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MAX WESTHEIMER AIRPORT
The UNIVERSITY of OKLAHOMA
Master Plan Update

Forecast of Aviation Demand

KSA

02 AVIATION DEMAND FORECAST

2.1 OVERVIEW

The demand forecast element of the planning process is used to determine the need for future capital development, as well as investment in the airport facility itself. Essential to this determination is the generation of forecasts and projected increases in airport activity. Demand forecasts provide a means of determining the type, extent, size, location, timing, and financial feasibility of future capital improvements. Consequently, demand forecasts influence the remaining phases of the planning process.

Forecasting aviation activity requires more than an extrapolation of past trends; it involves the application of statistical measures to correlate future demand with population projections, economic performance, and demographic data. Because demand forecasting is not an exact science, it requires the application of professional judgment and experience, and an understanding of the market forces that promote or limit aviation growth.

Demand forecasts have been prepared and are presented in this chapter to assist the sponsor in evaluating the performance-based needs of the Airport during the next 20-years. Additionally, the Federal Aviation Administration (FAA) will review and accept the forecasts to ensure they are reasonable compared to current FAA forecasting projections. The forecasts are organized to include a range of activity including, based aircraft, operational fleet mix, annual operations (itinerant and local), and ultimate critical aircraft.

2.2 DATA SOURCES

The forecasting process begins by obtaining recorded data pertinent to the operation and administration of the University of Oklahoma Max Westheimer Airport. Generally, aviation activity forecasting commences by utilizing the present time as an initial point, supplemented with historical trends obtained from previous years' activity and recorded information. This data has evolved from a comprehensive examination of historical airport records provided by airport personnel, FAA Form 5010-1, *Airport Master Record*, *FAA Terminal Area Forecast*s, and the *FAA Aerospace Forecasts Fiscal Years 2021-2041*. Supplemental publications providing trends and conditions of the aviation industry include the *General Aviation Statistical Databook Industry Outlook* and *Business Aviation Fact Book, 2018*. These documents were assembled in different years, making the base year data quite variable and emphasizing the need for establishing a well-defined and well-documented set of historical information from which to project future aviation activity trends.

2.3 FACTORS AFFECTING FUTURE AVIATION DEMAND

Before examining future activity, several assumptions and conditions that help form the basis or foundation for the development of forecasts should be noted. These statements cover a wide variety of physical, operational, industry, and socioeconomic considerations.

2.3.1 DEMOGRAPHICS

The existing socioeconomic condition of a particular region historically impacts aviation within an area and is often analyzed in the forecasts of aviation activity. Provided by Woods and Poole, the most current demographic data for Cleveland County shows average annual increases to the year 2041 for the population at 1.02 percent, employment at 1.48 percent, and per capita income at 1.4 percent. This compares to the OKC Metropolitan Statistical Area (MSA) which reflects average annual growth rates of 0.81 percent for population, 1.15 percent for employment, and 1.39 percent for per capita income.

2.3.2 COMMUNITY SUPPORT

Max Westheimer Airport benefits from the support of the surrounding community and government, local industry, strategic partnerships, and citizens. The Airport is recognized as a vital asset to the University of Oklahoma, City of Norman and Cleveland County, contributing to the stability and future of the area's economy. Additionally, much of the region benefits from the proximity of a regional aviation facility and, in turn, provides an economic base that can attract additional based aircraft, and industrial/business development to the airport.

2.3.3 THE UNIVERSITY OF OKLAHOMA

Max Westheimer Airport is owned by the University of Oklahoma, so it directly benefits from the growth of the university. The University of Oklahoma has an aviation program with 19 aircraft, and 250 students. The University aviation and flight programs have shown much growth over recent years, and have even since added a cap to the amount of students who are able to join the flight program each year. These operations by the University flight program are integral to the airport and providing operations at the Airport. Table 2.1 shows the growth of the University as a whole and of the OU aviation program as it continues to grow.

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TABLE 2.1 – UNIVERSTY OF OKLAHOMA TOTAL STUDENTS 2010-2021

Year	Total Enrollment	Aviation Students	% of enrollment
2010	26,490	216	0.8154%
2011	27,149	180	0.6630%
2012	27,518	164	0.5960%
2013	27,303	167	0.6117%
2014	27,278	161	0.5902%
2015	27,445	167	0.6085%
2016	27,937	180	0.6443%
2017	28,541	195	0.6832%
2018	28,582	203	0.7102%
2019	28,089	220	0.7832%
2020	27,782	240	0.8639%
2021	28,052	250	0.8912%

Source: University of Oklahoma

The University of Oklahoma also has nine men's sports teams and ten women's sports teams all of which can benefit from the use of the airport. The athletic department at OU has recently announced its move to the NCAA Southeastern Conference (SEC), from the Big XII Conference, which places its primary sports opponents in further geographical positions from Norman. In the Big XII Conference, OU was located mostly centrally between the other nine schools as eight of the ten schools were in Oklahoma, Texas, and Kansas, with one in West Virginia, and one in Iowa. The move to the SEC will require more teams to utilize air travel more frequently as opposed to other modes of transportation, i.e., charter bus, to get to competitions. This move will also attract additional traffic from game attendees, which will be discussed in detail in later sections.

2.3.4 COVID-19

Nothing has impacted the global or national aviation industry since the 2008/09 recession as the existing COVID-19 pandemic. This virus outbreak has led to major declines in demand for air carrier and general aviation activity and led those in the industry to announce severe cost-cutting measures, request government funding assistance, and/or ground fleets. Spread of the virus has created a concern for both short- and long-term effects within the aviation industry nationally and globally.

Similar to the well-known and stated declines with airlines, the general aviation sector has not been immune to similar impacts. General Aviation provides more than one (1) percent of $247 billion of the GDP in the U.S. and accounts for over 1.3 million jobs. Typically, the GA sector strength is based on sales and aircraft deliveries to various purchasers across the globe. When analyzing details provided by the General Aviation Manufacturers Association (GAMA), 2020 started strong and was on par to replicate or exceed 2019; however, when health and safety restrictions were put into place to respond to COVID-19, supply chains and deliveries were shut down and negatively impacted. The following

Table 2.2 compares general aviation aircraft sales and deliveries from the first quarter of 2019 to the first quarter of 2020. As reflected, decreases are exhibited across the board from all aircraft sectors.

TABLE 2.2 – GAMA SALES COMPARISON 2019-2020

Aircraft Type	2019	2020	% Change
Piston Airplanes	877	889	1.4%
Turboprop Airplanes	348	254	-27.0%
Business Jets	516	378	-26.7%
Total Airplanes	1,741	1,521	-12.6%
Total Airplane Billings	$14.9B	$11.9B	-20.1%
Piston Helicopters	141	105	-25.5%
Turbine Helicopters	434	333	-23.3%
Total Helicopters	575	438	-23.8%
Total Helicopter Billings	$2.2B	$1.9B	-16.2%

Source: General Aviation Manufacturers Association (GAMA).

While overall shipments were down, discussions provided by the National Business Aviation Association indicate the industry is on a trajectory that is turning the corner and headed back in the right direction. Fractional aircraft owner shares have witnessed significant increases in customer base who understand the "inherent advantages of business aviation: going more places in less time, reaching destinations they didn't think they could reach, and flying in a safe, secure, and healthy manner" and "clients see business aviation as an option to eliminate concerns about airlines cabins packed with people". These statements, along with the approval and dissemination of COVID-19 vaccines, are providing the framework to help put general aviation back on course for growth and potential record-breaking activity. Table 2.3 provides an updated comparison of aircraft deliveries from the third quarter of 2020 to the third quarter of 2021, showing an upward trend.

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TABLE 2.3 – GAMA SALES COMPARISON 2020-2021

Aircraft Type	2020	2021	% Change
Piston Airplanes	901	895	-0.7%
Turboprop Airplanes	254	357	40.6%
Business Jets	378	438	15.9%
Total Airplanes	1,533	1,690	10.2%
Total Airplane Billings	$11.9B	$13.4B	13.0%
Piston Helicopters	105	131	24.8%
Turbine Helicopters	332	410	23.5%
Total Helicopters	437	541	23.8%
Total Helicopter Billings	$1.8B	$2.4B	37.3%

Source: General Aviation Manufacturers Association (GAMA).

2.4 GENERAL AVIATION TRENDS

At the national level, fluctuating trends related to general aviation usage and economic uncertainty resulting from the national and international business cycles all have significant impacts on general aviation demand levels. General aviation aircraft are classified as all aircraft not flown by commercial airlines or the military. This includes an incredibly diverse array of flying that ranges from a personal vacation getaway in a small single-engine plane to overnight package delivery to an emergency medical evacuation to a morning sightseeing flight to flight instruction that trains new pilots to helicopter traffic reports that keep drivers informed of rush-hour delays. Simply stated, general aviation encapsulates all those individual unscheduled aviation activities that enrich, enhance, preserve, and protect our lives.

As defined by the FAA, general aviation activities are divided into six use categories:

- Personal – About a third of all private flying in the United States is for personal reasons, including practicing flight skills, personal or family travel, personal enjoyment, or personal business.
- Instructional – All private flight instruction for purposes ranging from private pilot to airline pilot is conducted through general aviation.
- Corporate – About 12 percent of the total private flying in the U.S. is done in aircraft owned by a business and piloted by a professional. Many of these flights are in jets and cover long distances, with some flying to intercontinental and international destinations. Businesses elect to fly these trips to save time and expand their geographic and operational networks.
- Business – About 11 percent of the total private flying in the U.S. is done by business individuals flying themselves to meetings or other events, primarily in piston or turboprop aircraft. Most pilots own or work for relatively small businesses and use the aircraft to accomplish missions that would otherwise take more time or be infeasible.
- Air Taxi – When scheduled air service either is unavailable or inconvenient, businesses and individuals use charter aircraft from air taxi service providers. These flights save time and make it possible to fly directly to those places that cannot be reached by scheduled service. (Note that "air taxi" is also utilized

as a charter or on-demand commercial air service classification).

- Other – All other activities are classified as being "other." Given the diverse nature of general aviation, this includes disaster relief, search and rescue, police operations, news reporting, border patrol, forest firefighting, aerial photography and surveying, crop dusting, and tourism activities, among many others.

2.4.1 BUSINESS USE OF GENERAL AVIATION

Business and corporate aviation are the fastest-growing facets of general aviation. Companies and individuals use aircraft as tools to improve the efficiency and productivity of their business and personnel. The use of general aviation aircraft afford businesses direct control of their travel itineraries and destinations and significantly reduce travel times and inconveniences often associated with scheduled airline service.

According to the NBAA's Business Aviation Fact Book, only 3 percent of the approximately 15,000 business aircraft registered in the U.S. are flown by large, Fortune 500 companies. The remaining 97 percent are operated by a broad cross-section of organizations, including government, universities, charitable organizations, and businesses of all sizes. Most U.S. companies that utilize business aircraft (85 percent) are small and mid-size businesses, many of which are based in the dozens of communities across the county where the airlines have reduced or eliminated service. The benefits of corporate general aviation are evidenced by the significant growth that business/corporate general aviation has recently experienced.

Business use of general aviation ranges from small, single-engine aircraft rentals to corporate aircraft fleets supported by dedicated flight crews and mechanics. Business aircraft usage by smaller companies has also escalated dramatically as various chartering, leasing, fractional ownership, interchange agreements, partnerships, and management contracts have emerged.

Of particular note is the immense popularity of fractional ownership operations, which began in 1986 with the creation of a program that offered aircraft owners increased flexibility in the ownership and operation of aircraft. The program uses current aircraft acquisition concepts, including shared or joint aircraft ownership, and provided for the management of the aircraft by an aircraft management company. The aircraft owners participating in the program agree not only to share their own aircraft with others having a shared interest but also to lease their aircraft to others in the program. The aircraft owners use a common management company to provide aviation management services, including maintenance of the aircraft, crew training and assignment, and leasing management.

Even in an unsteady economy, fractional operators say business has continued to improve as existing customers re-enter the market or increase their fractional aircraft usage. In addition, they say an increasing number of new prospects are making a move to fractional ownership as an alternative to flying commercially or owning a business jet outright. Fractional-share ownership makes up 15% of business aviation flights.

Growing segments of the business aircraft fleet mix include business liners and very light jets (VLJ). Business liners are large business jets, such as the Boeing Business Jet (BBJ) and Airbus ACJ, reconfigured versions of passenger aircraft flown by large commercial airlines. Labeled as "personal jets" VLJs are small, six-seat jets costing substantially less than typical business jet aircraft. Popular aircraft models in this category include the Eclipse 500 and 550, Embraer Phenom 100, Cessna Mustang, HondaJet, and the Cirrus Vision Jet.

2.4.2 GENERAL AVIATION OUTLOOK

National general aviation activity trends are monitored and forecasted by the FAA on an annual basis in the FAA Aerospace Forecasts publication. The most current edition covers Fiscal Years 2021-2041

Single and multi-engine piston aircraft experienced a decline in the number of total aircraft between 2010 and 2020. Although still the largest portion of aircraft in the active fleet, the number of single-engine aircraft fell from 139,500 in 2010 to 127,920 in 2020, a 0.9 percent average annual decline. During that same period, multi-engine piston aircraft had a much steeper decline, falling from 15,900 aircraft to 12,395, a 2.5 percent annual decrease. In total, active piston aircraft decreased at 1.0 percent annually over the last ten years. In its annual aviation forecast, the FAA indicates that it expects the number of active piston general aviation aircraft to continue to decline, but by a lower rate than in the past decade. Over the next decade, the decrease in the number of piston aircraft is expected to be 0.9 percent per year over the next two decades. The result of these predictions shows total piston aircraft (combined single and multi-engine) falling from 143,396 in 2019 to 116,905 in 2041.

Conversely, turboprop and jet aircraft experienced substantial growth between 2010 and 2020, increasing from approximately 20,853 to 25,450 aircraft, a 2 percent average annual increase over that period. One of the most important trends identified by the FAA in their forecasts is the growth anticipated in active general aviation jet aircraft. The active general aviation turboprop and jet aircraft fleet is anticipated to continue to increase dramatically over the projection period, to 35,780 aircraft in 2041, with jet aircraft almost doubling in numbers within this same time period.

The FAA also tracks and projects a valuable metric known as active general aviation and air taxi hours flown. This measurement captures a number of activity-related data, including aircraft utilization, frequency of use, and duration of use. Hours flown in general aviation piston aircraft experienced a decrease of 1.0 percent annually from 2010 to 2020, while turboprop and jet aircraft hours flown reflected a 2.0 percent average annual growth for the same period. Combined, general aviation hours flown are expected to grow at a rate of 1.0 percent per year through 2041.

2.4.3 SUMMARY

The aviation industry has navigated significant challenges (9/11 and 2008 global financial crisis), after which passenger numbers flatlined for 2-3 years before continuing the upward trajectory. Following these crises, many companies and their supply chains emerged and restructured to thrive. While there is no crystal ball on predicting when the turnaround will be realized, the International Air Transport Association (IATA) is postulating full recovery not occurring until at least 2023, with a worst-case scenario of 2025, assuming vaccine implementation continues, restrictions for international travel have relaxed, the global economy rebuilds, and passenger confidence increases. This sentiment is echoed by the airline data analytics firm OAG, which states, “several years of industry growth has been lost, and it could take until 2022 or 2023 before the volume of fliers returns to levels expected in 2020”.

Additionally, it is anticipated general aviation will witness the same rebound as the airlines, with a more expedited time frame. Increases in general aviation activity have already shown signs of starting to rebound and are expected to hit pre-COVID levels sooner than anticipated. Based on this information, the forecasting outcomes for OUN in the following sections will be based on a combination of industry trends pre- and post-COVID. Ultimately, the forecasts will be based on lower baseline numbers or reflect slower demand in the short-term while the long-term will be unaffected.

2.5 AVIATION FORECAST METHODOLOGY

2.5.1 DEMAND FORECAST APPROACH

In an effort to garner FAA approval and acceptance of aviation forecasts, certain methods of forecast development are necessary for evaluation. Choosing the appropriate forecasting methodology is important as developing forecasting scenarios to properly plan for the future. Forecast scenarios developed for OUN will consider historical operational data but will also rely largely upon expert judgment. It is important to emphasize the fact that aviation forecasting is not an "exact science" so experienced aviation judgment and practical considerations will influence the level of detail and effort required to establish a reasonable forecast and the development of decisions that result from them.

A qualitative forecast will give an explanation, understanding, or interpretation of current airport conditions and also explain why future development scenarios are justifiable. Forecasting scenarios for OUN will be developed by examining the meaningful and symbolic content of qualitative data, coupling it with available historical data. Sources and methods for forecasting are provided by several FAA documents, including Federal Aviation Administration Advisory Circular 150/5070-6B, *Airport Master Plans*, FAA Office of Aviation Policy and Plans, *Forecasting Aviation Activity by Airport, Review, and Approval of Aviation Forecasts, 2008*.

Projections of aviation demand incorporate local and national industry trends in assessing current and future demand. Therefore, socioeconomic factors such as local population, income, and employment are also analyzed for the effect they may have on historical and future levels of activity. The comparison of relationships among these various indicators provides the initial step in the development of realistic forecasts of aviation demand. Methodologies used to develop forecasts described in the section include:

- Time-Series Methodologies
- Market Share Methodologies
- Socioeconomic Methodologies

2.5.2 TIME SERIES METHODOLOGY

Historical trend lines and linear extrapolation are widely used methods of forecasting. These techniques utilize time-series types of data and are most useful for a pattern of demand that demonstrates a historical relationship with time. Linear extrapolation establishes a linear trend by fitting a straight line using the least-squares method to known historical data. Historical trend lines used in this chapter examine historical compounded annual growth rates (CAGR) and extrapolate future data values by assuming a similar compounded annual growth rate for the future.

2.5.3 MARKET SHARE METHODOLOGY

Market share, ratio, or top-down models compare local levels of activity with a larger entity. Such methodologies imply that the proportion of activity that can be assigned to the local level is a regular and predictable quantity. This method has been used extensively in the aviation industry to develop forecasts for the local level. It is most commonly used to determine the share of total national traffic activity that will be captured by a particular region or airport. Historical data is examined to determine the ratio of local traffic to total national traffic. The FAA develops national forecasts annually in its FAA Aerospace Forecasts document. This data source is compared with historical levels of activity reported by Max Westheimer Airport.

2.5.4 SOCIOECONOMIC METHODOLOGY

Though trend line extrapolation and market share analysis may provide mathematical and formulaic justification for demand projections, there are many factors beyond historical levels of activity that may identify trends in aviation and impact on aviation demand locally. Socioeconomic or correlation analysis examines the direct relationship between two or more sets of historical data. Local conditions that are examined in this chapter include population, per capita income, and total retail sales. Based upon the observed and projected correlation between historical aviation activity and the socioeconomic data sets, future aviation activity projects are developed.

2.6 GENERAL AVIATION ACTIVITY FORECASTS

2.6.1 BASED AIRCRAFT

Based aircraft are defined as those aircraft that are permanently stored at an airport either in a hangar or on an aircraft parking apron. Estimating the number and types of aircraft expected to be based at OUN over the 20-year study period will impact the planning for its future facility and infrastructure requirements. As the number of aircraft based at an airport increases, so do the aircraft storage requirements at the facility.

There are many factors that determine the number of general aviation aircraft that can be expected to be based at an airport, such as available facilities and services, proximity and access to the airport, amenities, and facilities at adjacent, nearby airports. General aviation aircraft owners and operators are particularly sensitive to both the quality and location of their basing facilities. Owners would rather be in close proximity to their home and/or work and typically weigh this need as primary when considering aircraft storage needs. According to airport personnel, a total of 100 aircraft are stored on the field.

According to *FAA Aerospace Forecasts, Fiscal Years 2021-2041, Table 28 – Active General Aviation and Air Taxi Aircraft*, between 2010 and 2020, the active general aviation aircraft in the U.S. decreased at a CAGR of -0.9 percent. During this same time frame, the number of piston aircraft (single-engine and multi-engine) in the U.S. fleet decreased at an average annual rate of 1.0 percent, while turbine (turboprop and jet) aircraft increased at an average CAGR of 2.0 percent. As has been the trend, piston aircraft continue to see year over year decreases while turbine aircraft remain in a positive growth mode. Conversely, for the projected years 2021-2041, the FAA projects a negative growth rate of 0.9 percent for piston aircraft and a positive rate of 1.7 percent for turbine aircraft. Overall, the total general aviation fleet (including rotorcraft, experimental, and light sport aircraft) is projected with a positive CAGR of 0.1 percent.

2.6.2 MARKET SHARE METHODOLOGY

Max Westheimer Airport's market share of the total U.S. general aviation fleet between 2012 and 2021 has fluctuated from a low of 0.0358% in 2012 to a high of 0.0579% in 2021, with the average calculated at 0.0471%. For the constant market share, the 2021 value of 0.0579% will be utilized for the 20-year planning period. Based on these percentages, based aircraft growth based on the constant market share provides a CAGR of 0.0 percent, and the increasing market share reflects a CAGR value of 1.3%. Table 2.4 show both market share scenarios.

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TABLE 2.4 – MARKET SHARE BASED AIRCRAFT FORECASTS

Year	OUN Based Aircraft	Total U.S. Active Aircraft	OUN Market Share
2010	90	223,370	0.0403%
2011	90	220,703	0.0408%
2012	78	218,036	0.0358%
2013	78	215,369	0.0362%
2014	94	212,702	0.0442%
2015	108	210,031	0.0514%
2016	111	211,794	0.0524%
2017	110	211,757	0.0519%
2018	122	211,758	0.0576%
2019	101	211,759	0.0477%
2020	103	211,749	0.0486%
2021	123	212,335	0.0579%
Constant Market Share Projection			
2026	122	207,075	0.0579%
2031	122	207,070	0.0579%
2036	122	207,485	0.0579%
2041	122	208,790	0.0579%
CAGR (2021-2041) = 0.1%			
Increasing Market Share Projection			
2026	127	207,075	0.0600%
2031	137	207,070	0.0650%
2036	147	207,485	0.0700%
2041	158	208,790	0.0750%
CAGR (2021-2041) = 1.3%			

Source: KSA; *FAA Aerospace Forecasts, 2021-2041, Table 28 - Active General Aviation and Air Taxi Aircraft*.

2.6.3 SOCIOECONOMIC – INCOME METHODOLOGY

Income can often be a strong indicator of one's propensity to own an aircraft. The socioeconomic income variable methodology compares historical-based aircraft at Max Westheimer Airport to per capita income in Cleveland County. According to data obtained by Woods and Poole, Inc. per capita income in Cleveland County has increased steadily from 2012 to 2021 and is anticipated to increase to $57,776 by 2041. The 2021 figure of 0.0028 based aircraft per $100 income is applied to projections of per capita income and shown in Table 2.5. This forecast posits a CAGR of 1.4 percent for a total of 162 based aircraft by the end of the planning period.

TABLE 2.5 – SOCIOECONOMIC – INCOME VARIABLE BASED AIRCRAFT FORECASTS

Year	OUN Based Aircraft	Cleveland County Per Capita Income	Based A/C per $100 Income
2010	90	$38,043	0.0024
2011	90	$39,193	0.0023
2012	78	$39,885	0.0020
2013	78	$39,598	0.0020
2014	94	$41,274	0.0023
2015	108	$41,657	0.0026
2016	111	$40,394	0.0027
2017	110	$40,732	0.0027
2018	122	$41,031	0.0030
2019	101	$41,579	0.0024
2020	103	$43,398	0.0024
2021	123	$43,420	0.0028
Socioeconomic – Income Variable			
2026	131	$46,832	0.0028
2031	141	$50,360	0.0028
2036	151	$54,003	0.0028
2041	162	$57,776	0.0028
CAGR (2021-2041) = 1.4%			

Source: KSA; Woods and Poole

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2.6.4 SOCIOECONOMIC – POPULATION METHODOLOGY

The socioeconomic population variable methodology compares historical-based aircraft at the Airport with the population of Cleveland County. Between 2010 and 2021, the population of Cleveland County increased from 257,085 to approximately 289,953. The 2021 figure of 0.0004 is applied to the population projections of Cleveland County and reflected in Table 2.6.

TABLE 2.6 – SOCIOECONOMIC – POPULATION VARIABLE BASED AIRCRAFT FORECASTS

Year	OUN Based Aircraft	Cleveland County Population	Based A/C per capita
2012	90	257,085	0.0004
2013	90	262,064	0.0003
2014	78	266,150	0.0003
2015	78	269,860	0.0003
2016	94	269,724	0.0003
2017	108	273,841	0.0004
2018	111	277,809	0.0004
2019	110	279,542	0.0004
2020	122	281,166	0.0004
2021	101	284,014	0.0004
Socioeconomic – Income Variable			
2026	123	306,619	0.0004
2031	129	323,202	0.0004
2036	136	339,462	0.0004
2041	142	355,163	0.0004
CAGR (2021-2041) = 0.7%			

Source: KSA; Woods and Poole

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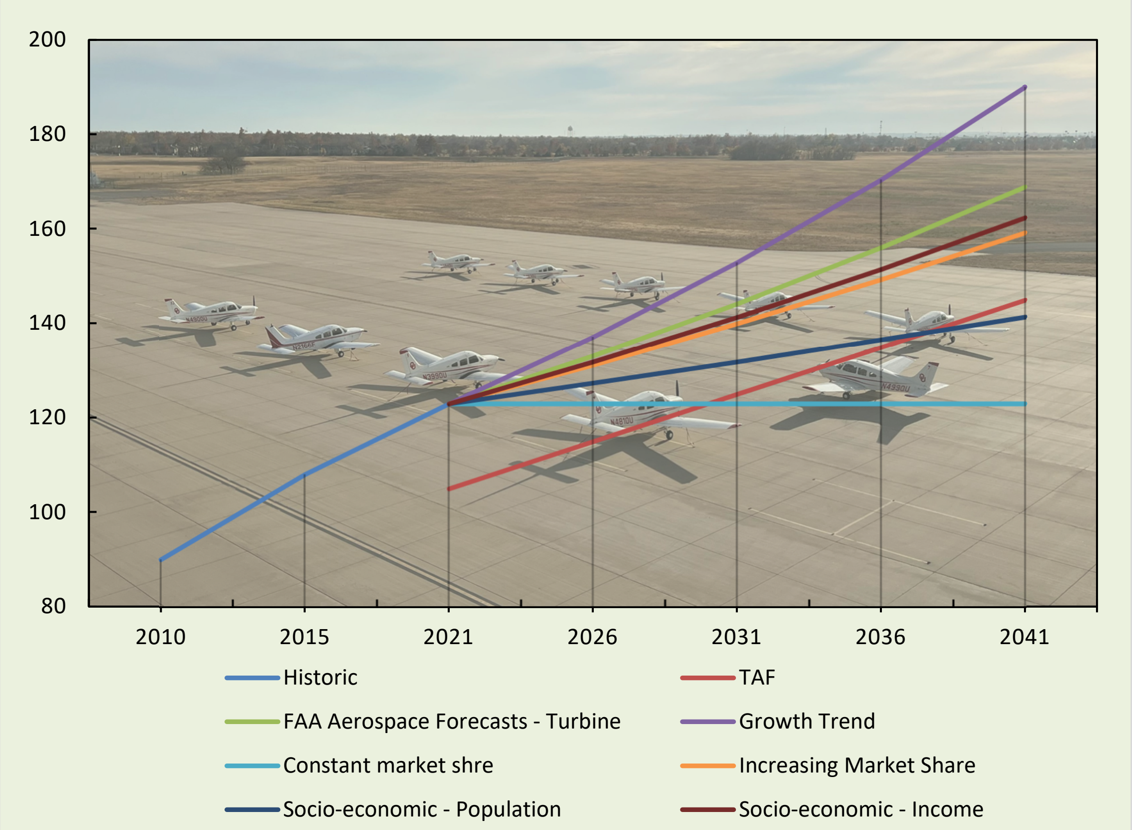
TABLE 2.7 – PREFERRED BASED AIRCRAFT FORECAST, 2021-2041

Year	FAA TAF Summary	FAA Aerospace Forecasts	Constant Market Share	Increasing Market Share	Socio-economic Income	Socio-economic Population	Growth Trend
2021	105	123	123	123	123	123	123
2026	115	133	123	131	127	132	137
2031	125	144	123	140	132	141	153
2036	135	156	123	149	137	152	170
2041	145	169	123	159	141	162	160
CAGR	1.6%	1.6%	0.0%	1.3%	0.7%	1.4%	2.2%

Source: KSA; *FAA Aerospace Forecasts, 2021-2041, Table 28 - Active General Aviation and Air Taxi Aircraft*.

EXHIBIT 2.1 – PREFERRED BASED AIRCRAFT FORECAST



2.6.5 PREFERRED BASED AIRCRAFT FORECAST

A comparison of projected based aircraft using the methodologies described in previous sections are shown above in Table 2.7 and Exhibit 2.1. All the methodologies anticipate either retention of the existing or increase in based aircraft demand over the next 20-years. With the airport exhibiting a current hangar waitlist of 25 individuals, the potential for the OU Flight Academy procuring additional training aircraft, and the opportunity to attract a higher percentage of Cleveland

County registered aircraft owners to the field, the preferred-based aircraft forecast follows course with the FAA Aerospace Forecast – Turbine Methodology, which closely parallels the projection associated with the Socio-economic population growth rate. This scenario increases based aircraft from the current level of 123 to 169 by 2041, an approximate CAGR of 1.6 percent.

2.7 BASED AIRCRAFT FLEET MIX

The current based aircraft fleet mix at OUN consists of 91 single-engine piston aircraft, 10 multi-engine piston aircraft, one (1) turboprop single-engine, six (6) turboprop multi-engine, seven (7) jets, and eight (8) helicopters. FAA's anticipated average annual growth rates for various components of the national general aviation fleet were considered when determining a projected based aircraft fleet mix for the airport. As reflected in Table 2.8, it is anticipated the number of piston aircraft (single and multi-engine) based at the airport as a percent of total will increase over the 20-year forecast period. This is contrary to national trends for piston aircraft and can be attributed to the high level of flight training operations conducted at Max Westheimer Airport. Additionally, based turbine and jet aircraft will continue to increase during the planning period.

TABLE 2.8 – GENERAL AVIATION BASED AIRCRAFT FLEET MIX, 2021-2041

Aircraft Type	2021	2026	2031	2036	2041
Single-Engine Piston	91	97	104	111	118
Multi-Engine Piston	10	10	11	11	12
Turboprop (SE)	1	3	4	6	8
Turboprop (ME)	6	7	9	11	12
Jet	7	8	9	9	10
Helicopter	8	8	8	8	9
Total	123	133	144	156	169

Source: KSA.

2.8 GENERAL AVIATION OPERATIONS FORECASTS

General aviation operations are those which are not categorized as commercial or military. Several forecast scenarios were developed to appropriately reflect current general aviation operational activity and provide realistic projections for the 20-year planning period. The forecast scenarios generated assume, for the most part, straight-line growth. While it is recognized that straight-line (consistent) growth never occurs years after year, average annual growth methodologies often serve to illustrate intermediate- and long-range planning. It should be noted that it is not actual numbers that are most important but the reasoning, assumptions, and trends the numbers represent. The following methodologies were considered in determining projections of general aviation demand.

- FAA Terminal Area Forecasts (TAF) – Data from the December 2021 *FAA Terminal Area Forecast* (TAF) is shown (1.4 percent).
- FAA Aerospace Forecasts – As indicated in this projection and according to the *FAA Aerospace Forecasts, Fiscal Years, 2021-2041, Table 29 – Active General Aviation and Air Taxi Hours Flown*, general aviation

operations nationwide are expected to increase at an average annual rate of 1.0 percent.

- FAA Aerospace Forecasts (turbine growth) – As reflected in the *FAA Aerospace Forecasts, Fiscal Years, 2021-2041, Table 29 – Active General Aviation and Air Taxi Hours Flown*, turbine-type aircraft are anticipated to grow at an average annual growth rate of 2.5%. This growth reflects increased flying by business and corporate aircraft overall.
- Operations Per Based Aircraft – Generally, there is a relationship between aviation activity and based aircraft, stated in terms of *Operations Per Based Aircraft (OPBA)*. The national trend has been changing, with more aircraft being used for business purposes and less for leisure. This impacts the OPBA in that business aircraft are usually flown more often than recreational or leisure aircraft. It is anticipated the OPBA will provide a CAGR of 1.6 percent.
- Demographics (Population and Income) – As previously mentioned, socioeconomic conditions of a particular area or region can affect aviation activity. This methodology utilizes the combined average annual population and income growth for Cleveland County of 2.5 percent.
- Growth Trend – Due to fluctuations in operations over the past decade, the growth trend shows a negative rate of 2.9 percent through the end of the planning period, with an outcome of 26,803. Thus, this forecast element will not be considered and is included for comparison.

Table 2.9 shows the results of the various general aviation operations forecasts. Based on the long-term trends previously mentioned for the general aviation industry, as well as the opportunity to attract additional business to the area, it is anticipated, at a minimum, the Airport is capable of achieving operational growth similar to national trends levels for general aviation at 1.0 percent annually. However, as previously shown, data for the general aviation fleet and operations is increasing at a more rapid pace within the turbine sector of aviation. This factor, coupled with the previously described increases in population and income for Cleveland County.

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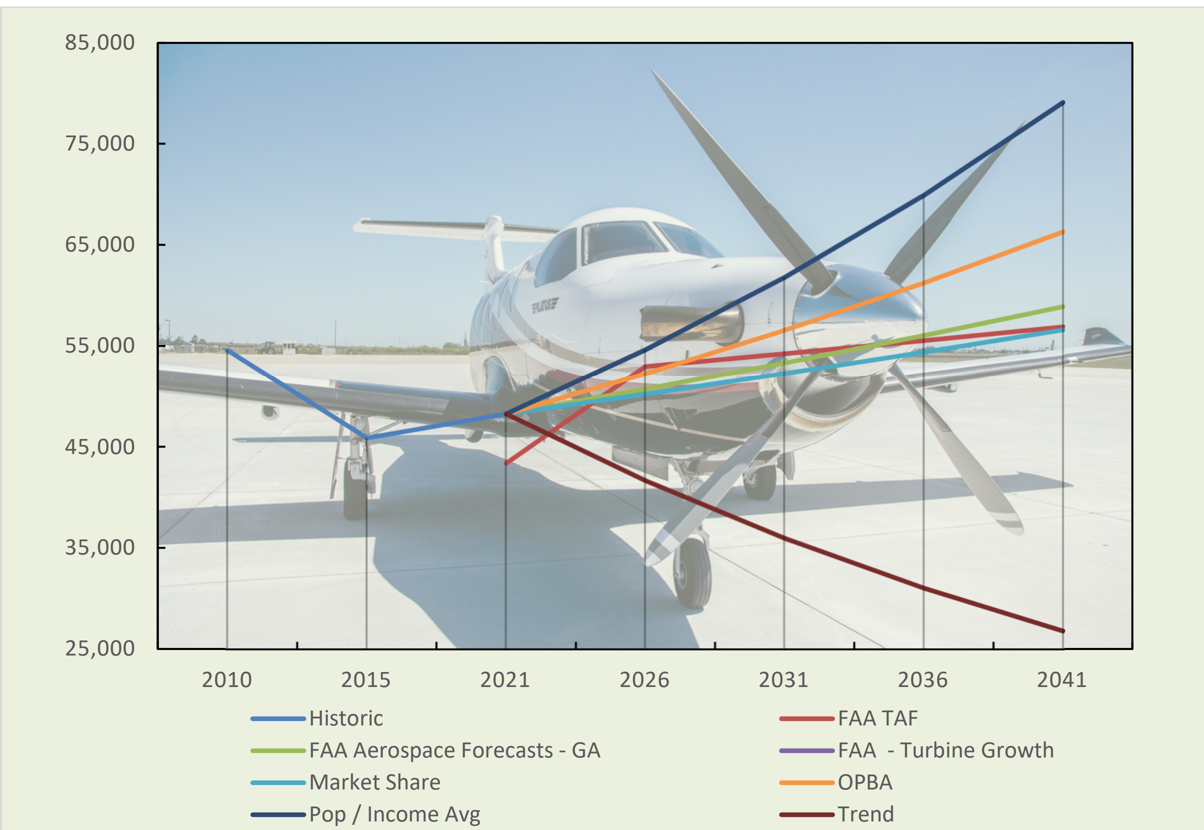
TABLE 2.9 – PREFERRED GENERAL AVIATION FORECASTS, 2021-2041

Year	FAA TAF Summary	FAA Aerospace Forecasts	FAA Aerospace Forecasts (Turbine Growth)	OBPA	Cleveland County Population / Income Avg.	Growth Trend
2021	43,391	48,284	48,284	48,284	48,284	48,284
2026	46,515	50,747	54,629	52,272	54,629	41,677
2031	49,863	53,336	61,808	56,590	61,808	35,975
2036	53,453	56,056	69,930	61,264	69,930	31,052
2041	57,301	58,916	79,119	66,325	79,119	26,803
CAGR	1.4%	1.0%	2.5%	1.6%	2.5%	-2.9%

Source: KSA, *FAA Aerospace Forecasts, Fiscal Years, 2021-2041, Table 29 – Active General Aviation and Air Taxi Hours Flown*

EXHIBIT 2.2 – PREFERRED GENERAL AVIATION OPERATIONS FORECAST



2.8.1 *ATHELETIC CONFERENCE TRANSITION*

To best understand the probable impacts of the University of Oklahoma's transition to the SEC, each of the airports nearest to existing SEC schools were identified. Of these, five of them are general aviation airports like OUN, being classified as either National or Regional in the NPIAS. These airports and their characteristics are depicted in Table 2.10 below.

TABLE 2.10 – AIRPORTS SERVING SEC ATHLETICS MEMBER UNIVERSITIES

School	Airport	NPIAS Category	Enplanements (2021)	Longest Runway	Jet Operations (Aug – Nov 2023)	Critical Aircraft (last 12 months)	Largest Civil Aircraft During 2023 Football Season
Oklahoma	*OUN*	*Reliever - Regional*	*35*	*5,199 ft.*	*834*	*C-II*	*ADG III business jets*
Alabama	TCL	GA - National	3,154	6,498 ft.	3,038	C-II	757-200 (x16)
Arkansas	FYV	GA - National	1,306	6,005 ft.	1,582	C-II	ADG III business jets
Auburn	AUO	GA - Regional	2,04	5,264 ft.	1,790	C-II	CRJ-900 (x2)
Mississippi	UOX	GA - Regional	66	5,600 ft.	2,311	C-II	ADG III business jets
Georgia	AHN	GA - Regional	1,797	6,122 ft.	1,685	C-II	737-800 (x8)

Of these airports, OUN has the fewest enplanements. This can be expected to increase as larger aircraft, including charters, increase their operations at the Airport. Max Westheimer also had the fewest jet operations during the previous football season by far. It is not unlikely that OUN's jet operations in subsequent autumns will double. OUN has the shortest maximum runway length of these airports, with three of the five of the comparison airports having runways of over 6,000 feet in length. This allows them to handle air carrier aircraft operating as football team charters, which OUN can currently not accommodate. When Oklahoma or their visiting opponents fly to and from games, they must use Will Rogers World Airport in Oklahoma City. It is important to note that the Airport would have to obtain Part 139 certification before any charter operations by air carrier-sized aircraft.

The following ADG III aircraft types operated to at least four of the five identified airports during the 2023 football season: Saab 2000, Cessna Citation Bravo, Gulfstream V, Bombardier Global Express, Gulfstream G650, Bombardier Global 5000, and Gulfstream G600. While OUN already sees operations by some of these types, it can be assumed that their visits will increase during subsequent football seasons. This will be discussed in further detail in the next section, *Facility Requirements*.

2.9 OPERATIONS FORECAST BY AIRCRAFT TYPE

As indicated in the following Table 2.11, total aircraft movements and operations are expected to increase an average of 1.6% annually from the current level of 48,284 to approximately 66,325 by the end of the planning period, with general aviation operations representing the majority percentage of activity through the planning period.

TABLE 2.11 – SUMMARY OF OPERATIONS BY AIRCRAFT TYPE, 2021-2041

Aircraft Type	2021	2026	2031	2036	2041
GENERAL AVIATION	47,684	51,672	55,990	60,664	65,725
Air Taxi	480	520	560	600	660
Single-Engine Piston	19,504	20,952	22,830	24,664	26,665
Multi-Engine Piston	7,200	7,300	7,300	7,300	7,300
Turbo-prop (SE)	2,400	3,100	4,000	4,900	5,900
Turbo-prop (ME)	4,800	5,200	5,600	6,100	6,600
Business Jet	12,000	13,100	14,100	15,300	16,600
Helicopter	1,300	1,500	1,600	1,800	2,000
MILITARY	600	600	600	600	600
Total	48,284	52,272	56,590	61,264	66,325

Source: KSA; Numbers may not equal due to rounding.

2.9.1 MILITARY OPERATIONS

Historically, military operations have comprised approximately one percent of total operations at Max Westheimer Airport. This category of operations is driven more by policy decisions than by economic conditions. In lieu of more definitive information or factors identified that would significantly increase the number of military operations in the future, forecast military operations will remain at 2021 levels – approximately 600 – throughout the planning effort.

2.10 LOCAL / ITINERANT OPERATIONS FORECAST

The FAA defines a local operation as any operation performed by an aircraft operating in the local traffic pattern or within sight of the tower, or aircraft known to be operating in local practice areas, or aircraft executing practice instrument approaches. According to the airport records, itinerant operations constituted approximately 48 percent of the overall operations total with local operations contributing the remaining 52 percent. Due to the significance in flight training activity, it is anticipated the airport will continue to facilitate such operations, in addition to serving as a center for business and other related general aviation operations. Table 2.12 reflects the total local and itinerant operations for the planning period.

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TABLE 2.12 – LOCAL AND ITINERANT OPERATIONS FORECAST, 2021-2041

Year	Itinerant Operations	Local Operations	Total Operations
2021	24,931	23,353	48,824
2026	27,181	25,091	52,272
2031	29,427	27,163	56,590
2036	31,857	29,407	61,264
2041	34,489	31,836	66,325

Source: KSA; Airport Master Record 5010-1; Max Westheimer Airport personnel

2.11 INSTRUMENT OPERATIONS FORECAST

Typically, instrument operations are conducted by commercial aircraft and by aircraft operating during periods of inclement weather. An instrument approach is commonly defined by the FAA as an approach to an airport with the intent to land an aircraft in accordance with an instrument flight rule (IFR) flight plan, when visibility is less than three miles, and / or when the ceiling is at or below the minimum initial approach altitude. Between 2010 and 2020, instrument operations at Max Westheimer Airport increased from 11.7% percent of total operations to 14.1 percent. Applying this same percentage to the total number of projected operations through 2041 results in 7,300 instrument operations in 2026, 7,900 in 2031, 8,600 in 2036, and 9,300 in 2041, a CAGR of 1.6 percent. **Table 2.13** shows the projected instrument operations through the planning period.

TABLE 2.13 – INSTRUMENT OPERATIONS FORECAST, 2021-2041

Year	Total Operations	Instrument Operations		Visual Operations	
		Operations	%	Operations	%
2021	48,284	6,790	14.1%	41,494	85.9%
2026	52,272	7,300	14.0%	44,972	86.0%
2031	56,590	7,900	14.0%	48,690	86.0%
2036	61,264	8,600	14.0%	52,664	86.0%
2041	66,325	9,300	14.0%	57,025	86.0%

Source: KSA; Airport Master Record 5010-1; Max Westheimer Airport personnel

2.12 CRITICAL AIRCRAFT

The development of airport facilities is impacted by both the demand for those facilities, typically represented by total based aircraft and operations at an airport, and the type of aircraft that will use those facilities. In general, airport infrastructure components are designed to accommodate the most demanding aircraft, referred to as the critical aircraft, which will utilize the infrastructure on a regular basis. The factors used to determine an airport's critical aircraft are the approach speed and wingspan/tail height of the most demanding class of aircraft that is anticipated to perform at least 500 annual operations at the airport during the planning period. These 500 operations can be conducted by a single aircraft type or composite aircraft representing a collection of aircraft with similar qualities.

2.13 RUNWAY DESIGN CODE (RDC)

The RDC is a three-component code that defines the applicable design standards that apply to a specific runway. The first component, depicted by a letter (A-E), is the Aircraft Approach Category (AAC) and relates to the approach speed of the design aircraft. Generally, the AAC applies to runways and runway-related facilities, such as runway width, runway safety area (RSA), runway object free area (ROFA), runway protection zone (RPZ), and separation standards. The second component, Airport Design Group (ADG), depicted by a Roman numeral (I-VI), relates to the greatest wingspan or tail height of the design aircraft, whichever is most restrictive. The ADG influences design standards for taxiways, aircraft wingtip clearances, and separation distances. The third component relates to runway visibility minimums as expressed in Runway Visual Range (RVR) equipment measurements. RVR-derived values represent feet of forward visibility that have statute mile equivalents (e.g., 2400 RVR = 1/2-mile). RDC classifications are summarized in Table 2.14.

TABLE 2.14 – RUNWAY DESIGN CODE

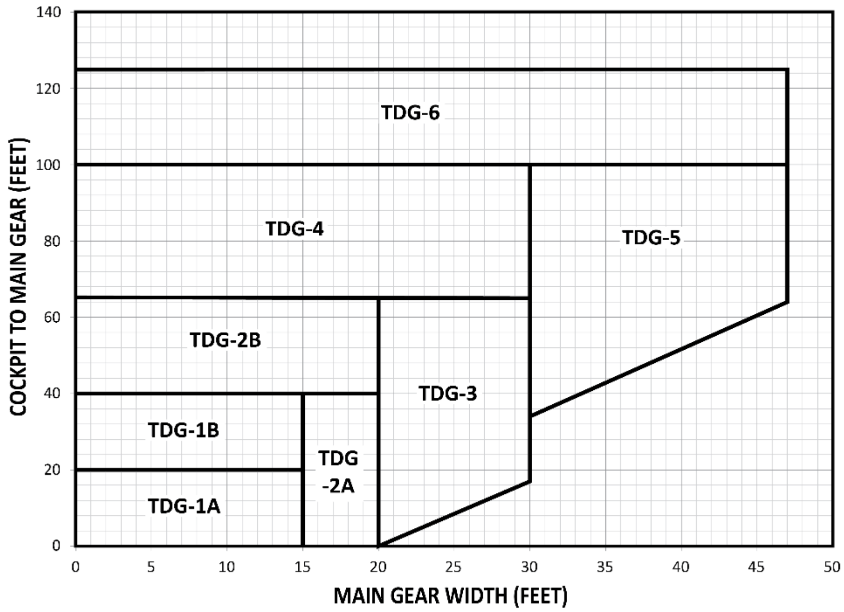
Aircraft Approach Category (AAC)		
AAC	**Approach Speed**	
A	Less than 91 knots	
B	91 knots or more but less than 121 knots	
C	121 knots or more but less than 141 knots	
D	141 knots or more but less than 166 knots	
E	166 knots or more	
Airplane Design Group (ADG)		
Group	**Tail Height (ft)**	**Wingspan (ft)**
I	< 20'	< 49'
II	20' - < 30'	49 ' - < 79'
III	30' - < 45'	79' - < 118'
IV	45' - < 60'	118' - < 171'
V	60' - < 66'	171' - < 214'
VI	66' - < 80'	214' - < 262'
Approach Visibility Minimums		
RVR (ft)	**Flight Visibility Category (statute mile)**	
5000	Not lower than 1-mile	
4000	Lower than 1-mile but not lower than ¾-mile	
2400	Lower than ¾-mile but not lower than ½-mile (CAT-I)	
1600	Lower than ½-mile but not lower than ¼-mile CAT-II)	
1200	Lower than ¼-mile (CAT-III)	

RVR – Runway Visual Range. The approximate visibility (in feet) as measured by the RVR light transmission/reception equipment or equivalent weather observer report.

2.15 TAXIWAY DESIGN CODE (TDG)

Separation between runways, taxiways, taxilanes, and objects is related to the aircraft characteristics encompassed by the ADG wingspan or tail height restriction. The Taxiway Design Group (TDG) takes into account the dimensions of the aircraft undercarriage or landing gear to determine taxiway widths and pavement fillets to be provided at taxiway intersections. Other taxiway elements such as taxiway safety and object free areas (TSA and TOFA), taxiway/taxilane separation standards, and taxiway/taxilane wingtip clearances are based solely on ADG.

EXHIBIT 2.3 – TAXIWAY DESIGN GROUP DETERMINATIONS



Source: FAA A/C 150/5300-13B, *Airport Design*

2.15 AIRPORT REFERENCE CODE (ARC)

The Airport Reference Code (ARC) is a coding system used to relate and compare airport design criteria to the operational and physical characteristics of the aircraft intended to operate at the airport. The ARC is similar in scope to the RDC, minus the third element of visibility. Based on the examination of the operational information and existing airport plans, it has been determined the airport will maintain the C-II designation on Runway 18/36 and reduce to a B-II designation on Runway 3/21. Table 2.15 summarizes the critical aircraft and design aircraft components for the runways at Max Westheimer Airport.

TABLE 2.15 – CRITICAL AIRCRAFT PARAMETERS

Existing				
Runway	**Critical Design Aircraft**	**RDC**	**ARC**	**TDG**
18 / 36	Challenger 600 / Gulfstream III	C-II-2400	C-II	2A
3 / 21	Challenger 600	C-II-4000	C-II	2A
Ultimate				
Runway	**Critical Design Aircraft**	**RDC**	**ARC**	**TDG**
18 / 36	Gulfstream 350 / 450	D-II-2400	D-II	2A
3 / 21	King Air 200 / 300	B-II-5000	B-II	1A

Source: KSA, FAA A/C 150/5300-13B, *Airport Design*

2.16 SUMMARY

Aircraft activity at Max Westheimer Airport has fluctuated in recent history. This is not an uncommon theme at many U.S. airports as economic uncertainty and increased travel costs have impacted travel behavior. Despite rapid volatility in fuel cost, airline bankruptcies, system-wide route restructuring, aircraft fleet overhauls, and impacts and uncertainty associated with COVID-19, the forecasts developed for this Airport Layout Plan (ALP) Update suggest positive growth in the number of based aircraft and total aircraft operations at the Airport over the next 20 years.

The following tables summarize the forecasts of aviation activity that have been presented in this chapter. This information will be utilized in the next chapter, Facility Requirements, to document, analyze, and quantify airside and landside needs. Therefore, the forecasts of aviation activity are an important part of the information base which will be used to develop ultimate plans for the airport and formulate implementation decisions relating to airport development.

To secure approval for these projections, the FAA requires a comparison of forecasts to the annually produced TAF, which are completed for each airport in the NPIAS and updated each year. The FAA prefers that airport planning forecasts not vary significantly from the TAF and looks for forecasts to be within 10 percent of their five-year forecasts and 15 percent of their ten-year forecasts. The FAA templates for summarizing and documenting airport planning forecasts and for comparing projections with the FAA TAF Forecasts are presented in **Tables 2.16** and **2.17**. The final **Table 2.18** provides a final summary of the forecast aviation demand.

TABLE 2.16 – SUMMARY OF OPERATIONS BY AIRCRAFT TYPE, 2021-2041

Operations	2021	2026	2031	2036	2041
GENERAL AVIATION	47,684	51,672	55,990	60,664	65,725
Air Taxi	480	520	560	600	660
Single-Engine Piston	19,504	20,952	22,830	24,664	26,665
Multi-Engine Piston	7,200	7,300	7,300	7,300	7,300
Turbo-prop (SE)	2,400	3,100	4,000	4,900	5,900
Turbo-prop (ME)	4,800	5,200	5,600	6,100	6,600
Business Jet	12,000	13,100	14,100	15,300	16,600
Helicopter	1,300	1,500	1,600	1,800	2,000
MILITARY	600	600	600	600	600
TOTAL OPERATIONS	48,284	52,272	56,590	61,264	66,325
Local Operations	23,353	25,091	27,163	29,407	31,836
Itinerant Operations	24,931	27,181	29,427	31,857	34,489
Based Aircraft					
Single-Engine	91	97	104	111	118
Multi-Engine	10	10	11	11	12
Turbo-prop (SE)	1	3	4	6	8
Turbo-prop (ME)	6	7	9	11	12
Jet	7	8	9	9	10
Helicopter	8	8	8	8	9
TOTAL	123	133	144	156	169

Source: KSA

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TABLE 2.17 – COMPARISON OF ACTIVITY AND TAF FORECASTS, 2021-2041(FAA FORMAT)

Year	Airport Forecasts	TAF Forecast	AF / TAF % Difference
Base Year (2021)	48,284	43,391	11.3%
2026	52,272	46,515	12.4%
2031	56,590	49,863	13.5%
2036	61,264	53,453	14.6%
2041	66,325	57,301	15.7%

Source: KSA

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TABLE 2.18 – SUMMARY OF AIRCRAFT PLANNING FORECASTS, 2021-2041 (FAA FORMAT)

						Average Annual Compound Growth Rate			
	2021	2026	2031	2036	2041	2026	2031	2036	2041
Operations – Itinerant									
General Aviation	24,529	27,181	29,427	31,857	34,489	1.5%	1.3%	1.3%	1.9%
Military	402	400	400	400	400	0.0%	0.0%	0.0%	0.0%
Operations – Local									
General Aviation	23,144	25,091	27,163	29,407	31,836	1.1%	1.6%	1.6%	1.6%
Military	209	200	200	200	200	0.0%	0.0%	0.0%	0.0%
TOTAL OPERATIONS	48,284	52,272	56,590	61,264	66,325	1.1%	1.6%	1.6%	1.6%
Instrument Operations	6,790	7,318	7,923	8,577	9,286	1.3%	1.6%	1.6%	1.6%
Peak Hour Operations	13	14	15	16	17	1.2%	1.4%	1.3%	1.2%
Based Aircraft									
Single-Engine	91	97	104	111	118	1.1%	1.4%	1.3%	1.2%
Multi-Engine	10	10	11	11	12	0.0%	1.9%	0.0%	1.8%
Turbo-prop	1	3	4	6	8	20.1%	5.9%	8.4%	5.9%
Jet	6	7	9	11	12	2.6%	5.2%	4.1%	1.8%
Helicopter	7	8	9	9	10	2.3%	2.4%	0.0%	2.1%
TOTAL BASED AIRCRAFT	123	133	144	156	169	1.3%	1.6%	1.6%	1.6%

Source: KSA