraft, the existing demand for hangar space, annual general aviation operations, and hangar storage needs, facility planning will consider additional hangars at the airport. It is expected that the aircraft storage hangar requirements will continue to be met through a combination of hangar types.

It should be noted that hangar requirements are general in nature and are based on aviation demand forecasts. The actual need for hangar space will further depend on the usage within the hangars. For example, some hangars may be utilized entirely for non-aircraft storage, such as maintenance, but they have an aircraft storage capacity from a planning standpoint; therefore, the needs of an individual user may differ from the calculated space necessary.

AIRCRAFT PARKING APRONS

The aircraft parking apron is an expanse of paved area intended for aircraft parking and circulation. Typically, a main apron is centrally located near the airside entry point, such as the terminal building or FBO facility. Ideally, the main apron is large enough to accommodate transient airport users, as well as a portion of locally based aircraft. Smaller aprons are often available adjacent to specialty aviation service operator (SASO) hangars and at other locations around the airport. The apron layout at GLE generally follows this pattern, with the main apron is adjacent to the terminal building.

To determine future apron needs, the FAA-recommended planning criterion³ of 755 square yards (sy) was used for ADG I aircraft (single-engine and multi-engine piston aircraft), while a planning criterion of 1,075 sy was used for larger ADG II aircraft (turboprops and jets). A parking apron should also provide space for locally based aircraft that require temporary tiedown storage. Locally based tiedowns are typically utilized by smaller single-engine aircraft; thus, a planning standard of 755 sy per position was utilized in the analysis.

The total apron parking requirements are presented in **Table 3W**. The existing apron pavement area at GLE encompasses approximately 30,000 sy. Using the planning standards described above and factoring in assumptions regarding operational and based aircraft growth, an additional 10,000 sy of aircraft parking apron pavement is estimated to be needed over the next 20 years.

TABLE 3W | Aircraft Parking Apron Requirements

	Currently Available	Short-Term Need	Intermediate-Term Need	Long-Term Need	Difference
Aircraft Parking Positions					
Based/Local GA Aircraft	–	3	3	3	–
Transient GA Aircraft	–	33	35	38	–
Corporate Jet Aircraft	–	2	4	6	–
Helicopter	–	1	2	3	–
Total Parking Positions	13	39	44	50	+37
Total Apron Area (square yards)	30,000	29,800	34,300	40,000	+10,000

Source: Coffman Associates analysis

SUPPORT FACILITIES

Various other landside facilities that support overall airport operations have also been identified. These support facilities include the following:

- Aviation fuel storage
- Perimeter fencing and gates

Aviation Fuel Storage

The airport’s fuel storage capacity consists of one 12,000-gallon Jet A aboveground fuel storage tank and one 10,000-gallon 100LL fuel storage tank. Each storage tank is owned by the City of Gainesville, and fuel dispensing is managed by city staff.

City records on fuel flowage show that an average of approximately 240,632 gallons of Jet A fuel was dispensed over a three-year period from 2022 to 2024. Over the same period, 100LL fuel flowage averaged approximately 114,967 gallons. Utilizing the FAA’s TFMSC data, turbine operations for 2024 totaled 1,247 at GLE. Of the 114,451 total base year operations for this master plan, 113,204 were conducted by piston-powered aircraft. As such, it is estimated that 192.97 gallons of Jet A fuel were pumped per turbine operation, while approximately 1.02 gallons of 100LL fuel were pumped per piston operation.

³ Per the FAA Apron Size Calculation Tool.

Maintaining a 14-day fuel supply would allow the airport to limit the impact of a disruption of fuel delivery. The airport currently has enough static fuel storage to meet the 14-day supply criteria for 100LL fuel through the long-term horizon. The forecasted fuel storage requirements summarized in **Table 3Y** show a need for additional Jet A fuel storage capacity by the short-term horizon.

Fuel storage requirements are typically based on keeping a two-week supply of fuel during an average month; however, more frequent deliveries can reduce the fuel storage capacity requirements. If demand warrants, the airport could begin ordering fuel on a weekly basis to meet demand until additional storage capacity can be added. Generally, a fuel tank should be of adequate capacity to accept a full refueling tanker (approximately 8,000 gallons) while maintaining a reasonable level of fuel in the storage tank.

TABLE 3Y | Fuel Storage Requirements

	Capacity	2024 Flowage Summary	PLANNING HORIZON		
			Short Term	Intermediate Term	Long Term
AvGas (100LL)					
Daily Usage (gal.)		315	334	348	379
14-Day Supply (gal.)	12,000	4,422	4,679	4,875	5,305
Annual Usage (gal.)		114,967	122,000	127,100	138,300
Jet A					
Daily Usage (gal.)		659	899	1,226	2,280
14-Day Supply (gal.)	12,000	9,255	12,581	17,164	31,916
Annual Usage (gal.)		240,632	328,000	447,500	832,100

Sources: Historical fuel flowage data provided by airport administration; fuel supply projections prepared by Coffman Associates

Future aircraft demand will determine the need for additional fuel storage capacity. It is important that airport personnel work with the City of Gainesville to plan for adequate levels of fuel storage capacity through the long-term planning period of this study.

Planning should consider an additional tank to store unleaded aviation fuel (100UL). The FAA has recently approved the use of 100UL fuel in piston-powered aircraft, although unknowns regarding production, infrastructure, and distribution remain; nevertheless, the alternatives will include placeholders for these facilities.

Perimeter Fencing and Gates

Perimeter fencing is used at airports primarily to secure the aircraft operations area. The physical barrier of perimeter fencing:

- Gives notice of the legal boundary of the outermost limits of the facility or security-sensitive areas;
- Assists in controlling and screening authorized entries into a secured area by deterring entry elsewhere along the boundary;
- Supports surveillance, detection, assessment, and other security functions by providing a zone for installing intrusion detection equipment and closed-circuit television (CCTV);
- Deters casual intruders from penetrating the aircraft operations area on the airport;
- Creates a psychological deterrent;

- Demonstrates a corporate concern for facilities; and
- Limits inadvertent access to the aircraft operations area by wildlife.

GLE is equipped with perimeter fencing and secure access gates. All fencing and coded gates should be maintained through the planning period and should be regularly inspected to ensure they are functioning properly and are undamaged. As new facilities are developed on the airport, it may be necessary to modify or expand the perimeter fencing.

OTHER POTENTIAL LANDSIDE FACILITY NEEDS

The previous chapter outlined the potential for additional aviation activity at GLE beyond general aviation. One consideration was the establishment of some level of commercial service at the airport in the future. If this were to happen, it would likely be in the form of a non-traditional carrier offering air charter services. Another segment considered was air cargo. If implemented, it is possible that a U.S. Customs facility would need to be established if international freight were to be handled. The following sections provide an overview of the facilities that may be necessary to accommodate these activities.

COMMERCIAL SERVICE FACILITIES

Chapter Two considered four scenarios in which commercial service was initiated at the airport. This included a passenger membership model, hop-on jet service, regional jet service, and irregularly scheduled charter flights. The type of commercial service facilities required depend on the type of service offered (scheduled vs. unscheduled, number of seats on the aircraft). The two options below provide a high-level overview of the facilities that may be necessary to accommodate various commercial service activities.

Option 1: Non-traditional Terminal

Chapter Two considered three commercial service scenarios that could be accommodated in a non-traditional terminal setting (i.e., no standard security checkpoint, no baggage claim or ticketing counters). This correlates to the type of service outlined in Scenarios 1 and 2 in Table 2S. In each of these scenarios, the service provider is able to operate at airports that are not Part 139 certified, either due to the number of seats on the aircraft (less than 31) or by operating under Part 135, which applies to on-demand charters. Because there is no requirement for the airport to become Part 139 certified, many of the facilities that passengers are accustomed to seeing in a terminal building, such as traditional security checkpoints, are not required. Rather, these operators often use their own “private terminals” or FBO facilities where security screening and other pre- and post-flight activities are conducted. For the airport sponsor, there are several advantages that come with not needing to become Part 139 certified, both in terms of the space and cost required to support Part 139 activities. **Table 3Z** outlines examples of airports offering the types of commercial service described above and the facilities they use.

TABLE 3Z | Non-traditional Terminal Example

Airport	Service Provider	Aircraft	Seats	Facility Size
Scottsdale Airport, AZ	JSX	Embraer 145	30	53,000 sf
Taos Regional Airport, NM	Contour/JSX	Embraer 135/145	30	17,000 sf
Boone County Regional Airport, AR	Southern Airways Express (Surf Air)	Cessna 208	9	6,000 sf

Source: Coffman Associates Analysis

Option 2: Traditional Terminal

Scenarios 3 and 4 in Table 2S considered an option where regional jet or irregularly scheduled charter operations by aircraft with more than 30 seats are implemented. In these scenarios, it would be necessary for GLE to seek a Part 139 certification. This would include, among other requirements, an aircraft rescue and firefighting (ARFF) station and equipment, traditional security screening measures, and an FAA-approved Airport Certification Manual (ACM) that outlines how the airport complies with Part 139. Accommodating aircraft of this size and its passengers would also necessitate the construction of a more traditional terminal facility, with queuing and holding areas, baggage facilities, and other features typically found in commercial service airports. **Table 3AA** presents examples of airports offering regional jet service and/or irregularly scheduled charter service and their associated facilities.

TABLE 3AA | Traditional Terminal Example

Airport	Service Provider(s)	Aircraft	Seats	Facility Size	Facility Features
Dubuque Regional Airport, IA	Sun Country Denver Air	Boeing 737-800 Embraer 145	186 30	32,000 sf	TSA security checkpoint/screening, hold room, baggage carousel, restaurant, ticketing counters, rental car counter
Yellowstone Regional Airport, WY	United Express	Bombardier CRJ200	50	27,000 sf	TSA security checkpoint/screening, hold room, baggage carousel, restaurant, ticketing counters, rental car counter, administrative offices
Flagstaff Airport, AZ	SkyWest	Bombardier CRJ200	50	24,000 sf	TSA security checkpoint/screening, hold room, baggage carousel, restaurant, ticketing counters, rental car counter, administrative offices

Source: Coffman Associates analysis

In summary, the size and features of a passenger terminal building would be entirely dependent on the type of service provided. If a passenger membership model or hop-on service is implemented, as shown in Option 1, then the existing terminal building could likely support some level of this activity. Alternatively, the service provider could elect to conduct operations out of a hangar (private terminal) on the airport. If regional jet or irregularly scheduled charter service using larger aircraft is implemented, as shown in Option 2, then the City of Gainesville would need to pursue Part 139 certification and additional facilities beyond what exist today to support those operations. This would likely necessitate the construction of a new terminal building with traditional features, including a security checkpoint, ticketing, and baggage facilities, along with the required Part 139 elements, such as ARFF.

AIR CARGO FACILITIES

Chapter Two also considered the potential for GLE to accommodate air cargo. Two scenarios were considered – one that included the introduction of a traditional cargo carrier (FedEx or UPS) utilizing Boeing 767-300 aircraft, and another that included a smaller feeder service (Ameriflight) utilizing aircraft such as the Beechcraft 1900. Similar to commercial service, the size and types of facilities necessary to accommodate air cargo are dependent upon the type of carrier.

The establishment of a U.S. Customs and Border Protection (CBP) facility and services may also be necessary if air cargo operations begin at GLE. This would provide clearance for aircraft containing international freight or passengers and may necessitate an on-site facility, or at a minimum, a specific area for aircraft parking and processing. There are three types of facilities offering different levels of service.

1. Port of Entry – Officially designated by CBP and must meet certain activity requirements to be designated as such
2. Landing Rights Airport – Arriving aircraft must provide advance notice to CBP and receive permission to land
3. User Fee Airport – Participating airports pay for CBP services

In order to support on-site CBP services, the airport would need to provide the following: 1) administrative office space; 2) cargo inspection areas; 3) primary and secondary inspection areas; and 4) any other space necessary for regular CBP operations. Depending upon the type of facility operated, there may be additional requirements in terms of the facility or security. The costs to include on-site CBP services will vary depending on the type and size of facility constructed.

The alternatives in the next chapter will consider various options for the development of air cargo facilities at GLE.

SUMMARY

This chapter outlines the safety design standards and facilities required to meet the potential aviation demand projected at GLE for the next 20 years. To provide a more flexible master plan, the yearly forecasts from Chapter Two have been converted to planning horizon levels. The short term roughly corresponds to a five-year period, the intermediate term is approximately 10 years, and the long term is 20 years. By utilizing planning horizons, airport management can focus on demand indicators for initiating projects and grant requests, rather than on specific dates in the future.

In Chapter Four, potential improvements to the airside and landside systems will be examined through a series of airport development alternatives. Most of the alternatives discussion will focus on capital improvements that would be eligible for federal and state grant funds. Ultimately, an overall airport development plan that presents a vision beyond the 20-year scope of this master plan will be developed.