KANSAS CITY
Aviation

## Airport Master Plan

# KANSAS CITY DOWNTOWN AIRPORT – WHEELER FIELD

Chapter 2

# Forecasts


## Airport Master Plan

# KANSAS CITY DOWNTOWN AIRPORT–WHEELER FIELD

## Chapter 2
# FORECASTS

The definition of demand that may reasonably be expected to occur during the useful life of an airport's key components (e.g., runways, taxiways, terminal buildings, etc.) is an important factor in facility planning. In airport forecasting, this involves projecting potential aviation activity for a 20-year timeframe. Aviation demand forecasting for the Kansas City Downtown Airport – Wheeler Field (MKC) will primarily consider based aircraft, aircraft operations, and peak activity periods. In addition, MKC receives numerous charter operations; therefore, charter passenger levels will also be considered.

The Federal Aviation Administration (FAA) has oversight responsibility to review and approve aviation forecasts developed in conjunction with airport planning studies. FAA will review individual airport forecasts with the objective of comparing them to its *Terminal Area Forecast* (TAF) and the *National Plan of Integrated Airport Systems* (NPIAS). While the TAF forecasts are a point of comparison for airport forecasts, they primarily serve other purposes, such as asset allocation by the FAA.

When reviewing a sponsor's airport forecast, the FAA must ensure that the forecast is based on reasonable planning assumptions, uses current data, and is developed using appropriate forecast methods. As stated in FAA Order 5090.5, *Formulation of the National Plan of Integrated Airport Systems* (NPIAS) *and Airports Capital Improvement Plan* (ACIP), forecasts should be:

- Realistic;
- Based on the latest available data;
- Reflective of current conditions at the airport (as a baseline);
- Supported by information in the study; and
- Able to provide adequate justification for airport planning and development.

The forecast process for an airport planning study consists of basic steps that vary in complexity depending upon the issues addressed and the level of effort required. The steps include a review of previous forecasts, determination of data needs (i.e., socioeconomic, air traffic activity, etc.), identification of data sources, collection of data, selection of forecast methods, preparation of the forecasts, and evaluation and documentation of the results. FAA Advisory Circular (AC) 150/5070-6B, *Airport Master Plans*, outlines seven standard steps involved in the forecast process for master plans, ALP updates, and other airport forecasting efforts:

1) **Identify Aviation Activity Measures**: This involves the levels and types of aviation activities likely to impact facility needs. For general aviation, this typically includes based aircraft and operations. Because MKC is also a Part 139 certificated airport, passenger levels as measured by enplanements (boardings) will also be considered.
2) **Review Previous Airport Forecasts**: This may include the FAA *Terminal Area Forecast*, state or regional system plans, and previous planning studies.
3) **Gather Data**: Determine what data are required to prepare the forecasts, identify data sources, and collect historical and forecast data.
4) **Select Forecast Methods**: There are several appropriate methodologies and techniques available, including regression analysis, trend analysis, market share or ratio analysis, exponential smoothing, econometric modeling, comparison with other airports, survey techniques, cohort analysis, choice and distribution models, range projections, and professional judgment.
5) **Apply Forecast Methods and Evaluate Results**: Prepare the actual forecasts and evaluate for reasonableness.
6) **Summarize and Document Results**: Provide supporting text and data tables as necessary.
7) **Compare Forecast Results with FAA's TAF**: For airports, such as MKC, forecasts for based aircraft, enplanements, and total operations are considered consistent with the TAF if they meet the following criteria:
    - Forecasts differ by less than 10 percent in the 5-year forecast period and 15 percent in the 10-year forecast period, or
    - Forecasts do not affect the timing or scale of an airport project, or
    - Forecasts do not affect the role of the airport as defined in the current version of FAA Order 5090.5, Formulation of the NPIAS and ACIP.

Aviation activity can be affected by many influences on the local, regional, and national levels, making it virtually impossible to predict year-to-year fluctuations of activity over 20 years with any certainty. Therefore, it is important to remember that forecasts are to serve only as guidelines, and planning must remain flexible enough to respond to a range of unforeseen developments.

The following forecast analysis for MKC was produced following these basic guidelines. Existing forecasts are examined and compared against current and historic activity. The historical aviation activity is then examined, along with other factors and trends that can affect demand. The intent is to provide an updated set of aviation demand projections for MKC that will permit airport management to make planning adjustments as necessary to maintain a viable, efficient, and cost-effective facility.

A common measure of growth is the compound annual growth rate (CAGR). The CAGR results in a growth percentage that is compounded year over year for a defined number of years. Figure 2-1 shows the CAGR formula that is used throughout this chapter. This is an important measure of the reasonableness of any individual forecast as it can be compared to historical trends readily.

$$CAGR = \left(\left(\frac{EV}{BV}\right)^{\frac{1}{n}} - 1\right) \times 100$$

**where:**

$EV$ = Ending value

$BV$ = Beginning value

$n$ = Number of years

*Figure 2-1: Formula for Compound Annual Growth Rate*

The forecasts for this study utilize a base year of 2022, with a long-range forecast year of 2042.

## AIRPORT SERVICE AREA

The initial step in determining the aviation demand for an airport is to define its generalized service area for various segments of aviation the airport can accommodate. The airport service area is determined primarily by evaluating the location of competing airports, their capabilities, their services, and their relative attraction and convenience. In determining the aviation demand for an airport, it is necessary to identify the role of that airport, as well as the specific areas of aviation demand the airport is intended to serve. The primary role of MKC is to relieve congestion at Kansas City International Airport (MCI) and to serve general aviation demand in the area.

The airport service area is a geographical area where there is a potential market for airport services. Access to general aviation airports and transportation networks enter the equation to determine the size of a service area. Subjective criteria, such as the services and amenities available, are also to be factored.

Defining a service area for an airport is an important factor in the forecasting process. Once a general service area is identified, various statistical comparisons can be made for projecting aviation demand. For example, in rural areas, where there may be one general aviation airport in each county, the service area could reasonably be defined as the entire county. This would facilitate comparisons to county population and other factors pertaining to that county for forecasting purposes.

In urban areas, where there are many general aviation airports, the definition of a service area is not as simple. Aircraft owners in urban areas have many more choices when it comes to basing their aircraft. The number one reason aircraft owners select an airport at which to base their aircraft is convenience to home or work. Other reasons may include the capability of the runway system, services available, availability of hangar space and airport congestion.

The service area will generally represent where most, but not all, based aircraft will come from. It is not unusual for some based aircraft to be registered outside the region or even outside the state. Particularly in urban areas, airport service areas will likely overlap to some extent as well.

The service area of an airport can be generalized by its proximity to other airports providing similar levels of service. MKC is one of six airports serving general aviation needs within 25 miles of downtown Kansas City. **Table 2A** summarizes available facilities at airports in proximity to MKC. There are varying levels of service offered at each airport.

**Kansas City International Airport (MCI)** has been the area's commercial passenger service airport since opening in 1972. All scheduled air passenger service was transferred to MCI from MKC at this time. The airport can accommodate most large transport aircraft. It has the lowest instrument approach visibility minimums in the region with a CAT II/III approach, which allows pilots to land when visibility is not lower than 100-feet. MCI does not have a large general aviation presence, as general aviation traffic generally utilizes other area airports.

**TABLE 2A | Area Public Airports with Paved Runways**

| Identifier | Airport | Nautical Miles/Direction from MKC | FAA Service Level[1] | Based Aircraft | Annual Operations | Longest Runway (ft.) | Lowest Visibility Minimum |
|---|---|---|---|---|---|---|---|
| **MKC** | **Kansas City Downtown Airport – Wheeler Field** | **NA** | **Reliever/ National GA** | **198** | **114,000** | **6,827** | **¾-mile** |
| MCI | Kansas City International Airport | 12nm/NNW | Commercial | 2 | 105,000 | 10,801 | CAT II/III (100') |
| LXT | Lee's Summit Municipal Airport | 14nm/SE | Reliever/ Regional GA | 132 | 53,000 | 5,501 | ¾-mile |
| OJC | Johnson County Executive Airport | 18nm/SSW | Reliever/ Regional GA | 136 | 39,000 | 4,097 | ¾-mile |
| GPH | Midwest National Air Center Airport | 18nm/NE | Regional GA | 98 | 44,500 | 5,502 | ¾-mile |
| 3GV | East Kansas City Airport | 19nm/ESE | NA | 201 | 40,000 | 4,507 | 1-mile |
| FLV | Sherman Army Airfield | 21nm/NW | NA | 32 | 10,000 | 5,318 | 1-mile |
| IXD | New Century Air Center | 22nm/SW | Reliever/ National GA | 140 | 54,000 | 7,339 | ½-mile |

*Source: www.airnav.com; [1]NPIAS*

**Lee's Summit Municipal Airport (LXT)** is a reliever regional general aviation airport with a 5,501-foot-long runway. The airport provides full fixed-base operator (FBO) services. There are approximately 132 aircraft based at LXT, which includes six business jets. This airport primarily serves the general aviation needs south of Kansas City. The lowest visibility minimum is ¾-mile.

**Johnson County Executive Airport (OJC)** is a reliever regional general aviation airport with a 4,097-foot-long runway. This airport has 136 based aircraft and two full service FBOs. This airport primarily serves the needs of south Johnson County, Kansas (along with IXD). The lowest instrument approach visibility minimum available is 1-mile.

**Midwest National Air Center Airport (GPH)** is a regional general aviation airport primarily serving the northeast Kansas City area. The runway is 5,502 feet long and there are approximately 98 based aircraft, which includes four business jets. The airport has FBO services. The lowest instrument approach visibility minimum is ¾-mile.

**East Kansas City Airport (3GV)** is not classified by FAA, but it does serve the general aviation needs of the area southeast of the Kansas City metro. This airport has a 4,507-foot-long runway and has instrument approach visibility minimums of 1-mile. FBO services are available.

**Sherman Army Airfield (FLV)** is located on Fort Leavenworth, but it is open to the public. This airport is not classified by the FAA, thus providing limited general aviation availability. The runway is 5,318 feet long and visibility minimums not lower than one mile are available. There are limited services available and no on-site FBO.

**New Century Air Center (IXD)** is located in south Johnson County, Kansas, and it is listed by FAA as a national reliever general aviation airport, the same classification as MKC. The longest runway is 7,339 feet long and Runway 36 has an instrument landing system (ILS) that has ½-mile visibility minimums. Full FBO services are available.

An examination of the FAA aircraft registration information for aircraft owners who base at MKC was also conducted to further define the airport service area. **Exhibit 2A** shows the zip code location of the 196 aircraft based at MKC. As can be seen, the registration address of aircraft owners who base at MKC are spread across the region. On the Kansas side, there are 59 owners whose aircraft are registered in Johnson County, four in Wyandotte, and two in Leavenworth. On the Missouri side, there are 40 registered aircraft owners in Clay County, 27 in Jackson County, and 16 in Platte County. There are no based aircraft owners who register their aircraft in any other immediately adjacent county; rather, the remaining aircraft are registered in more distant counties or out of state (likely corporate aircraft).

MKC serves the entire greater Kansas City area. It provides close and immediate access to downtown where numerous businesses that use private aviation are located. It also is attractive to local pilots in the region, as evidenced by the fact that all the general aviation hangars are currently full of tenants. For purposes of this study and forecasting effort to follow, the service area for MKC is defined by the following counties: Jackson, Clay, Cass, and Platte, in Missouri; and Johnson, Wyandotte, and Leavenworth in Kansas.

## SOCIOECONOMIC FORECASTS

Socioeconomic conditions provide an important baseline for preparing aviation demand forecasts. Local socioeconomic variables, such as population and employment, are indicators for understanding the dynamics of the community and can relate to local trends in aviation activity. Analysis of the demographics of the airport service area will give a more comprehensive understanding of the socioeconomic situations influencing the region which supports MKC. The following is a summary of the demographic and socioeconomic data presented in Chapter One, as well as forecasts of those socioeconomic characteristics.

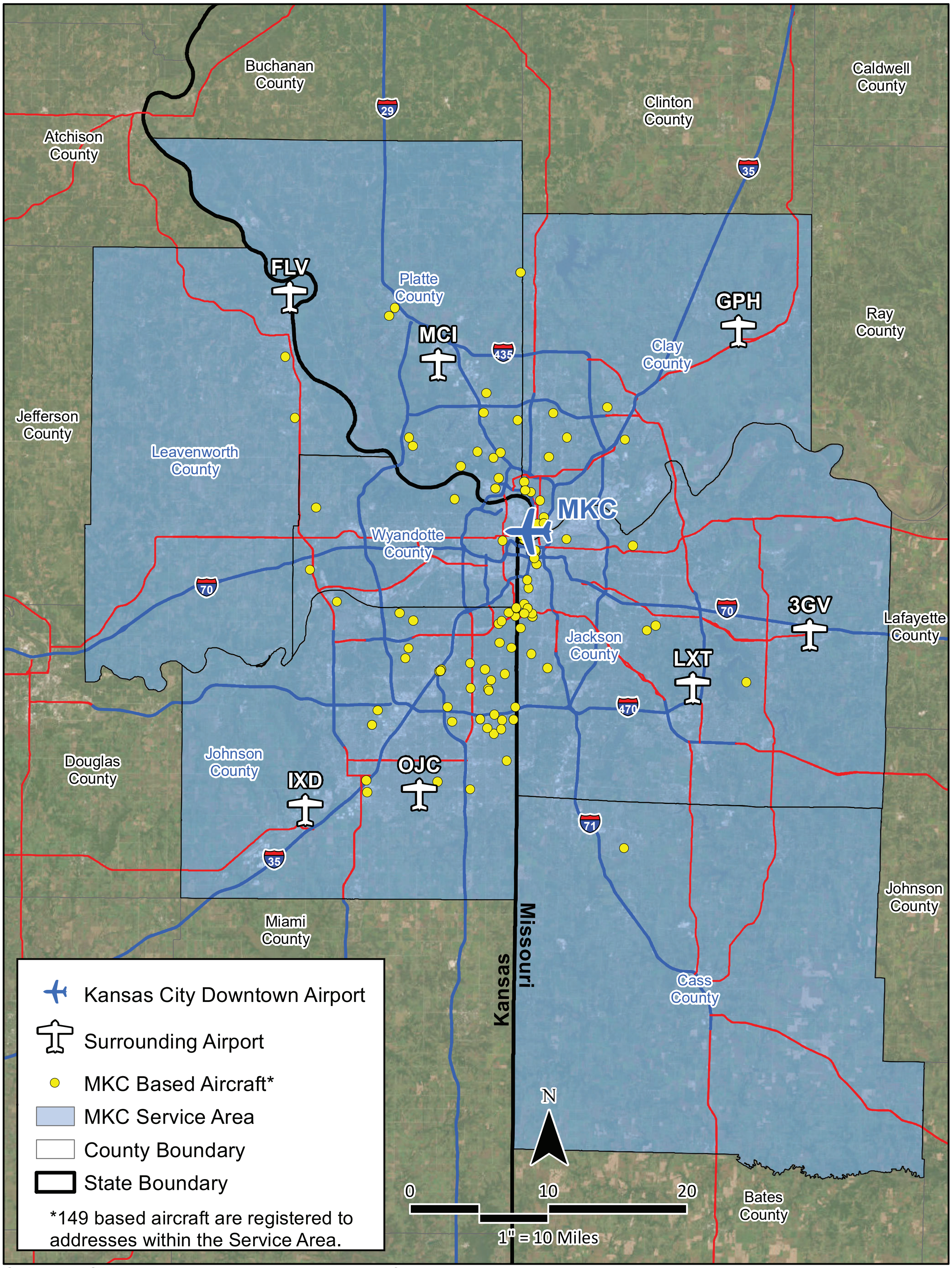
**Table 2B** summarizes historical and forecast population, employment, and income estimates for the seven-county airport service area.

**TABLE 2B | Socioeconomic History and Forecasts for the Service Area**

| | HISTORY | | | FORECAST | | | |
|---|---|---|---|---|---|---|---|
| **Socioeconomic Parameter** | **2013** | **2022** | **CAGR 2013-2022** | **2027** | **2032** | **2042** | **CAGR 2022-2042** |
| Population | 1,916,512 | 2,068,912 | 0.77% | 2,145,474 | 2,218,033 | 2,346,964 | 0.63% |
| Employment | 1,232,457 | 1,391,779 | 1.22% | 1,494,285 | 1,578,194 | 1,730,517 | 1.10% |
| Income (PCPI) | $44,661 | $49,066 | 0.95% | $52,839 | $56,713 | $64,795 | 1.40% |

CAGR: Compound annual growth rate
PCPI: Per capita personal income ($2012)

*Source: Woods & Poole - Complete Economic and Demographic Data Source (CEEDS) 2022*




Source: ESRI Basemap Imagery, BasedAircraft.com.



Exhibit 2A
AIRPORT SERVICE AREA

## NATIONAL AVIATION TRENDS AND FORECASTS

Each year, the FAA updates and publishes a national aviation forecast. Included in this publication are forecasts for large air carriers, regional/commuter air carriers, general aviation, and FAA workload measures. The forecasts are prepared to meet the budget and planning needs of the FAA and to provide information that can be used by state and local authorities, the aviation industry, and the general public. The current edition used in preparation of this study was FAA *Aerospace Forecasts – Fiscal Years 2023-2043*, published in March 2023. The FAA primarily uses the economic performance of the United States as an indicator of future aviation industry growth. Similar economic analyses are applied to the outlook for aviation growth in international markets. The following discussion is summarized from the FAA Aerospace Forecasts.

### FAA GENERAL AVIATION FORECASTS

The FAA forecasts the fleet mix and hours flown for single engine piston aircraft, multi-engine piston aircraft, turboprops, business jets, piston and turbine helicopters, light sport, experimental, and others (gliders and balloons). The FAA forecasts “active aircraft,” not total aircraft. An active aircraft is one that is flown at least one hour during the year. As previously mentioned, from 2010 through 2013, the FAA undertook an effort to have all aircraft owners re-register their aircraft. This effort resulted in a 10.5 percent decrease in the number of active general aviation aircraft, mostly in the piston category.

The COVID-19 pandemic of 2020-2021 also had a significant impact on the aviation industry; however, the impact was less acute in the general aviation sector as more people began to see private aviation as a viable alternative to commercial airlines, which were severely impacted. In fact, some sectors of general aviation saw increases in activity, such as charters and fractional use aircraft.

The long-term outlook for general aviation is relatively stable, as growth at the high-end offsets continuing retirements at the traditional low end of the segment. The active general aviation fleet is forecast to grow between 2023 and 2043. While steady growth in both gross domestic product (GDP) and corporate profits results in continued growth of the turbine and rotorcraft fleets, the largest segment of the fleet – fixed-wing piston aircraft – continues to decline over the forecast period. Against the growing fleet, the number of general aviation hours flown is projected to increase by an average of 0.91 percent per year during the same period, as growth in turbine, rotorcraft, and experimental hours more than offset a decline in fixed-wing piston hours. Following declining numbers of pilots from 2010-2016, growth in pilots has returned and is forecast to grow by 0.27 percent through 2043. **Table 2C** shows the primary general aviation demand indicators as forecast by the FAA.

**Exhibit 2B** presents the historical and FAA forecast of the U.S. active general aviation aircraft fleet and operations.

**TABLE 2C | FAA National General Aviation Forecast**

| Demand Indicator | 2022 | 2042 | CAGR 2023-2043 |
|---|---|---|---|
| **Total General Aviation Fleet** | **209,140** | **215,390** | **0.15%** |
| Total Fixed-Wing Piston | 137,465 | 119,350 | -0.70% |
| Total Fixed-Wing Turbine | 26,145 | 38,980 | 2.02% |
| Total Helicopters | 10,175 | 13,680 | 1.49% |
| Total Other (experimental, light sport, etc.) | 35,335 | 43,380 | 1.03% |
| **Total General Aviation Operations** | **28,664,223** | **32,222,776** | **0.74%** |
| Local | 14,029,412 | 16,562,635 | 0.83% |
| Itinerant | 14,634,811 | 16,660,141 | 0.65% |
| **Total General Aviation Hours Flown[1]** | **26,299,170** | **30,527,780** | **0.75%** |
| Total Pistons | 14,627,822 | 12,706,492 | -0.70% |
| Total Turbine | 10,002,179 | 15,426,555 | 2.19% |
| **Total General Aviation Pilots[2]** | **476,346** | **509,525** | **0.27%** |

[1]Excludes Experimental, Light Sport, and Others (gliders, balloons, etc.)
[2]Excludes student pilots
CAGR: compound annual growth rate
*Source: FAA Aerospace Forecast - Fiscal Years 2023-2043*

## UNMANNED AIRCRAFT SYSTEMS (UAS)

UAS are commonly referred to as drones, which have been experiencing healthy growth in the U.S. and around the world the past few years. According to the FAA *Aerospace Forecasts Fiscal Years 2022-2042*:

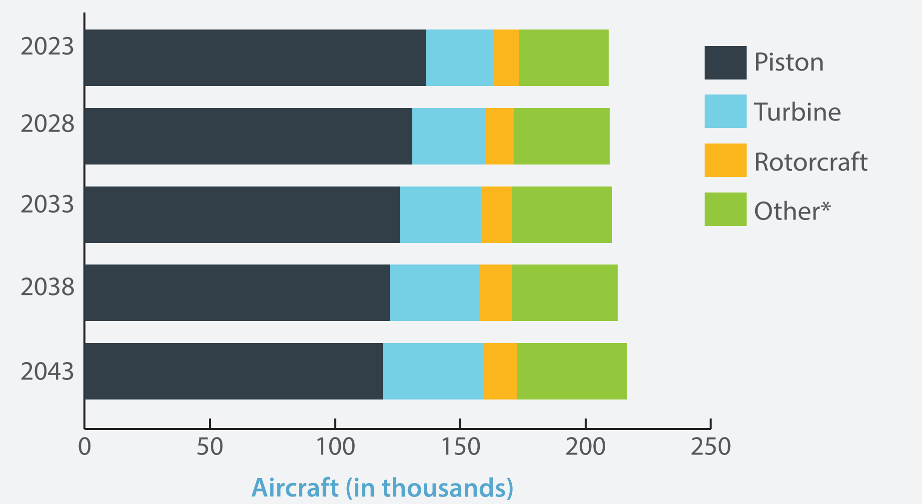
> "A drone consists of a remotely piloted aircraft and its associated elements – including the control station and the associated communication links – that are required for the safe and efficient operation in the national airspace system (NAS). The introduction of drones in the NAS has opened up numerous possibilities, especially from a commercial perspective. This has also brought challenges including drones' safe and secure integration into the NAS. Despite these challenges, the drone sector holds enormous promise; potential uses range from individuals flying solely for recreational purposes to large companies delivering commercial packages and delivering medical supplies. Public service uses, such as conducting search and rescue support missions following natural disasters, are proving promising as well."

On December 21, 2015, the FAA launched an online registration system for recreational/model small drones. This required all drones weighing more than 0.55 pounds (or 250 grams) and fewer than 55 pounds (or 25 kilograms) to be registered. The registration system captures the number of registered pilots but does not capture individual drone aircraft. Nevertheless, the registration information does provide a basic understanding of the growth in drone activity from which the FAA has made a growth forecast for the next five years.

### Trends in Recreational/Model Aircraft

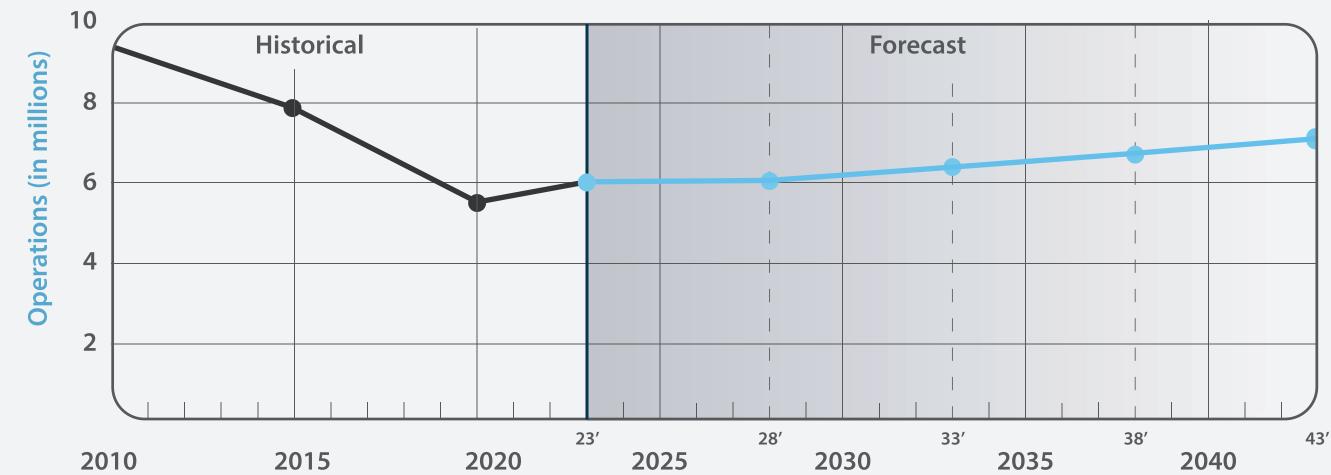
Through an examination of the drone aircraft registrations and renewals, the FAA estimated that there were as many as 1.68 million small drones in the national fleet. FAA developed three forecasts, which are presented in **Table 2D**. By 2026, FAA is forecasting as many as 1.89 million small drones.

## U.S. Active General Aviation Aircraft

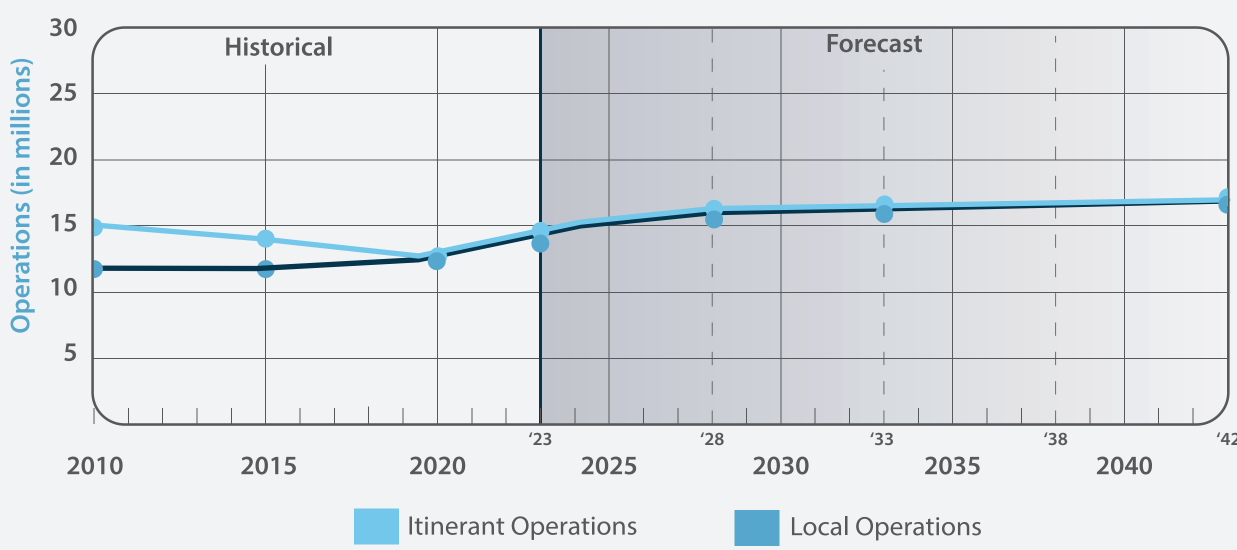



*Other includes Experimental and LSA aircraft

## U.S. Air Taxi Operations



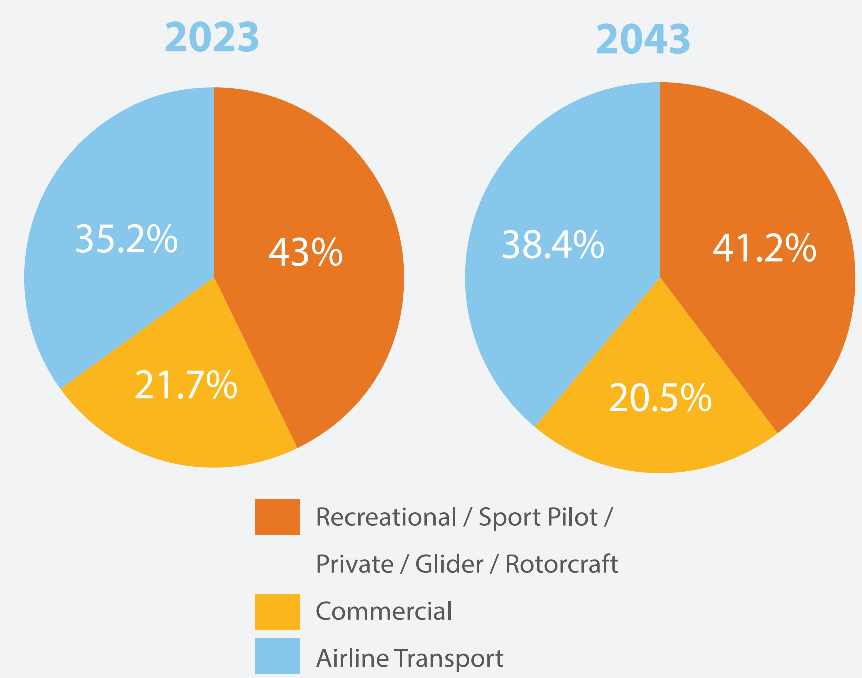

## U.S. General Aviation Operations




## Active Pilots By Certificate

Total Active Pilots: **482,025***

Total Active Pilots: **510,670**




**Excludes Student Pilot Certificates*

Source: FAA Aerospace Forecasts FY2023-2043

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TABLE 2D | Total Recreational/Model Fleet

| Fiscal Year | Low* | Base** | High** |
|---|---|---|---|
| 2022 | 612,200 | 1,688,500 | 1,688,500 |
| **Forecast** | | | |
| 2023 | 620,500 | 1,750,200 | 1,762,200 |
| 2024 | 639,300 | 1,785,400 | 1,815,800 |
| 2025 | 654,800 | 1,803,500 | 1,852,000 |
| 2026 | 663,400 | 1,814,900 | 1,875,700 |
| 2027 | 668,500 | 1,823,400 | 1,891,800 |
| CAGR | 1.78% | 1.55% | 2.30% |

CAGR: Compound annual growth rate
*Effective/Active fleet counts combined with multiplicity of aircraft ownership.
**New registration counts combined with multiplicity of aircraft ownership
*Source: FAA Aerospace Forecasts FY 2023-2043*

### Trends in Commercial/Non-Model UAS Aircraft

Online registration for commercial/non-model small drones went into effect on April 1, 2016. These are commercial drones weighing less than 55 pounds. Unlike recreational/model ownership, each aircraft must be registered individually. Registrations of commercial/non-model UAS aircraft have been increasing year-after-year, according to the FAA. **Table 2E** shows the FAA forecast for this category of UAS. It is estimated that there were up to 727,000 commercial/non-model UAS in 2022, which is forecast to increase to as many as 1,015,000 by 2026.

TABLE 2E | Total Commercial/Non-Model Fleet

| Fiscal Year | Low* | Base** | High** |
|---|---|---|---|
| 2022 | 328,000 | 727,000 | 727,000 |
| **Forecast** | | | |
| 2023 | 349,000 | 805,000 | 807,000 |
| 2024 | 364,000 | 862,000 | 867,000 |
| 2025 | 373,000 | 904,000 | 915,000 |
| 2026 | 378,000 | 933,000 | 966,000 |
| 2027 | 382,000 | 955,000 | 1,015,000 |
| CAGR | 3.10% | 5.61% | 6.90% |

CAGR: Compound annual growth rate
*Effective/Active fleet counts combined with multiplicity of aircraft ownership.
**New registration counts combined with multiplicity of aircraft ownership
*Source: FAA Aerospace Forecasts FY 2023-2043*

### Advanced Air Mobility (AAM)

The AAM segment has some cross-over with the functions of drone. AAM is defined as "a safe and efficient system for air passenger and cargo transportation, inclusive of small package delivery and other urban drone services, which support a mix of onboard/ground-piloted and increasingly autonomous operations."

AAM technology presents considerable opportunities for economic growth over the coming decades. The FAA forecasts indicate that package delivery is likely to experience economic growth over the next decade. Passenger service, on the other hand, promises larger markets for AAM services, but safety challenges, infrastructure, public acceptance, and evolving technology may slow full integration in the short term. Nevertheless, flight testing continues with numerous commercial companies conducting test flights. An example is the advancements that Joby Aviation has made with its Electric Vertical Takeoff and Landing Aircraft (eVTOL), which is expected to receive FAA certification in 2023 or 2024. Currently, this aircraft can fly over 150 miles on one battery charge and can carry four passengers.

One of the major challenges of eVTOL entering the marketplace is infrastructure. A system of vertiports for AAM services appears to be the preferred method of operation. Joby Aviation and Archer have partnered with parking garage operator REEF Technology with the goal of using parking garage rooftops as vertiports. Other options may include establishing vertiports at existing airports. For example, there could be an eVTOL air taxi service from MKC or MCI to area locations in the future. Future infrastructure planning for both airports should consider establishing vertiports to take advantage of the emerging AAM market.

## *FORECASTING APPROACH*

The development of aviation forecasts proceeds through both analytical and judgmental processes. A series of mathematical relationships is tested to establish statistical logic and rationale for projected growth; however, the judgment of the forecast analyst, based upon professional experience, knowledge of the aviation industry, and assessment of the local situation, is important in the final determination of the preferred forecast. The most reliable approach to estimating aviation demand is through the utilization of more than one analytical technique. Methodologies frequently considered include trend line/time-series projections, correlation/regression analysis, and market share analysis. The forecast analyst may decide to employ one or all these methods to arrive at a reasonable single forecast. The following is a description of those methodologies utilized to develop the forecasts of aviation demand.

**Trend Line/Time-Series Projections:** Trend line/time-series projections are probably the simplest and most familiar of the forecasting techniques. By fitting growth curves to historical data, and then extending them into the future, a basic trend line projection is produced. An assumption of this technique is that outside factors will continue to affect aviation demand in much the same manner as in the past. As broad as this assumption may be, the trend line projection does serve as a reliable benchmark for comparing other projections.

**Ratio Projection:** The ratio projection methodology examines the historical relationship between two variables as a ratio. A common example in aviation demand forecasting is to consider the number of based aircraft as a ratio of the service area population where there may be 1.8 aircraft per 1,000 people. This ratio can then be carried to future years in comparison to projections of population.

**Market Share Analysis:** Market share analysis involves a historical review of the airport activity as a percentage, or share, of a larger regional, state, or national aviation market. A historical market share trend is determined, providing an expected market share for the future. These shares are then multiplied by the forecasts for the larger geographical area to produce a market share projection. This method has the same limitations as trend line projections but can provide a useful check on the validity of other forecasting techniques.

**Regression Analysis:** This methodology measures the statistical relationship between dependent and independent variables, yielding a "correlation coefficient". The correlation coefficient (Pearson's "r") measures the association between changes in a dependent variable and independent variable(s). The resulting $r^2$ value is between -1 and 1 and it is a measure of the linear correlation of the variables. If all the variable data points form a perfect increasing line, then the $r^2$ value would be 1. Generally, the predictive value of regression models is higher with a higher $r^2$ value, however, because of the consideration of all the data points, some of which may be somewhat spread out, ultimately the data analyst must interpret the data for reasonableness. Therefore, it is not uncommon for a regression forecast with a lower $r^2$ value compared to others, to be a better choice for predictive value. Note: **Appendix B** shows the detailed regression analysis reports for each demand indicator for which regression analysis was done.

**Professional Judgement:** Once one or more forecasting methodologies have been applied, the forecast analyst must select a single forecast for each aviation demand indicator (i.e., based aircraft, operations). The selected forecast can be one of the several developed or it can be a blended forecast. Any single forecast selected must be reasonable, logical, and defensible.

The FAA indicates that a 20-year forecast be developed for long-range airport planning. Facility and financial planning usually require at least a 10-year view because it often takes more than five years to complete a major facility development program. However, it is important to use forecasts that do not overestimate revenue-generating capabilities or understate demand for facilities required to meet public (user) needs.

A wide range of factors are known to influence the aviation industry and can have significant impacts on the extent and nature of aviation activity in both the local and national markets. Historically, the nature and trends of the national economy have had direct impacts on the level of aviation activity. Recession-ary periods have been closely followed by declines in aviation activity. Nevertheless, over time, trends emerge and provide the basis for airport planning.

Future facility requirements, such as hangar and apron needs, are derived from projections of various aviation demand indicators. Using a broad spectrum of local, regional, and national socioeconomic and aviation information, and analyzing the most current aviation trends, forecasts are presented for the following aviation demand indicators:

- Passenger Enplanements
- Based Aircraft
- Based Aircraft Fleet Mix
- General Aviation Operations
- Air Taxi and Military Operations
- Operational Peaks

This forecasting effort was completed in March 2023, with a base year of 2022. The negative impacts of the COVID-19 pandemic appear to have largely passed and were not as impactful to certain general aviation airports, especially reliever type airports like MKC.

## EXISTING FORECASTS

Consideration is given to any forecasts of aviation demand that have been completed in the recent past. These are typically sourced from the FAA TAF, previous airport planning studies, and state or regional aviation plans. Since the most recent completed master plan is from 2004, it is considered to be out of date and is not referenced in this study.

### FAA *TERMINAL AREA FORECAST* (TAF 2022 – Published February 2023)

FAA publishes the TAF for each airport included in the NPIAS. The TAF is a generalized forecast of airport activity used by FAA primarily for internal planning purposes. It is available to airports and consultants to use as a point of comparison while developing local forecasts. The TAF was published in February 2023 and is based on the federal fiscal year (October-September).

**Table 2F** presents the 2022 TAF for MKC. The FAA TAF estimates that there are 176 based aircraft and 111,392 annual operations. The TAF forecast for based aircraft estimates a 0.03 percent annual growth rate with a 2042 based aircraft figure of only 177, the addition of one based aircraft over the next 20 years. Operations are projected to grow modestly at 0.34 percent annually, which has a 2042 estimate of 119,316 annual operations. Notably, the TAF local operations forecast is a flatline for the next 20 years, meaning it is a placeholder and not an actual forecast.

**TABLE 2F | 2022 FAA *Terminal Area Forecast***

| | 2022 | 2027 | 2032 | 2042 | CAGR |
|---|---|---|---|---|---|
| **ENPLANEMENTS** | | | | | |
| Air Carrier | 4,682 | 5,021 | 5,390 | 6,211 | **1.42%** |
| Commuter | 67 | 67 | 67 | 67 | **0.00%** |
| **Total Enplanements** | **4,749** | **5,088** | **5,457** | **6,278** | **1.41%** |
| **ANNUAL OPERATIONS** | | | | | |
| *Itinerant* | | | | | |
| Air Carrier | 338 | 356 | 386 | 446 | **1.40%** |
| Air Taxi & Commuter | 21,613 | 22,710 | 23,862 | 26,346 | **1.00%** |
| General Aviation | 49,872 | 50,626 | 51,390 | 52,955 | **0.30%** |
| Military | 984 | 984 | 984 | 984 | **0.00%** |
| **Total Itinerant** | **72,807** | **74,676** | **76,622** | **80,731** | **0.52%** |
| *Local* | | | | | |
| General Aviation | 38,538 | 38,538 | 38,538 | 38,538 | **0.00%** |
| Military | 47 | 47 | 47 | 47 | **0.00%** |
| **Total Local** | **38,585** | **38,585** | **38,585** | **38,585** | **0.00%** |
| **Total Operations** | **111,392** | **113,261** | **115,207** | **119,316** | **0.34%** |
| **Based Aircraft** | **176** | **177** | **177** | **177** | **0.03%** |

CAGR: Compound annual growth rate
*Source: FAA Terminal Area Forecast (February 2023)*

## *AVIATION FORECASTS*

To determine the types and sizes of facilities that should be planned to accommodate aviation activity, certain elements of this activity must be forecast. These indicators of aviation demand include based aircraft, aircraft fleet mix, operations, and peak periods.

The number of based aircraft is the most basic indicator of aviation demand for general aviation airports. By first developing a forecast of based aircraft for MKC, other demand indicators can be projected. The process of developing forecasts of based aircraft begins with an analysis of aircraft ownership in the primary service area through a review of historical aircraft registrations. An initial forecast of service area registered aircraft is developed and will be used as one data point to arrive at a based aircraft forecast for MKC.

Because of the numerous variables known to influence aviation demand, several separate forecasts are developed for each aviation demand indicator. Each of the forecasts is then examined for reasonableness and any outliers are discarded or given less weight. A single planning forecast is then selected for use in developing facility needs for the airport. The selected forecast can be one of the forecasts developed or, based on the experience and judgment of the forecaster, it can be a blend of the several forecasts.

### ADDITIONAL FORECASTING FACTORS

Traditional aviation demand forecasting relies heavily on historical trends. The forecasts considered here will follow those traditional models as well. However, other factors should influence the forecasting analyst when making a selected forecast for each aviation demand indicator. For example, nearby airport closure, and/or national or global conditions may affect the forecasts.

In the Kansas City region, no airports are planned to be closed; however, there are significant development plans for MKC that should be considered when projecting future demand. As noted in Chapter One – Existing Conditions, Taxiway L is planned to be constructed in 2023, which will have the immediate impact of opening the west development area for aeronautical development. This will make available approximately 50 acres of land for hangar development and it has been many years since the airport has had any developable land. Such a circumstance may be considered when projecting future demand, however a “build-it-and-they-may-come” scenario is not to be justification as a selected forecast.

The Kansas City Aviation Department (KCAD) has taken positive steps toward developing the west side of the airport once Taxiway L is extended in 2023. On May 23, 2023, the office of U.S. Congressman Emanuel Cleaver, submitted an appropriations request for $4.158 million for Pre-Development for the Westside Hangar Complex (MKC) through the subcommittee on Transportation, Housing and Urban Development (THUD). The project will include excavation and grading of the site, replacement of existing storm water infrastructure, and installation of a new utility corridor to the site.

In addition, national demand for private aviation services spiked during the COVID-19 pandemic (2020-2021). While commercial passenger service was significantly and negatively impacted, general aviation services, including charters and fractional aircraft ownership options, increased. To date, that demand has not subsided to a significant degree. Thus, it is necessary for the forecast analyst to recognize that general aviation operations have increased at MKC in recent years.

## PASSENGER ENPLANEMENT FORECAST

MKC is a Class IV, Part 139 reliever airport. As noted in Chapter One – Existing Conditions, this class of airport can accept unscheduled large air carrier aircraft, which for MKC, are typically professional and collegiate sports team charters. The passengers departing on those flights are counted as enplanements by FAA, which is an important matrix for any airport because if an airport's enplanements exceed 10,000 in a year, then it becomes eligible for at least $1 million in entitlement funding from FAA to go toward capital improvements. Any other paying passengers, such as helicopter tours or private charters, operating under C.F.R. Part 135, are also counted as enplanements.

**Table 2G** shows the history of enplanements at MKC as sourced from airport records. The airport has not exceeded the 10,000-enplanement threshold over the last 20+ years; however, in the last few years, enplanements have increased noticeably. In 2022, there were over 5,000 enplanements, which is the highest over the last 20+ years.

**TABLE 2G | Historical Passenger Enplanements**

| Year | Enplanements |
|---|---|
| 2001 | 1,167 |
| 2002 | 481 |
| 2003 | 917 |
| 2004 | 863 |
| 2005 | 615 |
| 2006 | 2,390 |
| 2007 | 1,586 |
| 2008 | 2,850 |
| 2009 | 2,146 |
| 2010 | 1,169 |
| 2011 | 2,121 |
| 2012 | 2,261 |
| 2013 | 3,065 |
| 2014 | 2,422 |
| 2015 | 2,969 |
| 2016 | 2,907 |
| 2017 | 3,417 |
| 2018 | 3,611 |
| 2019 | 3,296 |
| 2020 | 2,236 |
| 2021 | 4,301 |
| 2022 | 5,055 |

*Source: Airport records*

The airport requires any charter aircraft with more than 30 passenger seats to request prior permission to operate at the airport so that ARFF services can be made available. In 2022, there were 320 such operations. The Boeing 737 accounted for 240 of those operations and the Boeing 757 accounted for 38. Other aircraft with over 30 seats have included the MD-81/83, A320/321, and several models of ERJs.

Most of these charter flights were to transport sports teams to and from Kansas City. Sporting Kansas City (MLS) and the Royals (MLB), use MKC. A number of visiting teams also use MKC. During basketball season, many collegiate visiting teams use MKC.

Since enplanements are accounted for primarily by charter activity, traditional methods of forecasting enplanements, such as comparing historical records with national FAA enplanements forecasts, are not a good fit at MKC. Instead, the forecast analyst needs to be aware of any planned changes to the charter activity and/or any plans to provide scheduled passenger service (of which there are no plans).

There is no indication that any of the sports teams that currently utilize MKC are planning to change their operating procedures. One new team, the Kansas City Current of the National Women's Soccer League, recently began operating charters out of MKC. Therefore, some growth in enplanements could be expected.

### Time Series Regression Analysis

Two enplanement forecasts have been developed utilizing the historical enplanement data and the regression model. **Table 2H** shows the results. The first considered the timeframe from 2001-2022 and resulted in an "$r^2$" value of 0.74. While this is not a very strong "$r^2$" value, the results to appear reasonable with enplanements growing to 7,236 within the next 20-years and an annual growth rate of 1.81

percent. The second time-series regression model considers the last 10 years of data from 2013-2022. This results in an "$r^2$" value of 0.39 and an annual growth rate of 2.06 percent. By 2042, this model results in 7,598 enplanements.

**TABLE 2H | Time-Series Regression Enplanement Forecasts**

| | $r^2$ | 2022 | 2027 | 2032 | 2042 | CAGR |
|---|---|---|---|---|---|---|
| **Time-Series 2001-2022** | 0.74 | 5,055 | 4,836 | 5,636 | 7,236 | 1.81% |
| **Time-Series 2013-2022** | 0.39 | 5,055 | 4,984 | 5,855 | 7,598 | 2.06% |
| CAGR: Compound annual growth rate. | | | | | | |

### Terminal Area Forecast (2022)

The FAA's TAF also presents an enplanement forecast for MKC which has an annual growth rate of 1.41 percent. The 2022 base year for the TAF shows a total of 4,749 enplanements and a 20-year level of 6,278. Since the 2022 base year of the TAF is lower than current levels, a second enplanement forecast that is based on the TAF annual growth rate was developed. For this forecast, the 2022 base year was adjusted to 5,055, which reflects the airport records, and then the TAF annual growth rate of 1.41 percent was applied. This forecast results in a total of 6,689 enplanements by 2042. **Table 2J** summarizes the TAF and the adjusted TAF forecasts.

**TABLE 2J | FAA TAF Enplanement Forecasts**

| | 2022 | 2027 | 2032 | 2042 | CAGR |
|---|---|---|---|---|---|
| FAA TAF | 4,749 | 5,088 | 5,457 | 6,278 | 1.41% |
| ***FAA TAF (Adjusted base year) - Selected*** | ***5,055*** | ***5,422*** | ***5,815*** | ***6,689*** | ***1.41%*** |
| CAGR: Compound annual growth rate. | | | | | |
| *Source: TAF 2022 (published Feb. 2023)* | | | | | |

Consideration of an enplanement forecast that uses the TAF as a benchmark comes with challenges because of the nature of the enplanements at MKC being derived entirely from charter operations. The TAF was developed primarily considering enplanements sourced from regularly scheduled commercial airliners. However, for MKC, the TAF does reflect growth, which has occurred historically. The following is the actual compound annual growth rates in enplanements at MKC over the last five, 10-, and 20-year timeframes:

- Five Year 2018-2022: 6.96%
- 10-Year 2013-2022: 5.13%
- 20-Year 2003-2022: 8.91%

While it is feasible that enplanements at MKC could continue to increase as they have in the past, it is also feasible that the growth will level out because there may be a point in which event charter activity is maximized. Therefore, the modest growth rate of the TAF for enplanements appears reasonable, and in fact, may be a bit conservative.

### Enplanement Forecast Summary

Forecasting enplanements for an airport like MKC that does not have scheduled commercial passenger service is inherently challenging. All enplanements at the airport are derived from charter operations, fractional ownership operations, and other "on-demand" private operations. There is no indication of significant changes to the current level of activity by this sector of aviation at the airport (i.e., no new sports teams, no increase of usage by existing operators, etc.).

Two time-series regressions were run based on historical enplanement data. The first considered yearly data from 2001-2022. The "$r^2$" values for both were lower than ideal but the results were reasonable considering historical trends. One potential concern is that both time-series regressions have a five-year forecast that is slightly lower than the total number of enplanements in 2022.

Two other forecasts were considered, the 2022 TAF and the 2022 TAF growth rate with an adjusted base year. All of these forecasts form a fairly tight planning envelope. Now a single forecast must be identified for planning purposes. The 2022 airport TAF represents the low end of the planning envelope which may be attributable to the fact its 2022 base year is lower than the actual enplanement figure. The selected enplanement forecast the TAF growth rate as applied to the actual base year figure of 5,055. In the long term, this forecast results in 6,689 enplanements with an annual growth rate of 1.41. percent.

**Exhibit 2C** shows a graph of the forecasts for enplanements.

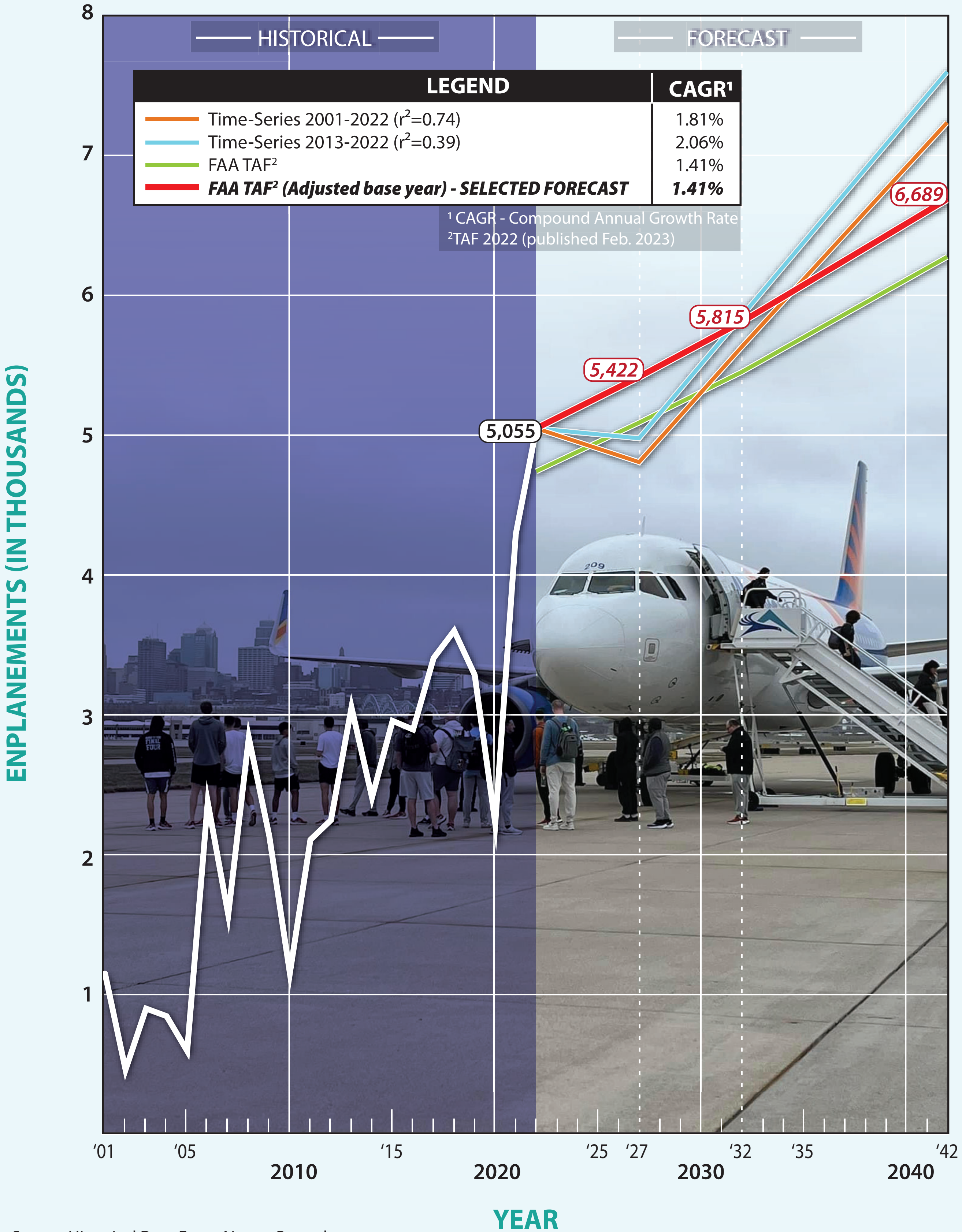
## BASED AIRCRAFT FORECAST

Forecasts of based aircraft may directly influence needed facilities and applicable design standards. The needed facilities may include hangars, aprons, taxilanes, etc. Applicable design standards may include separation distances and object clearing surfaces. The size and type of based aircraft are also an important consideration. The addition of numerous small aircraft may have no effect on design standards, while the addition of a few larger business jets can have a substantial impact on design standards.

### Based Aircraft Inventory

The FAA has established the National Based Aircraft Inventory Program through which sponsors (owners) of airports are to maintain a based aircraft inventory. This database makes it possible to cross-reference based aircraft claimed by one airport with other airports. This database evolves daily as aircraft are added or removed. It is the responsibility of the sponsor to input the based aircraft information through a dedicated website (www.basedaircraft.com). **Table 2K** summarizes the based aircraft at MKC since 2014.

The basedaircraft.com database has a front-facing summary page available to the public. This front facing page lists each airport in the database and has data columns for Validated Based Aircraft, 5010 Based Aircraft Count, Last Edit Date, and Date Confirmed. The back facing page, which is accessible and editable by the airport sponsor via a password, contains the above data points as well as several additional data columns. It also contains a based aircraft history and a list of all the aircraft (including N-numbers)




*Source:* Historical Data From Airport Records claimed by the airport. It is the Validated Based Aircraft column that FAA expects to be used as the base year for any forecasting effort; in some cases, however, the front facing and back facing Validated Based Aircraft counts are not the same. Such is the case for MKC, where the front facing Validated Based Aircraft count as of August 2023 was 196 and the back facing count was 187.

The trend at the airport since 2014 has been generally declining from a high of 231 in 2015 to a low of 160 in 2021. At the beginning of 2023, there were 161 validated based aircraft in the FAA database. Over the course of the next several months, coinciding with this master plan effort, airport management has been updating the database. As of August 15, 2023, there was a total of 196 validated based aircraft. For this forecasting effort, 196 will be used as the base year.

**TABLE 2K | Based Aircraft Inventory**

| Year | Single Engine Piston | Multi-Engine | Jets | Helicopter | Total |
|---|---|---|---|---|---|
| 1/1/2014 | 109 | 55 | 50 | 6 | 220 |
| 1/1/2015 | 112 | 62 | 51 | 6 | 231 |
| 1/1/2016 | 110 | 61 | 46 | 5 | 222 |
| 1/1/2017 | 105 | 59 | 45 | 5 | 214 |
| 1/1/2018 | 83 | 37 | 58 | 8 | 186 |
| 1/1/2019 | 78 | 22 | 59 | 7 | 166 |
| 1/1/2020 | 77 | 21 | 66 | 5 | 169 |
| 1/1/2021 | 72 | 20 | 63 | 5 | 160 |
| 1/1/2022 | 72 | 19 | 68 | 11 | 170 |
| 1/1/2023 | 70 | 18 | 61 | 12 | 161 |
| 7/15/2023 | 82 | 21 | 82 | 11 | 196 |

*Source: www.basedaircraft.com*

Based on interviews with airport staff, there are two primary reasons that the airport had a significant increase in based aircraft reported to the National Based Aircraft Inventory database. First, a new flight school with 10 new based aircraft entered the market in 2021. Second, with the initiation of this master plan, airport staff updated the database. It can be concluded that previous year figures may not be fully formed due to limited administrative counts and/or updates to the registry.

**Based Aircraft Regression Analysis**

Utilization of a mathematical statistical forecasting methodology, such as regression analysis, can be a powerful tool for predicting future based aircraft levels. However, such models are only as reliable as the data inputs. Single and multi-variable regressions were run for based aircraft. The data inputs are detailed in **Table 2L**.

**TABLE 2L | Regression Analysis Variables**

| Dependent Variable | Independent Variable[2] | | | |
|---|---|---|---|---|
| Y1-Based Aircraft[1] | X1-Year | X2-Population | X3-Employment | X4-Income |
| 220 | 2014 | 1,934,700 | 1,257,064 | 44,600 |
| 231 | 2015 | 1,953,771 | 1,285,229 | 46,048 |
| 222 | 2016 | 1,977,133 | 1,309,666 | 45,186 |
| 214 | 2017 | 1,999,016 | 1,327,819 | 45,557 |
| 186 | 2018 | 2,018,958 | 1,348,257 | 45,909 |
| 166 | 2019 | 2,034,377 | 1,353,414 | 46,655 |
| 169 | 2020 | 2,047,658 | 1,299,246 | 48,057 |
| 160 | 2021 | 2,053,036 | 1,360,932 | 48,330 |
| 170 | 2022 | 2,068,912 | 1,391,779 | 49,066 |
| 196 | 2023 | 2,084,401 | 1,422,624 | 49,804 |
| | Projected Independent Variables | | | |
| See TABLE 2M for results and $r^2$ values | 2027 | 2,145,474 | 1,494,285 | 52,839 |
| | 2032 | 2,218,033 | 1,578,194 | 56,713 |
| | 2042 | 2,346,964 | 1,730,517 | 64,795 |

[1]FAA National Based Aircraft Inventory database.
[2]Woods & Poole - Complete Economic and Demographic Data Source (CEDDS) 2022

The National Based Aircraft Inventory database (www.basedaircraft.com) has 10 years of data. Ideally, 20 or more years would be available when running regression analysis. The trend line for MKC has large swings from year to year, which naturally leads to lower "$r^2$" values when running regression analysis. **Table 2M** shows the results of the based aircraft regressions. The top regressions, return an "$r^2$" value of 0.80. The results of the top regressions project that based aircraft at MKC would decline by 20 in the first five years and by 40 over the next 20 years. This seems implausible for MKC as the declining trend in based aircraft has reversed course over the last two years. For the following reasons, none of the regressions for based aircraft are considered further in this study:

1. There are 112 aircraft owners on the hangar waitlist, indicating the potential for more based aircraft if hangars were available;
2. There is indication from airport staff that the updates to the based aircraft database were irregular, and that the historical data is not reflective of the actual numbers of based aircraft;
3. There is strong interest among developers to build new hangars in the west development area adjacent Taxiway L (once compete). This land is the first new land available for development in the last 15 years at MKC.

**TABLE 2M | Based Aircraft Regression Analysis**

| Variables (2014-2023) | $r^2$ | FORECAST BASED AIRCRAFT 2027 | 2032 | 2042 |
|---|---|---|---|---|
| Year/Employment/Income | 0.80 | 177 | 170 | 156 |
| Year/Population/Employment/Income | 0.80 | 176 | 169 | 156 |
| Population/Employment/Income | 0.78 | 169 | 156 | 144 |
| Year/Population/Employment | 0.75 | 159 | 140 | 113 |
| Population/Employment | 0.74 | 155 | 132 | 91 |
| Year/Population/Income | 0.67 | 150 | 129 | 102 |
| Population/Income | 0.67 | 151 | 130 | 102 |
| Year/Population | 0.67 | 148 | 124 | 94 |
| Year/Employment | 0.66 | 147 | 117 | 52 |
| Population | 0.63 | 139 | 108 | 53 |
| Year/Income | 0.64 | 151 | 131 | 95 |
| Year - Time Series | 0.58 | 136 | 103 | 36 |
| Income | 0.42 | 136 | 98 | 20 |
| Employment/Income | 0.42 | 135 | 97 | 20 |
| Employment | 0.29 | 148 | 124 | 80 |

*Source: Coffman Associates analysis*

**Constant Ratio of Based Aircraft to Population Forecast**

Trends comparing the number of based aircraft with the airport's service area population were analyzed. Over the last 10 years, there has been an average of 0.962 based aircraft per 1,000 people in the airport service area. Typically, this ratio declines over time, however it has increased each of the last two years for MKC. Therefore, a forecast has been developed that takes the average ratio over the last ten years and maintains that as a constant through the 20-year planning horizon. This forecast results in 226 based aircraft by 2042, which is an annual growth rate of 0.75 percent as detailed in **Table 2N**.

**TABLE 2N | Based Aircraft Forecast as an Average Constant Share of Population**

| Year | Service Area Population | Based Aircraft per 1,000 Population | Based Aircraft at MKC |
|---|---|---|---|
| 2014 | 1,934,700 | 0.1137 | 220 |
| 2015 | 1,953,771 | 0.1182 | 231 |
| 2016 | 1,977,133 | 0.1123 | 222 |
| 2017 | 1,999,016 | 0.1071 | 214 |
| 2018 | 2,018,958 | 0.0921 | 186 |
| 2019 | 2,034,377 | 0.0816 | 166 |
| 2020 | 2,047,658 | 0.0825 | 169 |
| 2021 | 2,053,036 | 0.0779 | 160 |
| 2022 | 2,068,912 | 0.0822 | 170 |
| 2023 | 2,084,401 | 0.0940 | 196 |
| **Constant Average Based Aircraft Per 1,000 Population** | | | |
| 2027 | 2,145,474 | 0.0962 | 206 |
| 2032 | 2,218,033 | 0.0962 | 213 |
| 2042 | 2,346,964 | 0.0962 | 226 |
| | | **CAGR** | **0.75%** |

CAGR = Compound annual growth rate

*Source: Coffman Associates analysis*

**Constant Ratio of Based Aircraft to Employment Forecast**

A forecast is developed that considers the ratio of based aircraft at MKC with forecast growth in employment. Employment growth tends to typically align more closely with aviation demand than does population. Over the last ten years, there have been 0.1454 based aircraft per 1,000 people employed in the service area. Over the last two years this ratio has been increasing. For this forecast we apply the 10-year average of 0.1454 based aircraft per 1,000 employed to the plan years to arrive at a forecast. It is reasonable to use the average rather than a declining trend because airport staff have indicated that actual based aircraft were higher than what was reflected in the FAA database and that they are been working to correct the based aircraft database, this the most recent years are more reflecting of what is happening at the airport. This forecast results in 252 based aircraft at MKC by 2042, which is an annual growth rate of 2.09 percent. **Table 2P** outlines the details for this forecast of based aircraft.

TABLE 2P | Based Aircraft Forecast as an Average Constant Share of Employment

| Year | Service Area Employment | Based Aircraft per 1,000 Employed | Based Aircraft at MKC |
|---|---|---|---|
| 2014 | 1,257,064 | 0.1750 | 220 |
| 2015 | 1,285,229 | 0.1797 | 231 |
| 2016 | 1,309,666 | 0.1695 | 222 |
| 2017 | 1,327,819 | 0.1612 | 214 |
| 2018 | 1,348,257 | 0.1380 | 186 |
| 2019 | 1,353,414 | 0.1227 | 166 |
| 2020 | 1,299,246 | 0.1301 | 169 |
| 2021 | 1,360,932 | 0.1176 | 160 |
| 2022 | 1,391,779 | 0.1221 | 170 |
| 2023 | 1,422,624 | 0.1378 | 196 |
| Constant Average Based Aircraft Per 1,000 Employment | | | |
| 2027 | 1,494,285 | 0.1454 | 217 |
| 2032 | 1,578,194 | 0.1454 | 229 |
| 2042 | 1,730,517 | 0.1454 | 252 |
| | | CAGR | 2.09% |

CAGR = Compound annual growth rate

*Source: Coffman Associates analysis*

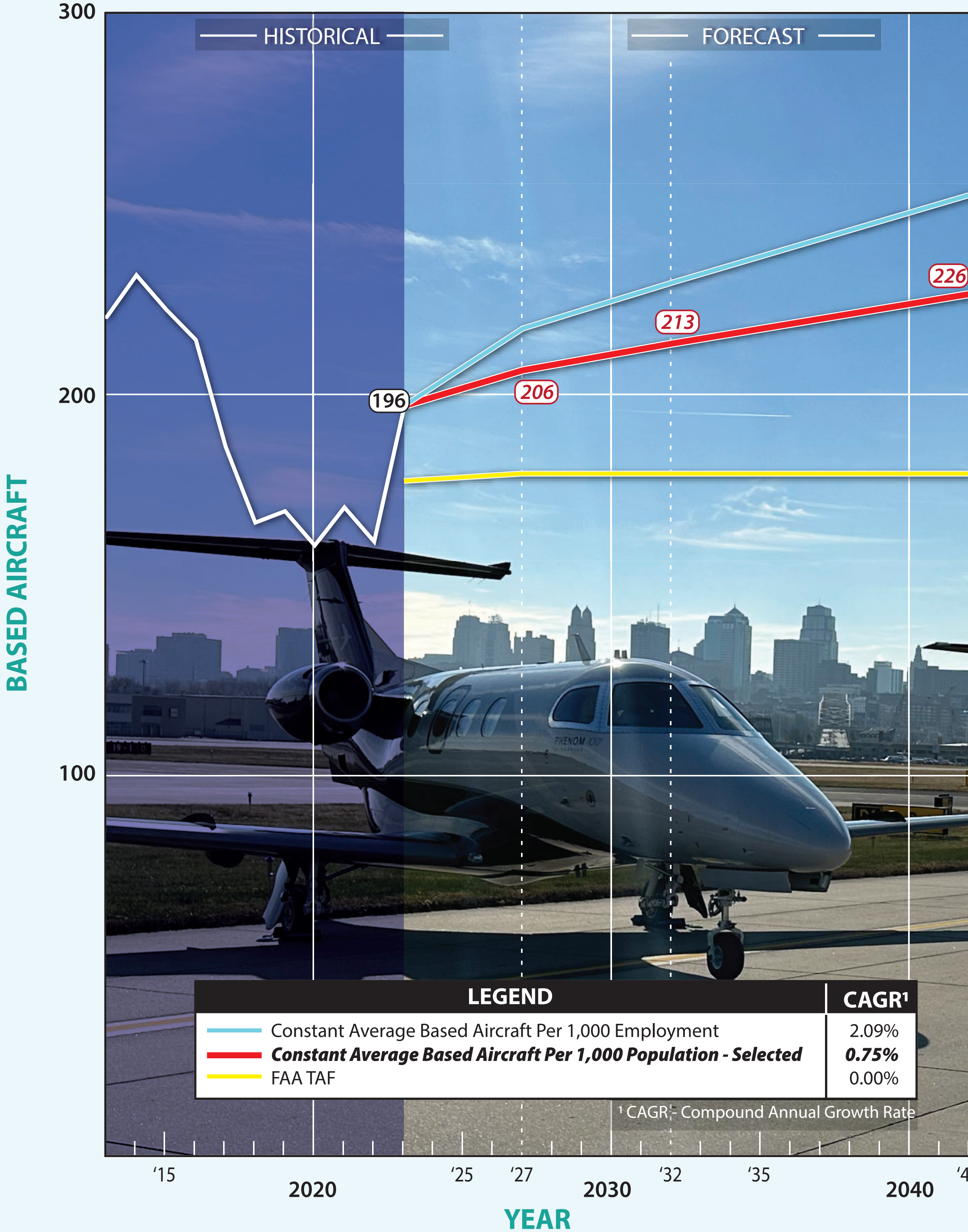
**Based Aircraft Forecast Summary**

The based aircraft forecasts are graphically summarized on **Exhibit 2D**. The next step is for the forecast analyst to choose a selected forecast to be used to determine future facility needs.

The current TAF projection for MKC has a 2022 based aircraft base line of 176 and a projection over the next 20-years of 177 for each year. In short, the TAF projects zero growth in based aircraft for the foreseeable future at MKC. The FAAs National Based Aircraft Inventory database now shows that there were 196 validated based aircraft as of August 2023. Since the TAF does not reflect the current based aircraft status or provide a reasonable projection in light of strong recent growth (other than a flat line), it is not believed that the TAF projection is reasonable as the selected based aircraft forecast.

Regression analysis was examined to determine if there is a reliable statistical relationship between historical validated based aircraft (dependent variable) and several aviation demand indicators (independent variables of population, employment, income, and time). All of the regressions returned an "$r^2$" value below the threshold for statistically reliability. While based aircraft at MKC have increased over the last two years, all of the regressions resulted in significant declines in based aircraft. Therefore, none of the regressions were considered further.

Two additional forecasts, which are a function of population and employment in the service area, were developed. These are market share forecasts that more heavily weigh the recent trends where the ratio of based aircraft to both population and employment has increased year-over-year for three years in a row. It is more typical for this ratio to decline over time, as it had from 2014 to 2021. To balance the past history with the most recent three-year trend, the average ratio of based aircraft to both population and employment was applied as a constant ratio to the future plan years.




***Source:*** Historical Data From FAA's National Based Aircraft Inventory Program (basedaircraft.com)



**Exhibit 2D**
**BASED AIRCRAFT FORECAST**

Of these two forecasts, it is the judgement of the forecast analyst, that the ratio of based aircraft to population is the most reasonable forecast. This forecast considers the addition of 30 based aircraft over the next 20 years. The employment ratio forecast appears to be too aggressive with the addition of 56 based aircraft. The population ratio forecast does not specifically consider the potential influx of new based aircraft that may result from the development of hangars once the Taxiway L project is complete, but it would account for a portion of those if the development does occur as planned. In many cases, considering the potential for future development as a means to justify a based aircraft forecast is not ideal. The "If you build it, they will come" approach is not generally acceptable due to building uncertainty; however, at MKC it is reasonable to consider the fact that strong regional demand for hangar space at MKC exists today and will follow once the new development area is engaged. There has been little development opportunity at MCK due to land constraints, but that has changed with the removal of the VOR and taxiway modifications currently occurring. KCAD  indicates that the acreage available is highly desirable as they have had numerous inquiries about building hangars on the soon to be available land. In addition, the airport has 112 aircraft owners on their hangar wait list as of November 2023. The based aircraft forecast to be utilized for planning purposes is:

- 2022 – 196 Based Aircraft
- 2027 – 206 Based Aircraft
- 2032 – 213 Based Aircraft
- 2042 – 226 Based Aircraft

## BASED AIRCRAFT FLEET MIX

The fleet mix of based aircraft is oftentimes more important to airport planning and design than the total number of aircraft. For example, the presence of one, or a few, business jets can impact the design standards more than many smaller, single engine piston-powered aircraft.

Knowing the aircraft fleet mix expected to utilize MKC is necessary to properly plan for facilities that will best serve the level of activity and the type of activities occurring at the airport. The existing fleet mix of aircraft based at the airport is comprised of 82 single engine piston aircraft, 12 multi-engine piston aircraft, nine turboprops, 82 jets, and 11 helicopters, for a total of 196 based aircraft.

The history of the based aircraft fleet mix was previously presented in **Table 2K**. It showed that over the last 10-years, piston engine aircraft (single and multi-engine) have declined substantially in numbers from a combined 164 in 2014 to 103 in 2023. Jets and turboprops have conversely increased substantially from a combined 50 in 2014 to 82 in 2023.

The national trends in active general aviation aircraft by engine type was previously presented in **Table 2C** and on **Exhibit 2B**. Those national forecasts project that fixed wing piston aircraft will decline by 0.70 percent annually through 2043, while turbine engine aircraft will increase by 2.02 percent annually through 2043.

MKC is a national general aviation reliever airport. Its historical based aircraft fleet mix has tracked generally with national trends in that piston aircraft have declined and turbine aircraft have increased. In fact, the decline in the number of piston aircraft has been more aggressive (-2.30% annually) from 2014 to 2023, and the increase in turbine aircraft at MKC has been more aggressive (2.50% annually) than the national averages.

**Table 2Q** summarizes the future based aircraft fleet mix for MKC. This forecast takes into consideration the 10-years of based aircraft history and the FAAs national forecast. Turbine engine aircraft are projected to continue to increase as a percentage of the whole while piston engine aircraft are projected to decline.

**TABLE 2Q | Based Aircraft Fleet Mix**

| | HISTORY | | | | FORECAST | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Aircraft Type | 2014 | % | 2023 | % | 2027 | % | 2032 | % | 2042 | % |
| Single Engine Piston | 109 | 49.5% | 82 | 41.8% | 83 | 40.3% | 85 | 39.9% | 88 | 38.9% |
| Multi-Engine Piston | 55 | 25.0% | 12 | 6.1% | 12 | 5.8% | 11 | 5.2% | 10 | 4.4% |
| Turboprop | 6 | 2.7% | 9 | 4.6% | 11 | 5.3% | 13 | 6.1% | 15 | 6.6% |
| Jet | 44 | 20.0% | 82 | 41.8% | 87 | 42.2% | 90 | 42.3% | 96 | 42.5% |
| Helicopter | 6 | 2.7% | 11 | 5.6% | 13 | 6.3% | 14 | 6.6% | 17 | 7.5% |
| **Totals** | **220** | **100.0%** | **196** | **100.0%** | **206** | **100.0%** | **213** | **100.0%** | **226** | **100.0%** |

*Source: Airport Records; Coffman Associates Analysis*

## GENERAL AVIATION ANNUAL OPERATIONS

General aviation operations are classified as either local or itinerant. A local operation is a take-off or landing performed by an aircraft that operates within sight of the airport, or which executes simulated approaches or touch-and-go operations at the airport. Generally, local operations are characterized by training operations. Itinerant operations are those performed by aircraft with a specific origin or destination away from the airport. Typically, itinerant operations increase with business and commercial use, since business aircraft are not typically used for large scale training activities. Local operations include a portion of general aviation and military operations, while itinerant operations include general aviation, military, and air taxi (for-hire operators, such as air cargo, life flight, charters, and fractional users).

Each operational segment is forecast individually, then the segments are combined to arrive at a total operations forecast. **Table 2R** shows total historical operations since 2000. As can be seen, 2022 was the highest operational level since 2003. According to airport staff, the reason for the significant increase in operations in 2021 and 2022 was assumed to be the increase in general aviation usage since the COVID-19 pandemic. These recent operational trends appear to be continuing into 2023. As of the end of July 2023, operations are 6.57 percent higher than from January through July of 2022.

TABLE 2R | Historical Operations

| | ITINERANT OPERATIONS | | | | | LOCAL OPERATIONS | | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | Air Carrier | Air Taxi | GA | Mil | Total | GA | Mil | Total | Total |
| 2000 | 115 | 13,872 | 76,432 | 724 | 91,143 | 37,158 | 265 | 37,423 | 128,566 |
| 2001 | 242 | 17,105 | 65,618 | 1,008 | 83,973 | 33,200 | 279 | 33,479 | 117,452 |
| 2002 | 82 | 20,166 | 66,294 | 937 | 87,479 | 36,785 | 196 | 36,981 | 124,460 |
| 2003 | 34 | 19,213 | 61,063 | 731 | 81,041 | 36,371 | 99 | 36,470 | 117,511 |
| 2004 | 102 | 20,092 | 56,543 | 942 | 77,679 | 29,931 | 104 | 30,035 | 107,714 |
| 2005 | 16 | 15,204 | 55,719 | 464 | 71,403 | 26,986 | 209 | 27,195 | 98,598 |
| 2006 | 24 | 14,850 | 44,482 | 540 | 59,896 | 22,202 | 118 | 22,320 | 82,216 |
| 2007 | 99 | 16,903 | 49,884 | 921 | 67,807 | 24,916 | 213 | 25,129 | 92,936 |
| 2008 | 134 | 14,449 | 42,031 | 947 | 57,561 | 15,976 | 366 | 16,342 | 73,903 |
| 2009 | 159 | 14,288 | 38,273 | 1,007 | 53,727 | 17,755 | 581 | 18,336 | 72,063 |
| 2010 | 87 | 15,851 | 37,345 | 921 | 54,204 | 16,951 | 480 | 17,431 | 71,635 |
| 2011 | 169 | 17,801 | 36,002 | 1,168 | 55,140 | 13,539 | 399 | 13,938 | 69,078 |
| 2012 | 187 | 15,656 | 41,321 | 1,099 | 58,263 | 16,108 | 307 | 16,415 | 74,678 |
| 2013 | 176 | 14,233 | 39,824 | 685 | 54,918 | 12,984 | 121 | 13,105 | 68,023 |
| 2014 | 203 | 15,239 | 39,691 | 913 | 56,046 | 13,221 | 343 | 13,564 | 69,610 |
| 2015 | 189 | 14,685 | 39,435 | 1,068 | 55,377 | 15,322 | 400 | 15,722 | 71,099 |
| 2016 | 194 | 13,433 | 42,091 | 1,002 | 56,720 | 13,616 | 267 | 13,883 | 70,603 |
| 2017 | 232 | 15,163 | 43,335 | 919 | 59,649 | 14,260 | 86 | 14,346 | 73,995 |
| 2018 | 173 | 15,747 | 39,981 | 950 | 56,851 | 14,565 | 179 | 14,744 | 71,595 |
| 2019 | 214 | 16,305 | 45,515 | 935 | 62,969 | 16,293 | 262 | 16,555 | 79,524 |
| 2020 | 176 | 15,075 | 38,525 | 763 | 54,539 | 18,803 | 137 | 18,940 | 73,479 |
| 2021 | 322 | 19,899 | 44,210 | 892 | 65,323 | 31,385 | 108 | 31,493 | 96,816 |
| 2022 | 321 | 21,592 | 50,661 | 930 | 73,504 | 40,549 | 41 | 40,590 | 114,094 |

*Source: OPSNET - FAA operations count from the MKC control tower*

**Year-To-Date Operations**

This forecasting effort was undertaken in September/October of 2023. Since 2022 is the last full calendar year of data available, 2022 is the base year of the forecasts. However, airport operations data is available for January through August 2023 from the ATCT. This data was examined to see if the recent trends of exceptional optional growth has continued into 2023. The concern being that now that the COVID pandemic has subsided, have general aviation operations slow or reverse trend.

**Table 2S** summarizes operations data at MKC for the January through August timeframe for 2021, 2022, and 2023. Operations are continuing their upward trend, but it should be noted that air taxi operations are growing at a much higher pace than other categories of operations. Local general aviation operations have declined a bit since 2022 but are still well above the 2021 level. This information is provided to inform the reader and the forecast analyst of the most recent operational data available and the current trends.

**TABLE 2S | 2023 Year-To-Date Operations Comparison**

| | ITINERANT OPERATIONS | | | | | LOCAL OPERATIONS | | | |
|---|---|---|---|---|---|---|---|---|---|
| Timeframe | Air Carrier | Air Taxi | GA | Military | Subtotal | GA | Military | Subtotal | Total Operations Jan-July |
| Jan-August 2021 | 230 | 12,245 | 27,964 | 598 | 41,037 | 19,809 | 80 | 19,889 | 60,926 |
| Jan-August 2022 | 250 | 13,795 | 32,719 | 661 | 47,425 | 25,257 | 28 | 25,285 | 72,710 |
| Jan-August 2023 | 251 | 20,271 | 31,895 | 563 | 52,980 | 23,251 | 91 | 23,342 | 76,322 |

*Source: OPSNET FAA operations database accessed on October 3, 2023.*

### Itinerant General Aviation Operations Forecast

Itinerant general aviation operations are by those operators that are arriving or departing to or from other locations. Itinerant operations do not include training activities or other operations within the traffic pattern airspace.

As can be seen in **Table 2R**, itinerant general aviation operations have fluctuated between the high 70,000's and the mid 30,000's. Since the mid-2000's, itinerant operations have been in the lower portion of this range, however, 2021 and 2022 realized noticeable growth. In 2020 there were 38,525 itinerant general aviation operations and in 2022 there were 50,661. An increase of 31.5 percent in just two years. Much of this increase may be attributable to the impact the COVID-19 pandemic had on general aviation operations nationally, which was a growth area.

*Itinerant General Aviation Operations Regression Forecasts*

Two simple trend-line regression models were run to examine the statistical reliability of extending the trend to the forecast years. The first considered MKC itinerant general aviation operations from 2003-2022. This resulted in a steep decline to a point well below historical levels and an $r^2$ value of only 0.20. This result is not surprising because of the "U" shape curve of historical itinerant general aviation operations. Regression analysis is generally more reliable when there is a clear trend in the historical data.

A second trend-line was run using the last ten years of data from 2013-2022. This appears to be a more reliable trend for this range, however the notable increase in the last two years will influence the statistical reliability for this regression. Nonetheless, this regression results in a moderate increase over time and an annual growth rate of 1.00 percent. The $r^2$ value is still low at only 0.42, however this may be attributable to the increase over the last two years. **Table 2T** shows these two trendline regressions.

**TABLE 2T | GA Itinerant Operations Regressions**

| | $r^2$ | 2022 | 2027 | 2032 | 2042 | CAGR |
|---|---|---|---|---|---|---|
| Trend Line 2003-2022 | 0.20 | 50,661 | 36,641 | 34,001 | 28,721 | -2.80% |
| Trend Line 2013-2022 | 0.42 | 50,661 | 49,900 | 53,886 | 61,858 | 1.00% |
| CAGR - Compound annual growth rate | | | | | | |

*Source: Trend-line regression analysis by Coffman Associates*

In addition to the time-series regressions, additional independent variables were examined. Those variables are the FAA forecast for national itinerant general aviation operations, the service area population and employment levels. **Table 2U** summarizes the historical data used in the additional regressions.

**TABLE 2U | Regression Analysis Variables**

| Dependent Variable | Independent Variables | | | |
|---|---|---|---|---|
| Y1-MKC GA Itinerant Operations[1] | X1-Year | X2 - US GA Itinerant Operations[2] | X3-Population[3] | X4-Employment[3] |
| 39,824 | 2013 | 14,117,370 | 1,916,512 | 1,232,457 |
| 39,691 | 2014 | 13,978,993 | 1,934,700 | 1,257,064 |
| 39,435 | 2015 | 13,887,203 | 1,953,771 | 1,285,229 |
| 42,091 | 2016 | 13,905,204 | 1,977,133 | 1,309,666 |
| 43,335 | 2017 | 13,839,151 | 1,999,016 | 1,327,819 |
| 39,981 | 2018 | 14,130,495 | 2,018,958 | 1,348,257 |
| 45,515 | 2019 | 14,244,787 | 2,034,377 | 1,353,414 |
| 38,525 | 2020 | 12,608,003 | 2,047,658 | 1,299,246 |
| 44,210 | 2021 | 13,774,861 | 2,053,036 | 1,360,932 |
| 50,661 | 2022 | 14,634,811 | 2,068,912 | 1,391,779 |
| | Projected Independent Variables | | | |
| See TABLE 2V for Results and $r^2$ Values | 2027 | 16,026,989 | 2,145,474 | 1,494,285 |
| | 2032 | 16,232,627 | 2,218,033 | 1,578,194 |
| | 2042 | 16,660,141 | 2,346,964 | 1,730,517 |

*[1]FAA OPSNET database sourced from MKC ATCT.*
*[2]FAA Aerospace Forecast - fiscal Years 2023-2043*
*[3]Woods & Poole - Complete Economic and Demographic Data Source (CEDDS) 2022*

**Table 2V** shows the results of both single and multivariable regressions utilizing the data in **Table 2U**. They are organized from highest $r^2$ value to lowest. As is common with regression analysis, the more variables that are included, the smoother the line becomes and often the higher resulting $r^2$ value. However, higher $r^2$ values do not necessarily correlate to a better statistical reliability. Where possible, it is preferrable to consider single variable regressions because there is less smoothing of the results, even if the $r^2$ values are higher. Ultimately, it falls to the analyst to assess the results and make a determination as to reasonableness. The best single variable regression utilizes employment figures as the independent variable.

**TABLE 2V | MKC GA Itinerant Operations Regression Analysis**

| | | FORECAST MKC GA ITINERANT OPERATIONS | | | |
|---|---|---|---|---|---|
| Variables (2013-2022) | $r^2$ | 2027 | 2032 | 2042 | CAGR |
| Year/US GA Itin Ops/Pop. | 0.85 | 60,925 | 66,907 | 79,897 | 2.30% |
| Year/US GA Itin Ops/Pop./Emp. | 0.85 | 60,920 | 66,911 | 79,924 | 2.31% |
| Year/US GA Itin Ops/Emp. | 0.84 | 60,865 | 66,009 | 76,684 | 2.09% |
| Year/Us GA Itin Ops | 0.83 | 60,200 | 65,400 | 75,875 | 2.04% |
| US GA Itin Ops/Pop. | 0.81 | 59,282 | 63,691 | 71,820 | 1.76% |
| US GA Itin Ops/Pop./Emp. | 0.81 | 60,000 | 64,039 | 71,486 | 1.74% |
| Year/Pop./Emp. | 0.77 | 57,793 | 65,902 | 84,264 | 2.58% |
| US GA Itin Ops/Emp. | 0.75 | 57,293 | 62,037 | 70,808 | 1.69% |
| Population/Employment | 0.64 | 53,475 | 58,615 | 68,032 | 1.49% |
| Year/Employment | 0.61 | 52,742 | 57,549 | 66,077 | 1.34% |
| Employment | 0.60 | 52,721 | 57,630 | 66,540 | 1.37% |
| Year/Population | 0.49 | 52,580 | 58,493 | 72,527 | 1.81% |
| Year - Time Series | 0.42 | 49,900 | 53,886 | 61,858 | 1.00% |
| Population | 0.37 | 48,512 | 51,605 | 57,102 | 0.60% |
| US GA Itin Operations | 0.36 | 51,450 | 52,337 | 54,182 | 0.34% |

CAGR: compound annual growth rate

*Source: Coffman Associates analysis*

*Market Share of U.S. Itinerant General Aviation Operations Forecasts*

Over the last ten years, itinerant general aviation operations at MKC, as a share of national operations, have increased from 0.2821 percent to 0.3462 percent. By applying the percent change increase to the plan years an increasing market share forecast emerges. This forecast results in 60,615 itinerant general aviation operations in the next five years and 79,022 within 20-years. This forecast is shown in **Table 2W**.

The table also serves as a point of comparison for the employment regression forecast, the airport TAF and the airport TAF growth rate when applied to the 2022 base year itinerant operations figure. The comparison allows the forecast analyst to examine if the market share percentage is reasonable as compared to the historical data. The TAF and the TAF growth rate forecasts both appear to be low compared to the recent trend. The increasing markets share forecast may be reasonable but certainly it would represent a high range forecast. In fact, the airport has not reached 79,000 itinerant general aviation operations within the last 20+ years. The employment regression forecast may be a little low in the first five years compared to recent growth the last two years, but then the 10 year and 20-year forecasts appear to be reasonable. For these reasons it is the opinion of the forecast analyst that the employment regression is the selected forecast for planning purposes.

TABLE 2W | General Aviation Itinerant Operations Forecast

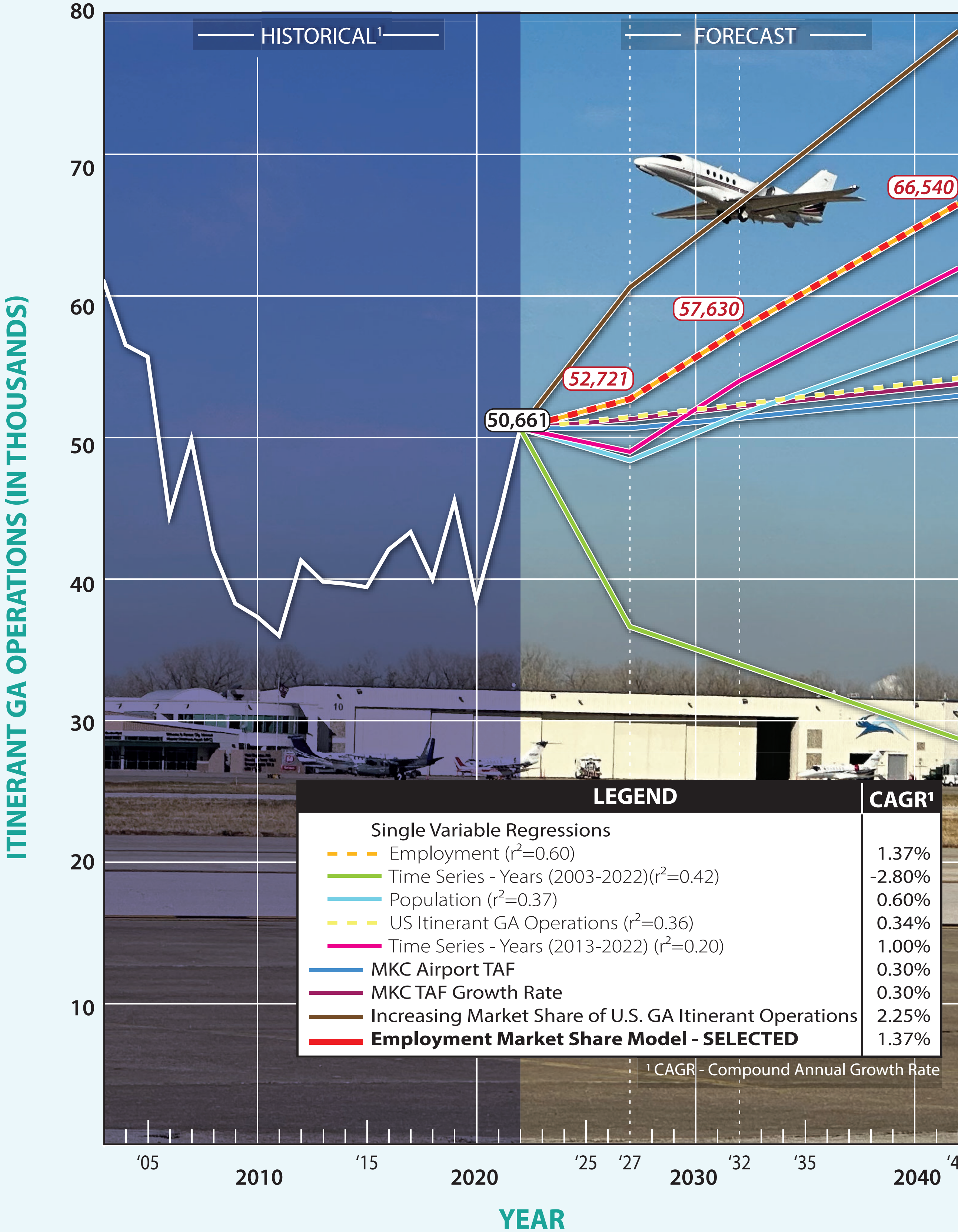
| Year | MKC GA Itinerant Operations[1] | US GA Itinerant Operations[2] | Market Share US GA Itinerant Operations |
|---|---|---|---|
| 2013 | 39,824 | 14,117,370 | 0.2821% |
| 2014 | 39,691 | 13,978,993 | 0.2839% |
| 2015 | 39,435 | 13,887,203 | 0.2840% |
| 2016 | 42,091 | 13,905,204 | 0.3027% |
| 2017 | 43,335 | 13,839,151 | 0.3131% |
| 2018 | 39,981 | 14,130,495 | 0.2829% |
| 2019 | 45,515 | 14,244,787 | 0.3195% |
| 2020 | 38,525 | 12,608,003 | 0.3056% |
| 2021 | 44,210 | 13,774,861 | 0.3209% |
| 2022 | 50,661 | 14,634,811 | 0.3462% |
| **FAA Airport TAF (CAGR = 0.30%)** | | | |
| 2027 | 50,626 | 16,026,989 | 0.3159% |
| 2032 | 51,390 | 16,232,627 | 0.3166% |
| 2042 | 52,955 | 16,660,141 | 0.3179% |
| **FAA Airport TAF Growth Rate (CAGR = 0.30%)** | | | |
| 2027 | 51,425 | 16,026,989 | 0.3209% |
| 2032 | 52,202 | 16,232,627 | 0.3216% |
| 2042 | 53,789 | 16,660,141 | 0.3229% |
| **Increasing Market Share of U.S. GA Itinerant Operations (CAGR = 2.25%)** | | | |
| 2027 | 60,615 | 16,026,989 | 0.3782% |
| 2032 | 66,593 | 16,232,627 | 0.4102% |
| 2042 | 79,022 | 16,660,141 | 0.4743% |
| ***Employment Regression Model (CAGR = 1.37%) - Selected Forecast*** | | | |
| 2027 | 52,721 | 16,026,989 | 0.3290% |
| 2032 | 57,630 | 16,232,627 | 0.3550% |
| 2042 | 66,540 | 16,660,141 | 0.3994% |

[1]Historical data from ATCT records as reported to FAA in the OPSNET database.
[2]FAA Forecasts Fiscal Years 2023-2043
CAGR = Average Annual Growth Rate from 2022 to 2042
*Source: Coffman Associates analysis*

**Exhibit 2E** summarizes the forecasts considered for itinerant general aviation operations.

### Local General Aviation Operations Forecast

Local general aviation operations are those that operate within the traffic pattern airspace and are typically characterized as training or touch-and-go operations. Much of the local traffic is attributable to the two flight schools on the airfield, ATP and ATD Flight Systems. ADT has been operating at MKC since 1996, while ATP is relatively new to the airport having established operations in 2021. Historical local operations were outlined in **Table 2R**. Local operations have spiked in the last two years, increasing from 18,803 in 2020 to 40,549 in 2022. The owners of both flight schools were interviewed and asked about future business plans. Both are planning for growth and planning to make additional investments in more aircraft and potentially building their own hangars, once more developable land is available. ATD specifically stated that in the next five to ten years they plan to double their fleet from 13 currently to 26 single and multi-engine piston aircraft.




¹Historical data from ATCT records as reported to FAA.



Exhibit 2E
ITINERANT GA OPERATIONS FORECAST

*Local General Aviation Operations Regression Forecasts*

Single and multi-variant regression analysis was done for local general aviation operations. The independent variables considered were years, national local operations as forecast by FAA, the service area population and employment. **Table 2Y** documents the data inputs.

**TABLE 2Y | Regression Analysis Variables**

| Dependent Variable | Independent Variables | | | |
|---|---|---|---|---|
| Y1-MKC GA Local Operations[1] | X1-Year | X2 - US GA Local Operations[2] | X3-Population[3] | X4-Employment[3] |
| 12,984 | 2013 | 11,688,355 | 1,916,512 | 1,232,457 |
| 13,221 | 2014 | 11,675,040 | 1,934,700 | 1,257,064 |
| 15,322 | 2015 | 11,691,338 | 1,953,771 | 1,285,229 |
| 13,616 | 2016 | 11,632,612 | 1,977,133 | 1,309,666 |
| 14,260 | 2017 | 11,732,324 | 1,999,016 | 1,327,819 |
| 14,565 | 2018 | 12,354,014 | 2,018,958 | 1,348,257 |
| 16,293 | 2019 | 13,109,215 | 2,034,377 | 1,353,414 |
| 18,803 | 2020 | 12,332,877 | 2,047,658 | 1,299,246 |
| 31,385 | 2021 | 13,479,087 | 2,053,036 | 1,360,932 |
| 40,549 | 2022 | 14,029,412 | 2,068,912 | 1,391,779 |
| | Projected Independent Variables | | | |
| See TABLE 2Z for Results and $r^2$ Values | 2027 | 15,713,699 | 2,145,474 | 1,494,285 |
| | 2032 | 15,987,407 | 2,218,033 | 1,578,194 |
| | 2042 | 16,562,635 | 2,346,964 | 1,730,517 |

[1]*FAA OPSNET database sourced from MKC ATCT.*
[2]*FAA Aerospace Forecast - fiscal Years 2023-2043.*
[3]*Woods & Poole - Complete Economic and Demographic Data Source (CEDDS) 2022.*

**Table 2Z** shows the results of both single and multivariable regressions utilizing the data in **Table 2Y**. They are organized from highest $r^2$ value to lowest. As is common with regression analysis, the more variables that are included, the smoother the line becomes and often the higher resulting $r^2$ value. However, higher $r^2$ values do not necessarily correlate to a better statistical reliability. Where possible, it is preferrable to consider single variable regressions because there is less smoothing of the results, even if the $r^2$ values are higher. Ultimately, it falls to the analyst to assess the results and determine reasonableness. The best single variable regression utilizes the national forecast for local general aviation operations ss the independent variable.

**TABLE 2Z | MKC GA Local Operations Regression Analysis**

| Variables (2013-2022) | $r^2$ | FORECAST MKC GA LOCAL OPERATIONS 2027 | 2032 | 2042 | CAGR |
|---|---|---|---|---|---|
| Year/Pop./Emp. | 0.9796 | 60,751 | 85,077 | 145,715 | 6.60% |
| Year/US GA Local Ops/Pop./Emp. | 0.9796 | 60,724 | 84,779 | 144,791 | 6.57% |
| Year/US GA Local Ops/Pop. | 0.9598 | 57,342 | 76,682 | 126,200 | 5.84% |
| Year/Population | 0.9535 | 56,804 | 79,467 | 136,829 | 6.27% |
| Year/US GA Local Ops/Emp. | 0.7986 | 49,567 | 51,850 | 57,214 | 1.74% |
| US GA Local Ops/Pop./Emp. | 0.7956 | 50,834 | 51,931 | 54,794 | 1.52% |
| US GA Local Ops/Pop. | 0.7952 | 51,180 | 52,582 | 56,004 | 1.63% |
| US GA Local Ops/Emp. | 0.7945 | 50,272 | 51,512 | 54,575 | 1.50% |
| Year/US GA Local Ops | 0.7914 | 50,631 | 53,679 | 60,028 | 1.98% |
| US GA Local Ops | 0.7911 | 50,705 | 53,294 | 58,735 | 1.87% |
| Year/Employment | 0.6253 | 42,078 | 54,198 | 78,478 | 3.36% |
| Year - Time Series | 0.6252 | 42,186 | 54,337 | 78,638 | 3.37% |
| Population/Employment | 0.5191 | 40,492 | 50,893 | 69,568 | 2.74% |
| Population | 0.4983 | 37,083 | 46,078 | 62,061 | 2.15% |
| Employment | 0.4833 | 42,319 | 53,283 | 73,186 | 3.00% |

CAGR: compound annual growth rate
*Source: Coffman Associates analysis*

*Market Share of U.S. Local General Aviation Operations Forecasts*

Over the last ten years, local general aviation operations at MKC, as a share of national operations, have increased from 0.1111 percent to 0.2890 percent. By applying the percent change increase to the plan years an increasing market share forecast emerges. This forecast results in 59,398 local general aviation operations in the next five years and 106,796 local operations within 20 years. This forecast is shown in **Table 2AA**.

A second increasing market share of national local operations forecast is also included in the table. This forecast is based on the future plans of the two active flight schools at the airport. Both have indicated that they plan to double in size and operations in the next five to ten years.

The preferred regression forecast is also included in the market share table as a method to examine the reasonableness of the regression forecast. Both the increasing market share forecast, and the flight school forecast, would lead to a level of local operations that far exceeds any year in the last 20 years. Therefore, these two forecasts are not the selected forecast. The regression forecast is selected to be carried forward in this study because it is based on mathematical formulas, historical trends, and represents a reasonable growth trend for the airport. **Exhibit 2F** graphically shows the local general aviation operations forecasts.

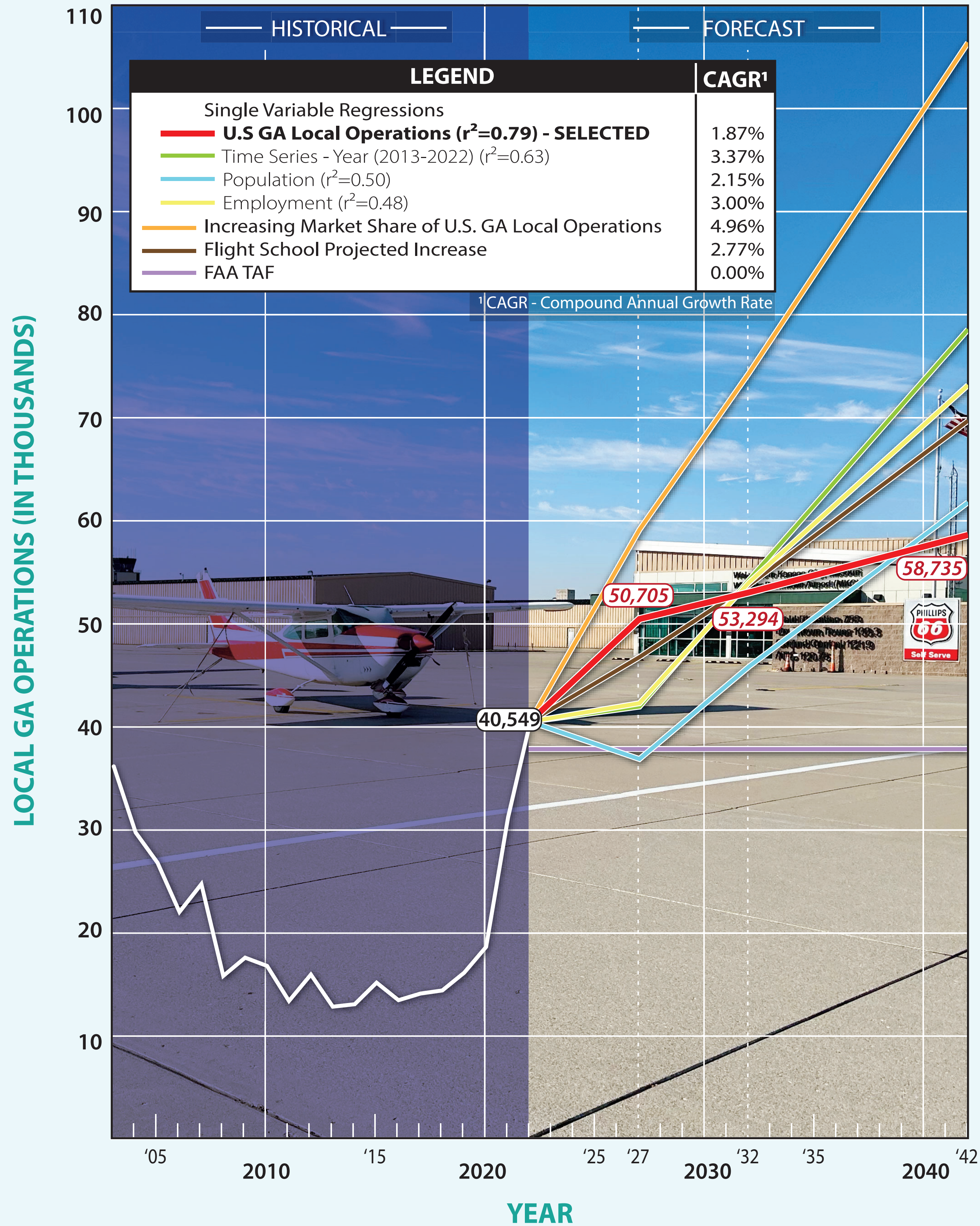





Exhibit 2F
LOCAL GA OPERATIONS FORECAST

TABLE 2AA | General Aviation Local Operations Forecast

| Year | MKC GA Local Ops[1] | US GA Local Ops[2] | Market Share Local Ops |
|---|---|---|---|
| 2013 | 12,984 | 11,688,355 | 0.1111% |
| 2014 | 13,221 | 11,675,040 | 0.1132% |
| 2015 | 15,322 | 11,691,338 | 0.1311% |
| 2016 | 13,616 | 11,632,612 | 0.1171% |
| 2017 | 14,260 | 11,732,324 | 0.1215% |
| 2018 | 14,565 | 12,354,014 | 0.1179% |
| 2019 | 16,293 | 13,109,215 | 0.1243% |
| 2020 | 18,803 | 12,332,877 | 0.1525% |
| 2021 | 31,385 | 13,479,087 | 0.2328% |
| 2022 | 40,549 | 14,029,412 | 0.2890% |
| ***US GA Local Operations Regression (CAGR = 1.87%) - Selected Forecast*** | | | |
| 2027 | 50,705 | 15,713,699 | 0.3227% |
| 2032 | 53,294 | 15,987,407 | 0.3333% |
| 2042 | 58,735 | 16,562,635 | 0.3546% |
| **Increasing Market Share of U.S. GA Local Operations (CAGR = 4.96%)** | | | |
| 2027 | 59,398 | 15,713,699 | 0.3780% |
| 2032 | 74,645 | 15,987,407 | 0.4669% |
| 2042 | 106,796 | 16,562,635 | 0.6448% |
| **Flight School Projected Increase (CAGR = 2.77%)** | | | |
| 2027 | 47,000 | 15,713,699 | 0.2991% |
| 2032 | 54,000 | 15,987,407 | 0.3378% |
| 2042 | 70,000 | 16,562,635 | 0.4226% |

[1]Historical data from ATCT records as reported to FAA OPSNET database.
[2]FAA Forecasts Fiscal Years 2023-2043
CAGR = Average Annual Growth Rate from 2022 to 2042

*Source: Coffman Associates analysis*

### Air Taxi Operations Forecast

Air taxi operations are those with the authority to provide "on-demand" or "for-hire" transportation of persons or property via aircraft with fewer than 60 passenger seats. Air taxi includes a broad range of operations, including some smaller commercial service aircraft, some charter aircraft, air cargo aircraft, many fractional ownership aircraft, aerial tour, and air ambulance services. The team-chartered aircraft operations utilizing aircraft with more than 60 seats are not counted under the air taxi category and are instead classified as air carrier.

MKC air taxi operations had been relatively flat from 2013-2020, generally ranging between 13,000 and 16,000. In 2020, there were 15,075 air taxi operations. The last two air taxi operations have increased sharply with 19,899 in 2021 and 21,592 in 2022. To determine if this trend is continuing, the available air taxi operation counts from January through August 2023 were examined. At the end of August, MKC recorded 20,271 air taxi operations, which appears to be trending toward approximately 28,000 air taxi operations by the end of 2023. Referencing **Table 2R**, in the last 20-years, MKC has exceeded 20,000 air taxi operations only two other times, in 2002 and 2004. So, there is clearly a shift to an increasing trend in air taxi operations.

*Regression Analysis*

Single and multiple regressions were run to examine the statistical relationship among historical air taxi operations and the year, US air taxi operations as forecast by FAA, population, and employment. **Table 2BB** shows the last 10 years of data considered for the independent variables.

**TABLE 2BB | Air Taxi Operations Regression Analysis Variables**

| Dependent Variable | Independent Variables | | | |
|---|---|---|---|---|
| Y1-MKC Air Taxi Operations[1] | X1-Year | X2 - US Air Taxi Operations[2] | X3-Population[3] | X4-Employment[3] |
| 15,656 | 2013 | 8,803,402 | 1,916,512 | 1,232,457 |
| 14,233 | 2014 | 8,439,711 | 1,934,700 | 1,257,064 |
| 15,239 | 2015 | 7,895,478 | 1,953,771 | 1,285,229 |
| 14,685 | 2016 | 7,580,119 | 1,977,133 | 1,309,666 |
| 13,433 | 2017 | 7,179,651 | 1,999,016 | 1,327,819 |
| 15,163 | 2018 | 7,125,556 | 2,018,958 | 1,348,257 |
| 15,747 | 2019 | 7,234,239 | 2,034,377 | 1,353,414 |
| 16,305 | 2020 | 5,471,641 | 2,047,658 | 1,299,246 |
| 15,075 | 2021 | 5,884,738 | 2,053,036 | 1,360,932 |
| 19,899 | 2022 | 6,522,238 | 2,068,912 | 1,391,779 |
| | Projected Independent Variables | | | |
| See TABLE 2CC for Results and $r^2$ Values | 2027 | 6,009,133 | 2,145,474 | 1,494,285 |
| | 2032 | 6,335,768 | 2,218,033 | 1,578,194 |
| | 2042 | 7,030,550 | 2,346,964 | 1,730,517 |

[1]*FAA OPSNET database sourced from MKC ATCT.*
[2]*FAA Aerospace Forecast - fiscal Years 2023-2043*
[3]*Woods & Poole - Complete Economic and Demographic Data Source (CEDDS) 2022*

Because of the sharp increase in air taxi operations over the last two years, it was anticipated that the results would be mixed, which proved to be the case**. Table 2CC** shows the results. The highest $r^2$ value is 0.75, which is from the multi-variate regression for all four independent variables. This may not be a statistically reliable forecast since the $r^2$ is low. The primary problem with all of the regressions is not necessarily that the $r^2$ values are low, but that the five-year forecasts are each expected to be exceeded in 2023. The combination of these two issues has led the forecast analyst to discard any of the regressions from further consideration.

**TABLE 2CC | MKC Air Taxi Operations Regression Analysis**

| | | FORECAST MKC GA ITINERANT OPERATIONS | | |
|---|---|---|---|---|
| Variables (2013-2022) | $r^2$ | 2027 | 2032 | 2042 |
| Year/US Air Taxi Ops/Pop./Emp. | 0.75 | 22,434 | 29,286 | 44,088 |
| Year/US Air Taxi Ops/Emp. | 0.74 | 22,245 | 29,179 | 43,892 |
| Year/US Air Taxi Ops/Pop. | 0.62 | 22,561 | 27,794 | 39,661 |
| Year/Population | 0.51 | 20,697 | 23,799 | 31,673 |
| Year/Pop./Emp. | 0.51 | 20,704 | 23,810 | 31,690 |
| Year/US Air Taxi Ops | 0.51 | 21,497 | 26,166 | 35,571 |
| US Air Taxi Ops/Pop./Emp. | 0.48 | 19,508 | 24,258 | 32,880 |
| US Air Taxi Ops/Pop. | 0.35 | 19,648 | 22,807 | 28,557 |
| Year/Employment | 0.35 | 18,313 | 19,855 | 23,078 |
| Year - Time Series | 0.33 | 18,671 | 20,318 | 23,610 |
| Population/Employment | 0.26 | 17,924 | 19,120 | 21,241 |
| Population | 0.26 | 17,974 | 19,190 | 21,350 |
| US Air Taxi Ops/Emp. | 0.21 | 18,215 | 19,380 | 21,483 |
| Employment | 0.21 | 18,357 | 19,686 | 22,098 |
| US Air Taxi Operations | 0.12 | 16,218 | 16,035 | 15,646 |

*Source: Coffman Associates analysis*

*Market Share of National Air Taxi Operations as Forecast by FAA*

Two air taxi operations forecasts have been developed and are presented in **Table 2DD**. The first continues the percentage increase over the last 10-years and applies that same growth to the future plan years. This results in an air taxi operations forecast that reach 47,091 by 2042. This forecast appears very aggressive, being more than twice the previous high level recorded; therefore, a second increasing market share forecast was developed that moderates the recent sharp growth trend in the outer years over the forecast period.

**TABLE 2DD | Air Taxi Operations Forecast**

| Year | MKC Total Air Taxi Operations[1] | U.S. ATCT Air Taxi Operations[2] | MKC Percent |
|---|---|---|---|
| 2013 | 14,233 | 8,803,402 | 0.1617% |
| 2014 | 15,239 | 8,439,711 | 0.1806% |
| 2015 | 14,685 | 7,895,478 | 0.1860% |
| 2016 | 13,433 | 7,580,119 | 0.1772% |
| 2017 | 15,163 | 7,179,651 | 0.2112% |
| 2018 | 15,747 | 7,125,556 | 0.2210% |
| 2019 | 16,305 | 7,234,239 | 0.2254% |
| 2020 | 15,075 | 5,471,641 | 0.2755% |
| 2021 | 19,899 | 5,884,738 | 0.3381% |
| 2022 | 21,592 | 6,522,238 | 0.3311% |
| **Increasing Market Share of U.S. Air Taxi Operations (CAGR = 3.98%)** | | | |
| 2027 | 24,982 | 6,009,133 | 0.4157% |
| 2032 | 31,706 | 6,335,768 | 0.5004% |
| 2042 | 47,091 | 7,030,550 | 0.6698% |
| **Moderate Market Share of U.S. Air Taxi Operations - Selected (CAGR = 1.70%)** | | | |
| 2027 | 28,508 | 6,009,133 | 0.4744% |
| 2032 | 29,069 | 6,335,768 | 0.4588% |
| 2042 | 30,222 | 7,030,550 | 0.4299% |

[1]Historical data from ATCT records as reported to FAA OPSNET database.
[2]FAA Forecasts 2023-43
CAGR = Average Annual Growth Rate from 2022 to 2042

*Source: Coffman Associates analysis*

Through August 2023, there were 20,271 air taxi operations. By adding September-December air taxi operations, we can estimate that there will be 28,068 air taxi operations for the 2023 calendar year. This figure is likely on the conservative side since the 2022 monthly numbers have been exceeded in 2023 every month except in January. **Table 2EE** shows the monthly air taxi operations since January 2021 to demonstrate the sharp increasing trend. (Note: Through October 2023, there were 25,181 air taxi operations.)

**TABLE 2EE | Monthly Air Taxi Operations Since January 2021**

| Month | 2021 | 2022 | 2023 | 2023 Including Sept-Dec 2022 |
|---|---|---|---|---|
| Jan | 1,267 | 1,847 | 1,831 | 1,831 |
| Feb | 1,179 | 1,482 | 1,687 | 1,687 |
| Mar | 1,356 | 1,735 | 2,233 | 2,233 |
| Apr | 1,420 | 1,704 | 3,286 | 3,286 |
| May | 1,579 | 1,739 | 3,480 | 3,480 |
| June | 1,627 | 1,742 | 3,296 | 3,296 |
| July | 1,890 | 1,802 | 2,181 | 2,181 |
| Aug | 1,927 | 1,744 | 2,277 | 2,277 |
| Sept | 1,838 | 2,002 | | 2,002 |
| Oct | 1,874 | 2,052 | | 2,052 |
| Nov | 2,038 | 1,924 | | 1,924 |
| Dec | 1,904 | 1,819 | | 1,819 |
| **Total** | **19,899** | **21,592** | | **28,068** |

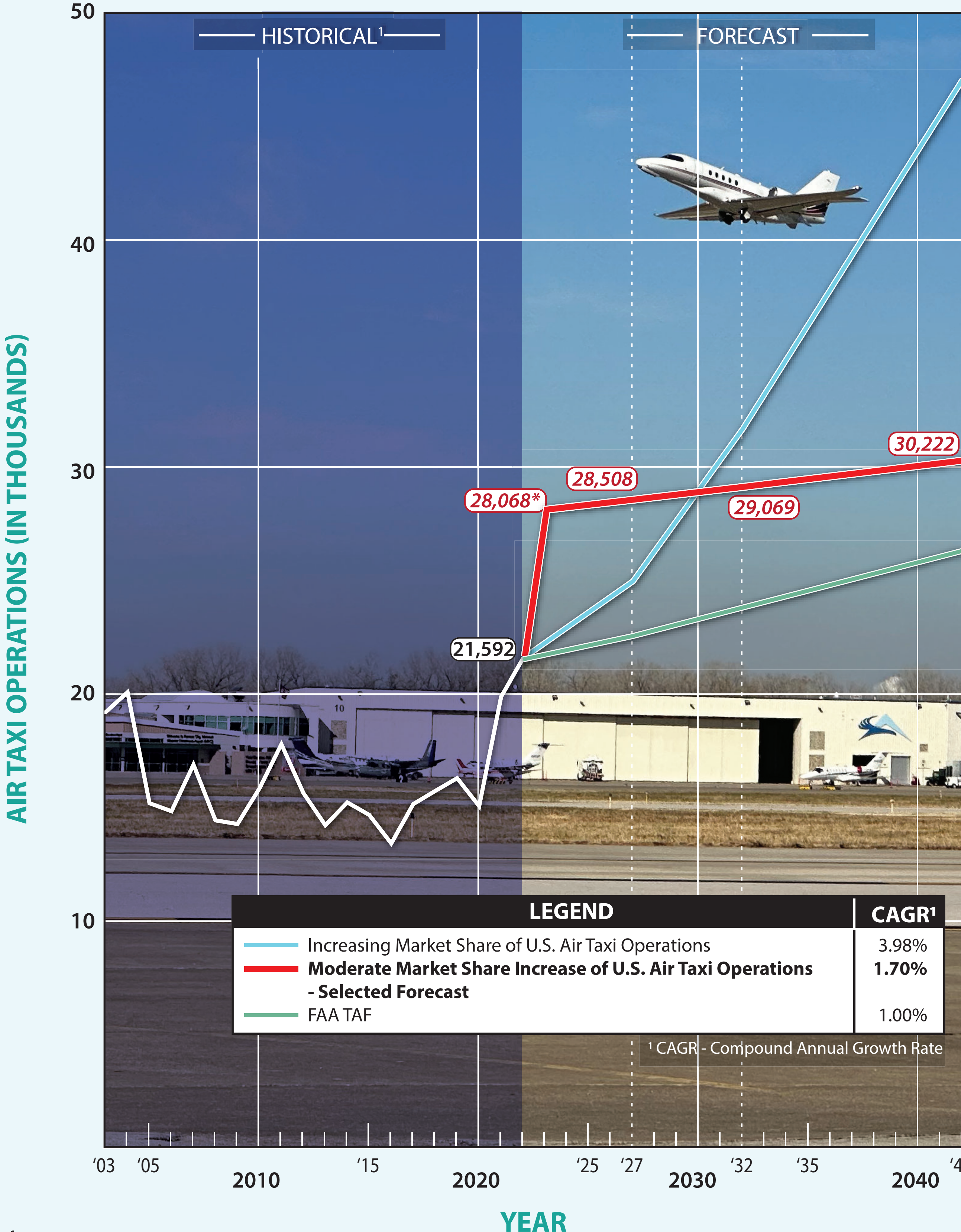
*Source: OPSNET FAA operations database accessed on October 3, 2023.*

There has been no indication that the growth trend in air taxi operations will reverse in the coming years, however there is also no indication it will continue its current trend. The second market share forecast shows an increasing market share but it has been moderated due to the unknowns created by the recent sharp increase in air taxi operations. This forecast assumes that calendar year 2023 will be around 28,068 air taxi operations and then an annual growth rate of 0.39 percent is applied for each year thereafter. This annual growth rate is the same as the FAA forecast for national air taxi operations. This forecast is outlined in **Table 2DD** and results in 30,222 air taxi operations by 2042 and an overall annual growth rate of 1.70 percent.

**Exhibit 2G** shows the air taxi operations forecast in graph form as well as the TAF forecast for comparison purposes. The TAF forecast shows a 1.00 percent annual increase in air taxi operations for MKC, however the 2042 TAF estimate of 26,346 is expected to be exceeded in 2023. Thus, it is not the selected forecast.

### Military Operations Forecast

Military aircraft can and do utilize civilian airports across the country. There is an inherent challenge to forecasting military operations, as recognized by FAA, because the military's mission can and does change quickly. As a result, FAA in their TAF for airports will include a placeholder figure. At MKC, 984 itinerant military operations are the placeholder for each year in the future. Local military operations have a placeholder of 47 operations for each year in the future. For this forecasting effort, the itinerant and local military operations will be maintained at the TAF constant rates. **Table 2FF** shows the history of military operations and the forecast.




¹Historical data from ATCT records as reported to FAA.
*Jan-Aug 2023 actual + Sept-Dec 2022 actual



Exhibit 2G
AIR TAXI OPERATIONS FORECAST

TABLE 2FF | Military Operations Forecast

| Year | Military Itinerant | Military Local | Total |
|---|---|---|---|
| 2011 | 1,168 | 399 | 1,567 |
| 2012 | 1,099 | 307 | 1,406 |
| 2013 | 685 | 121 | 806 |
| 2014 | 913 | 343 | 1,256 |
| 2015 | 1,068 | 400 | 1,468 |
| 2016 | 1,002 | 267 | 1,269 |
| 2017 | 919 | 86 | 1,005 |
| 2018 | 950 | 179 | 1,129 |
| 2019 | 935 | 262 | 1,197 |
| 2020 | 763 | 137 | 900 |
| 2021 | 892 | 108 | 1,000 |
| 2022 | 930 | 41 | 971 |
| FAA *Terminal Area Forecast* (CAGR = 0.0%) | | | |
| 2027 | 984 | 47 | 1,031 |
| 2032 | 984 | 47 | 1,031 |
| 2042 | 984 | 47 | 1,031 |

Note: History from ATCT records as reported to FAA

*Source: Coffman Associates analysis*

## AIR CARRIER OPERATIONS

Air carrier operations are those conducted for commercial purposes utilizing aircraft with more than 60 seats. Typically, air carrier operations are associated with scheduled commercial passenger activity. However, MKC is certificated to accommodate large commercial aircraft operations that are non-scheduled. Perhaps the most common activity in this classification is charter flights for sports teams.

Without scheduled commercial service, it can be challenging to forecast the air carrier category. Nonetheless, there is a history of activity that has been increasing over the last several years. **Table 2GG** shows the air carrier operations history and a forecast for the plan years. Air carrier operations are forecast to increase from 321 in 2022 to 480 by 2042, for an annual growth rate of 2.03 percent. Based on the year-over-year air carrier operations for January through July, air carrier operations are five percent higher in 2023 than 2022.

TABLE 2GG | Air Carrier Operations Forecast

| Year | Air Carrier Operations |
|---|---|
| 2011 | 169 |
| 2012 | 187 |
| 2013 | 176 |
| 2014 | 203 |
| 2015 | 189 |
| 2016 | 194 |
| 2017 | 232 |
| 2018 | 173 |
| 2019 | 214 |
| 2020 | 176 |
| 2021 | 322 |
| 2022 | 321 |
| Air Carrier Forecast (CAGR = 2.03%) | |
| 2027 | 360 |
| 2032 | 400 |
| 2042 | 480 |

Note: History from ATCT records as reported to FAA

*Source: Coffman Associates analysis*

This forecast assumes that scheduled air carrier operations will not be introduced into MKC primarily because Kansas City International Airport already caters to this class of activity; however, new sports users associated with the women's professional soccer league and increased usage by collegiate sports with regional events at T-Mobile arena will generate more air carrier operations.

### TOTAL OPERATIONS FORECAST SUMMARY

**Table 2HH** presents the total operations forecast. The airport experiences a mix of operation types, including general aviation, air taxi, and military. Multiple forecasts for each of these operational categories were developed, which created a planning envelope that represents a reasonable range of activity. Based on local conditions and the judgement of the forecast analyst, a single forecast was selected for each category. Combined, total operations are forecast to increase from 114,094 in 2022 to 157,008 in 2042, for an annual growth rate of 1.61 percent.

**TABLE 2HH | Total Operations Forecast**

| Year | ITINERANT OPERATIONS | | | | LOCAL OPERATIONS | | TOTAL OPERATIONS |
|---|---|---|---|---|---|---|---|
| | Air Carrier | Air Taxi | GA | MIL | GA | MIL | |
| 2022 | 321 | 21,592 | 50,661 | 930 | 40,549 | 41 | 114,094 |
| 2027 | 360 | 28,508 | 52,721 | 984 | 50,705 | 47 | 133,326 |
| 2032 | 400 | 29,069 | 57,630 | 984 | 53,294 | 47 | 141,423 |
| 2042 | 480 | 30,222 | 66,540 | 984 | 58,735 | 47 | 157,008 |
| **CAGR 2022-2042** | **2.03%** | **1.70%** | **1.37%** | **NA** | **1.87%** | **NA** | **1.61%** |

CAGR = Compound annual growth rate; GA = General Aviation; MIL = Military

*Source: Coffman Associates analysis*

## *PEAKING CHARACTERISTICS*

Many aspects of facility planning relate to levels of peaking activity – times when an airport is busiest. For example, the appropriate size of terminal facilities can be estimated by determining the number of people that could reasonably be expected to use the facility at a given time. The following planning definitions apply to the peak periods:

- **Peak Month** – The calendar month when peak aircraft operations occur.
- **Design Day** – The average day in the peak month.
- **Design Hour** – The peak hour within the design day.

**Table 2JJ** shows the monthly operational levels for 2022 at MKC.

The peak month of 2022 was September when there was a total of 12,149 operations, which is 10.65 percent of total annual operations. Future peak months were estimated at 10.7 percent of annual operations. The design day was determined by dividing the peak month by the number of days in that month, which is

**TABLE 2JJ | Peak Month 2022**

| Month | Total Operations | Percent of Annual |
|---|---|---|
| January | 8,869 | 7.77% |
| February | 6,363 | 5.58% |
| March | 8,580 | 7.52% |
| April | 8,413 | 7.37% |
| May | 8,477 | 7.43% |
| June | 10,593 | 9.28% |
| July | 10,952 | 9.60% |
| August | 10,463 | 9.17% |
| **September** | **12,149** | **10.65%** |
| October | 11,909 | 10.44% |
| November | 9,454 | 8.29% |
| December | 7,872 | 6.90% |
| **Total** | **114,094** | **100.00%** |

*Source: OPSNET database.*

30 (12,149 ÷ 30 = 405). The design hour was determined through analysis of hourly operations data from September 2022 as provided by the airport traffic control tower. The design hour is the average of the peak hour of the peak day of each week of the peak month. **Table 2KK** summarizes the hourly operations on the peak day of each week of the peak month of September 2022.

**TABLE 2KK | Design Hour Determination**

| Hour | Wednesday Sept. 7 | Wednesday Sept. 14 | Wednesday Sept. 21 | Thursday Sept. 29 |
|---|---|---|---|---|
| 11:00-12:00pm | 11 | 3 | 4 | 4 |
| 10:00-11:00pm | 27 | 4 | 3 | 16 |
| 9:00-10:00pm | 24 | 29 | 11 | 13 |
| 8:00-9:00pm | 42 | 35 | 22 | 33 |
| 7:00-8:00pm | 7 | 6 | 8 | 26 |
| 6:00-7:00pm | 10 | 24 | 13 | 47 |
| 5:00-6:00pm | 56 | 18 | 18 | 43 |
| 4:00-5:00pm | ***58*** | 28 | 24 | 40 |
| 3:00-4:00pm | 38 | 28 | 40 | 44 |
| 2:00-3:00pm | 21 | 35 | 50 | 38 |
| 1:00-2:00pm | 40 | 37 | ***68*** | 48 |
| 12:00-1:00pm | 47 | 42 | 45 | 33 |
| 11:00-12:00pm | 28 | ***46*** | 48 | 43 |
| 10:00-11:00am | 32 | 38 | 44 | ***48*** |
| 9:00-10:00am | 40 | 38 | 31 | 7 |
| 8:00-9:00am | 42 | 26 | 23 | 24 |
| 7:00-8:00am | 13 | 33 | 9 | 18 |
| 6:00-7:00am | 22 | 27 | 4 | 1 |
| 5:00-6:00am | 4 | 1 | 2 | 0 |
| 4:00-5:00am | 4 | 4 | 3 | 3 |
| 3:00-4:00am | 7 | 6 | 4 | 6 |
| 2:00-3:00am | 3 | 13 | 0 | 0 |
| 1:00-2:00am | 3 | 3 | 4 | 4 |
| 12:00-1:00am | 3 | 2 | 2 | 2 |
| **Total** | **582** | **526** | **480** | **541** |
| **Peak Hour %** | **9.97%** | **8.75%** | **14.17%** | **8.87%** |

**The design hour is the average of 58, 46, 68, and 48, which is 55.**
Note: Peak hour is ***BOLD italicized***.
*Source: ATCT hourly operations count for September 2022*

A summary of the peaking characteristics is outlined in **Table 2LL.**

**TABLE 2LL | Peak Operations Forecast**

| Peaking Parameter | Factor | 2022 | 2027 | 2032 | 2042 |
|---|---|---|---|---|---|
| Annual Operations | 100% of tower count | 114,094 | 133,326 | 141,423 | 157,008 |
| Peak Month | 10.7% of annual operations | 12,149 | 14,199 | 15,062 | 16,721 |
| Design Day | 3.3% of peak month | 405 | 473 | 502 | 557 |
| Design Hour | 13.6% of design day | 55 | 64 | 68 | 76 |

*Source: MKC control tower operations count.*

## OPERATIONS BY FLEET MIX

Developing an understanding of the operational fleet mix, including the approximate volume of operations by aircraft type, is an important input in determining future facility needs. The baseline operations mix is derived from an examination of FAA's Traffic Flow Management System Count (TFMSC) database, which captures operations by those that file a flight plan. The FAA believes this database captures approximately 95 percent of operations by jets and turboprops. Total operations by jets and turboprops are summarized in **Table 2MM**.

**TABLE 2MM | Historical Jet and Turboprop Operations**

| Engine Type | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| Jet | 17,776 | 18,968 | 19,084 | 18,886 | 20,400 | 20,450 | 20,526 | 15,156 | 22,838 | 24,470 |
| Turboprop | 5,438 | 5,268 | 5,320 | 4,322 | 4,650 | 4,538 | 4,556 | 4,382 | 5,948 | 6,324 |
| **Total** | **23,214** | **24,236** | **24,404** | **23,208** | **25,050** | **24,988** | **25,082** | **19,538** | **28,786** | **30,794** |

*Source: Traffic Flow Management System Count Database - Data normalized annually*

Utilizing the Traffic Flow Management System Count (TFMSC) data for jets and turboprops, we can establish a baseline operations number for those aircraft types. Because the FBO performs maintenance repair and overhaul of jet engines, a portion of the operations are local in nature to account for test flights. Future jet and turboprop operational estimates are based on local trends with both aircraft types having higher utilization rates and representing a larger percentage of overall operations.

The operations estimate for helicopters and multi-engine piston aircraft are a function of typical counts in relation to the number of based aircraft. Helicopter operations are estimated at 400 annually per based helicopter, and multi-engine piston are estimated at 200 annual operations per based aircraft. The resulting annual operational estimates account for both local and itinerant operations for helicopters and multi-engine piston aircraft. All remaining operations are assigned to single engine piston operations.

**Table 2NN** presents the fleet mix operations forecast for MKC. Piston aircraft are anticipated to continue to represent most operations but are forecast to decline as a percentage of the whole over time. Multi-engine piston operations are also forecast to decline as a percentage of the whole over time. Growth areas are in turbine engines and helicopters. While turboprops and jets are rarely used for touch-and-go operations, due to the presence of turbine engine maintenance activities at the airport, some local operations are included by these aircraft.

**TABLE 2NN | Fleet Mix Operations Forecast**

| | 2022 | % | 2027 | % | 2032 | % | 2042 | % |
|---|---|---|---|---|---|---|---|---|
| **Local Operations** | | | | | | | | |
| Single Engine Piston | 39,490 | 97.29% | 49,612 | 97.75% | 52,161 | 97.79% | 57,522 | 97.86% |
| Multi-Engine Piston | 400 | 0.99% | 400 | 0.79% | 400 | 0.75% | 400 | 0.68% |
| Turboprop | 100 | 0.25% | 120 | 0.24% | 140 | 0.26% | 180 | 0.31% |
| Jet | 200 | 0.49% | 220 | 0.43% | 240 | 0.45% | 280 | 0.48% |
| Helicopter | 400 | 0.99% | 400 | 0.79% | 400 | 0.75% | 400 | 0.68% |
| **Total Local** | **40,590** | **100.00%** | **50,752** | **100.00%** | **53,341** | **100.00%** | **58,782** | **100.00%** |
| **Itinerant Operations** | | | | | | | | |
| Single Piston | 37,010 | 50.35% | 40,454 | 48.99% | 43,292 | 49.15% | 49,076 | 49.96% |
| Multi-Piston | 2,000 | 2.72% | 2,000 | 2.42% | 1,800 | 2.04% | 1,600 | 1.63% |
| Turboprop | 6,224 | 8.47% | 8,570 | 10.38% | 10,130 | 11.50% | 11,670 | 11.88% |
| Jet | 24,270 | 33.02% | 26,750 | 32.40% | 27,660 | 31.40% | 29,480 | 30.01% |
| Helicopters | 4,000 | 5.44% | 4,800 | 5.81% | 5,200 | 5.90% | 6,400 | 6.52% |
| **Total Itinerant** | **73,504** | **100.00%** | **82,574** | **100.00%** | **88,082** | **100.00%** | **98,226** | **100.00%** |
| **Total Operations** | **114,094** | | **133,326** | | **141,423** | | **157,008** | |

*Source: Coffman Associates analysis*

## *FORECAST SUMMARY*

This study has outlined the various activity levels that might reasonably be anticipated over the planning period. **Exhibit 2H** presents a summary of the aviation forecasts prepared in this study. The base year for these forecasts is 2022, with a 20-year planning horizon to 2042. The primary aviation demand indicators are based aircraft and operations.

Based aircraft are forecast to increase from 196 in 2022 to 226 by 2042, for a CAGR of 0.71 percent. Total operations are forecast to increase from 114,094 in 2022 to 157,008 by 2042, which is a CAGR of 1.70 percent. Several forecasts for each aviation demand indicator were developed to create a range of reasonable forecasts from which a single forecast was selected for use in determining facility needs.

Projections of aviation demand will be influenced by unforeseen factors and events in the future. Therefore, future demand will not likely follow the exact projection line, but, over time, forecasts of aviation demand will tend to fall within the planning envelope. The need for additional facilities will be based upon these forecasts; however, if demand does not materialize as projected, then implementation of facility construction can be slowed. Likewise, if demand exceeds these forecasts, then implementation of facility construction can be accelerated.

| | Base Year | Forecast | | | CAGR |
|---|---|---|---|---|---|
| | 2022 | 2027 | 2032 | 2042 | |
| **ENPLANEMENTS AND AIR CARGO** | | | | | |
| Annual Enplanements | 5,055 | 5,422 | 5,815 | 6,689 | 1.41% |
| **ANNUAL OPERATIONS** | | | | | |
| ***Commercial Operations (Itinerant)*** | | | | | |
| Air Carrier (>59 seats) | 321 | 360 | 400 | 480 | 2.03% |
| Air Taxi | 21,592 | 28,508 | 29,069 | 30,222 | 1.70% |
| Total Commercial Operations | 21,913 | 28,868 | 29,469 | 30,702 | 1.70% |
| ***General Aviation Operations*** | | | | | |
| Itinerant | 50,661 | 52,721 | 57,630 | 66,540 | 1.37% |
| Local | 40,549 | 50,705 | 53,294 | 58,735 | 1.87% |
| Total General Aviation Operations | 91,210 | 103,426 | 110,923 | 125,275 | 1.60% |
| ***Military Operations*** | | | | | |
| Itinerant | 930 | 984 | 984 | 984 | 0.28% |
| Local | 41 | 47 | 47 | 47 | 0.69% |
| Total Military Operations | 971 | 1,031 | 1,031 | 1,031 | 0.30% |
| Total Itinerant Operations | 73,504 | 82,574 | 88,082 | 98,226 | 1.46% |
| Total Local Operations | 40,590 | 50,752 | 53,341 | 58,782 | 1.87% |
| **TOTAL ANNUAL OPERATIONS** | **114,094** | **133,326** | **141,423** | **157,008** | **1.61%** |
| **BASED AIRCRAFT** | | | | | |
| Single Engine Piston | 82 | 83 | 85 | 88 | 0.35% |
| Multi-Engine Piston | 12 | 12 | 11 | 10 | -0.91% |
| Turboprop | 9 | 11 | 13 | 15 | 2.59% |
| Jet | 82 | 87 | 90 | 96 | 0.79% |
| Helicopter | 11 | 13 | 14 | 17 | 2.20% |
| **TOTAL BASED AIRCRAFT** | **196** | **206** | **213** | **226** | **0.71%** |

CAGR: Compound Annual Growth Rate

| **PEAKING ACTIVITY PROJECTIONS** | | | | |
|---|---|---|---|---|
| Annual Operations | 114,094 | 133,326 | 141,423 | 157,008 |
| Peak Month | 12,149 | 14,199 | 15,062 | 16,721 |
| Design Day | 405 | 473 | 502 | 557 |
| Design Hour | 55 | 64 | 68 | 76 |



**Exhibit 2H**
**FORECAST SUMMARY**

## FORECAST COMPARISON TO THE TAF

The FAA reviews the aviation demand forecasts developed in airport planning studies and compares them to the *Terminal Area Forecast* (TAF) for the airport. The forecasts are considered consistent with the TAF if they meet the following criteria:

- Forecasts differ by less than 10 percent in the 5-year forecast period, and 15 percent in the 10-year forecast period, or
- Forecasts do not affect the timing or scale of an airport project, or
- Forecasts do not affect the role of the airport as defined in the current version of FAA Order 5090.5, *Formulation of the National Plan of Integrated Airport Systems* (NPIAS) and *Airports Capital Improvement Plan* (ACIP).

If the forecasts exceed these parameters, they may be sent to FAA headquarters in Washington, D.C., for further review. **Table 2PP** presents the direct comparison of the planning forecast with the 2022 TAF published in February 2023. The forecasts are not expected to affect the timing or scale of any major airport projects, and the role of the airport as a reliever general aviation facility is not expected to change.

**TABLE 2PP | Forecast Comparison to the 2022 FAA *Terminal Area Forecast* (TAF)**

| | 2022 | 2027 | 2032 | 2042 | CAGR 2022-2042 |
|---|---|---|---|---|---|
| **Passenger Enplanements** | | | | | |
| Master Plan Forecast | 5,055 | 5,422 | 5,815 | 6,689 | 1.41% |
| FAA TAF 2022 | 4,749 | 5,088 | 5,457 | 6,278 | 1.41% |
| % Difference | 6.2% | 6.4% | 6.4% | 6.3% | |
| **Commercial Operations (Air Carrier/Commuter/Air Taxi)** | | | | | |
| Master Plan Forecast | 21,913 | 28,868 | 29,469 | 30,702 | 1.70% |
| FAA TAF 2022 | 21,951 | 23,066 | 22,607 | 26,792 | 1.00% |
| % Difference | 0.2% | 22.3% | 26.4% | 13.6% | |
| **Total Operations** | | | | | |
| Master Plan Forecast | 114,094 | 133,326 | 141,423 | 157,008 | 1.61% |
| FAA TAF 2022 | 111,392 | 113,261 | 115,207 | 119,316 | 0.34% |
| % Difference | 2.4% | 16.3% | 20.4% | 27.3% | |
| **Based Aircraft** | | | | | |
| Master Plan Forecast | 198 | 206 | 213 | 226 | 0.71% |
| FAA TAF 2022 | 176 | 177 | 177 | 177 | 0.03% |
| % Difference | 11.8% | 15.1% | 18.5% | 24.3% | |

CAGR: Compound annual growth rate

*Source: Coffman Associates analysis*

For passenger enplanements, the master plan forecast is within tolerance of the TAF. Enplanements at MKC are generated primarily through charter flights including sports team flights. The number of sports teams or the frequency of their flights are not expected to change significantly.

Commercial operations and total operations are both higher than the TAF and are not within TAF tolerance. The primary reason for this discrepancy is that the TAF is a lagging indicator and does not fully account for the shape increase in air taxi operations and overall operations.

Based aircraft are not within tolerance of the TAF because the 2022 TAF only has 176 based aircraft when there were 196 validated based aircraft. The TAF projects 177 based aircraft for each year over the next 20-years. The TAF allows for the addition of one (1) new based aircraft over the next 20 years. The master plan-based aircraft forecast instead starts with the actual number of based aircraft, which is 196, as identified in the FAA's National Based Aircraft Inventory database (www.basedaircraft.com). The master plan then shows multiple forecasting methods for based aircraft and identifies a selected forecast that is within the planning envelope formed by the several forecasts.

## *AIRCRAFT/AIRPORT/RUNWAY CLASSIFICATION*

The FAA has established several aircraft classification systems that group aircraft types based on their performance (approach speed in landing configuration) and design characteristics (wingspan and landing gear configuration). These classification systems are used to determine the appropriate airport design standards for specific airport elements, such as runways, taxiways, taxilanes, and aprons.

### AIRCRAFT CLASSIFICATION

The selection of appropriate FAA design standards for the development and location of airport facilities is based primarily upon the characteristics of the aircraft which are currently using, or are expected to use, an airport. The critical design aircraft is used to define the design parameters for an airport. The design aircraft may be a single aircraft type or a composite aircraft representing a collection of aircraft with similar characteristics. The design aircraft is classified by three parameters: Aircraft Approach Category (AAC), Airplane Design Group (ADG), and Taxiway Design Group (TDG). FAA AC 150/5300-13B, *Airport Design*, describes the following airplane classification systems, the parameters of which are presented on **Exhibit 2J.**

***Aircraft Approach Category (AAC):*** A grouping of aircraft based on a reference landing speed ($V_{REF}$), if specified, or if $V_{REF}$ is not specified, 1.3 times stall speed ($V_{SO}$) at the maximum certificated landing weight. $V_{REF}$, $V_{SO}$, and the maximum certificated landing weight are those values established for the aircraft by the certification authority of the country of registry.

The AAC generally refers to the approach speed of an aircraft in landing configuration. The higher the approach speed, the more restrictive the applicable design standards. The AAC, depicted by a letter A through E, is the aircraft approach category and relates to aircraft approach speed (operational characteristics). The AAC generally 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.

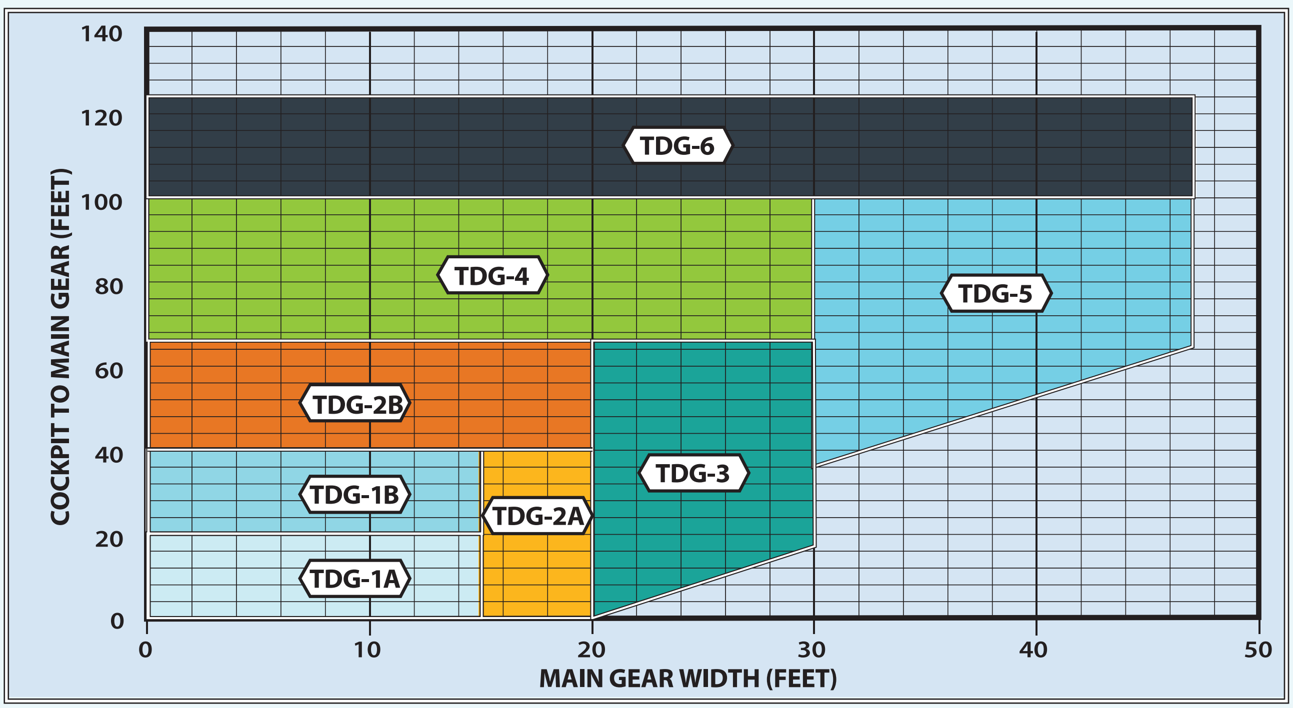
| AIRCRAFT APPROACH CATEGORY (AAC) | |
|---|---|
| **Category** | **Approach Speed** |
| A | less than 91 knots |
| B | 91 knots or more but less than 121 knots |
| C | 121 knots or more but less than 141 knots |
| D | 141 knots or more but less than 166 knots |
| E | 166 knots or more |

| 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 |

| VISIBILITY MINIMUMS | |
|---|---|
| **RVR* (ft)** | **Flight Visibility Category (statute miles)** |
| VIS | 3-mile or greater visibility minimums |
| 5,000 | Not lower than 1-mile |
| 4,000 | Lower than 1-mile but not lower than ¾-mile |
| 2,400 | Lower than ¾-mile but not lower than ½-mile |
| 1,600 | Lower than ½-mile but not lower than ¼-mile |
| 1,200 | Lower than ¼-mile |

***RVR**: Runway Visual Range

## TAXIWAY DESIGN GROUP (TDG)




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



**Exhibit 2J**
**AIRCRAFT CLASSIFICATION PARAMETERS**

## A-I

| Aircraft | TDG |
|---|---|
| Beech Baron 55 | 1A |
| **Beech Bonanza** | **1A** |
| Cessna 150, 172 | 1A |
| Eclipse 500 | 1A |
| Piper Archer, Seneca | 1A |

## B-I

| Aircraft | TDG |
|---|---|
| **Beech Baron 58** | **1A** |
| Beech King Air 90 | 1A |
| Cessna 421 | 1A |
| Cessna Citation CJ1 (525) | 1A |
| Cessna Citation 1(500) | 2A |
| Embraer Phenom 100 | 1B |

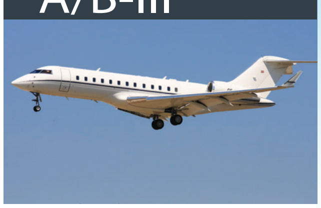
## A/B-II 12,500 lbs. or less

| Aircraft | TDG |
|---|---|
| **Beech Super King Air 200** | **2A** |
| Cessna 441 Conquest | 1A |
| Cessna Citation CJ2 (525A) | 2A |
| Pilatus PC-12 | 1A |

## B-II over 12,500 lbs.

| Aircraft | TDG |
|---|---|
| Beech Super King Air 350 | 2A |
| Cessna Citation CJ3(525B), V (560) | 2A |
| Cessna Citation Bravo (550) | 1A |
| **Cessna Citation CJ4 (525C)** | **1B** |
| Cessna Citation Latitude/Longitude | 1B |
| Embraer Phenom 300 | 1B |
| Falcon 10, 20, 50 | 1B |
| Falcon 900, 2000 | 2A |
| Hawker 800, 800XP, 850XP, 4000 | 1B |
| Pilatus PC-24 | 1B |

## A/B-III

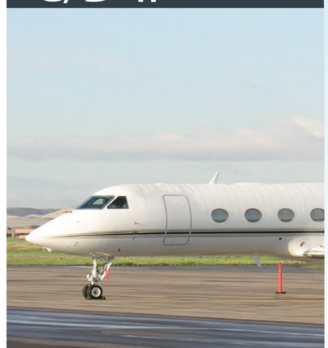


| Aircraft | TDG |
|---|---|
| Bombardier Dash 8 | 3 |
| **Bombardier Global 5000**, 6000, 7000, 8000 | **2B** |
| Falcon 6X, 7X, 8X | 2B |

## C/D-I

| Aircraft | TDG |
|---|---|
| **Lear** 25, 31, 45, 55, **60** | **1B** |
| Learjet 35, 36 (D-I) | 1B |

## C/D-II



| Aircraft | TDG |
|---|---|
| Challenger 600/604/ 800/850 | 1B |
| Cessna Citation VII, X+ | 1B |
| Embraer Legacy 450/500 | 1B |
| **Gulfstream IV,** 350, 450 (D-II) | 2A |
| Gulfstream G200/G280 | 1B |
| Lear 70, 75 | 1B |
| CRJ 700 | 2B |
| ERJ 175, 195 | 3 |
| CRJ 900 | 2B |

## C/D-III less than 150,000 lbs.

| Aircraft | TDG |
|---|---|
| Gulfstream V | 2A |
| **Gulfstream** G500, 550, 600, **650 (D-III)** | **2B** |

## C/D-III over 150,000 lbs.

| Aircraft | TDG |
|---|---|
| Airbus A319-100, 200 | 3 |
| **Boeing 737 -800**, 900, BBJ2 (D-III) | **3** |
| MD-83, 88 (D-III) | 4 |

## C/D-IV

| Aircraft | TDG |
|---|---|
| Airbus A300-100, 200, 600 | 5 |
| Boeing 757-200 | 4 |
| **Boeing 767**-300, **400** | **5** |
| MD-11 | 6 |

## D-V

| Aircraft | TDG |
|---|---|
| Airbus A330-200, 300 | 5 |
| Airbus A340-500, 600 | 6 |
| Boeing 747-100 - 400 | 5 |
| Boeing 777-300 | 6 |
| **Boeing 787**-8, 9 | **5** |

Note: Aircraft pictured is identified in bold type.



Exhibit 2J
AIRCRAFT REFERENCE CODES

***Airplane Design Group (ADG)***: The ADG, depicted by a Roman numeral I through VI, is a classification of aircraft which relates to aircraft wingspan or tail height (physical characteristics). When the aircraft wingspan and tail height fall in different groups, the higher group is used. The ADG influences design standards for taxiway safety area (TSA), taxiway object free (TOFA), taxilane object free area, apron wingtip clearance, and various separation distances.

***Taxiway Design Group (TDG)***: A classification of airplanes based on outer-to-outer Main Gear Width (MGW) and Cockpit to Main Gear (CMG) distance. The TDG relates to the undercarriage dimensions of the design aircraft. The TDG is classified by an alphanumeric system: 1A, 1B, 2, 3, 4, 5, 6, and 7. The taxiway design elements determined by the application of the TDG include the taxiway width, taxiway edge safety margin, taxiway shoulder width, taxiway fillet dimensions, and, in some cases, the separation distance between parallel taxiways/taxilanes. Other taxiway elements, such as the taxiway safety area (TSA), taxiway/taxilane object free area (TOFA), taxiway/taxilane separation to parallel taxiway/taxilanes or fixed or movable objects, and taxiway/taxilane wingtip clearances are determined solely based on the wingspan (ADG) of the design aircraft utilizing those surfaces. It is appropriate for taxiways to be planned and built to different TDG standards based on expected use.

**Exhibit 2J** also summarizes the classification of the most common aircraft in operation today. Generally, recreational and business piston and turboprop aircraft will fall in AAC A and B, and ADG I and II. Business jets typically fall in ACC B and C, while the larger commercial aircraft will fall in AAC C and D.

## AIRPORT AND RUNWAY CLASSIFICATIONS

Airport and runway classifications, along with the aircraft classifications defined previously, are used to determine the appropriate FAA design standards to which the airfield facilities are to be designed and built.

***Runway Design Code (RDC):*** A code signifying the design standards to which the runway is to be built. The RDC is based upon planned development and has no operational component.

The AAC, ADG, and runway visual range (RVR) are combined to form the RDC of a runway. The RDC provides the information needed to determine certain design standards that apply. The first component, depicted by a letter, is the AAC and relates to aircraft approach speed (operational characteristics). The second component, depicted by a Roman numeral, is the ADG and relates to either the aircraft wingspan or tail height (physical characteristics), whichever is most restrictive. The third component relates to the available instrument approach visibility minimums expressed by RVR values in feet of 1,200 (⅛-mile), 1,600 (¼-mile), 2,400 (½-mile), 4,000 (¾-mile), and 5,000 (1-mile). The RVR values approximate standard visibility minimums for instrument approaches to the runways. The third component reads "VIS" for runways designed for visual approach use only.

***Approach Reference Code (APRC):*** A code signifying the current operational capabilities of a runway and associated parallel taxiway regarding landing operations. Like the RDC, the APRC is composed of the same three components: the AAC, ADG, and RVR. The APRC describes the current operational capabilities of a runway under meteorological conditions where no special operating procedures are necessary, as opposed to the RDC, which is based upon planned development with no operational component. The APRC for a runway is established based upon the minimum runway-to-taxiway centerline separation.

***Departure Reference Code (DPRC):*** A code signifying the current operational capabilities of a runway and associated parallel taxiway regarding takeoff operations. The DPRC represents those aircraft that can take off from a runway while any aircraft are present on adjacent taxiways, under meteorological conditions with no special operating conditions. The DPRC is like the APRC, but is composed of two components, AAC and ADG. A runway may have more than one DPRC depending on the parallel taxiway separation distance.

***Airport Reference Code (ARC)*****:** An airport designation that signifies the airport's highest Runway Design Code (RDC), minus the third (visibility) component of the RDC. The ARC is used for planning and design only and does not limit the aircraft that may be able to operate safely at an airport.

## CRITICAL AIRCRAFT

The selection of appropriate FAA design standards for the development and location of airport facilities is based primarily upon the characteristics of the aircraft which are currently using, or are expected to use, an airport. The critical aircraft is used to define the design parameters for an airport. The critical aircraft may be a single aircraft or a composite aircraft representing a collection of aircraft classified by three parameters: AAC, ADG, and TDG.

The first consideration is the safe operation of aircraft likely to use an airport. Any operation of an aircraft that exceeds design criteria of an airport may result in a lesser safety margin; however, it is not the usual practice to base the airport design on an aircraft that uses the airport infrequently.

**The critical aircraft is defined as the most demanding aircraft type, or grouping of aircraft with similar characteristics, that make regular use of the airport. Regular use is 500 annual operations, excluding touch-and-go operations.** Planning for future aircraft use is of importance since the design standards are used to plan separation distances between facilities. These future standards must be considered now to ensure that short-term development does not preclude the reasonable long-range potential needs of the airport.

According to FAA AC 150/5300-13B, *Airport Design*, "Airport designs based only on existing aircraft can severely limit the ability to expand the airport to meet future requirements for larger, more demanding aircraft. Airport designs that are based on large aircraft never likely to be served by the airport are not economical." Selection of the current and future critical aircraft must be realistic in nature and supported by current data and realistic projections.

### CURRENT AIRPORT CRITICAL AIRCRAFT

There are three elements for classifying the airport design aircraft. The three elements are the AAC, ADG, and the TDG. The AAC and ADG are examined first, followed by the TDG.

The primary source of operations data is the FAA's TFMSC database, which captures an operation when a pilot files a flight plan and/or when flights are detected by the National Airspace System, usually via radar. It includes documentation of commercial traffic (air carrier and air taxi), general aviation, and military aircraft. Due to factors, such as incomplete flight plans, limited radar coverage, and VFR operations, TFMSC data does not account for all aircraft activity at an airport by a given aircraft type; however, the TFMSC does provide an accurate reflection of IFR activity. Operators of high-performance aircraft, such as turboprops and jets, tend to file flight plans at a high rate. **Exhibit 2K** presents the last 10 years of TFMSC data for turboprops and business jets for the airport.

On **Exhibit 2K**, the data has been organized to easily analyze operations by classifications. The exhibit includes a table for the Aircraft Approach Category. Each year over the last 10 years, there have been more than 1,000 operations by aircraft in approach category D but only a few in category E; therefore, the appropriate current AAC is D.

The airport has been experiencing a growing number of operations by aircraft in ADG III. In 2021 and 2022, there were more than 1,000 ADG III operations in each year, and, over the last six years, there have been more than 500 every year. There are only a few operations by aircraft in ADG IV. A current ADG of III is clearly supported for the airport.

The TDG is the third component of the airport design aircraft determination. The TDG is primarily based on the main gear wheel width. Medium and large business jets, as well as turboprops, tend to have the greatest wheel widths. The table called Taxiway Design Group on **Exhibit 2K** summarizes the annual operations of jets and turboprops by TDG. Over the last six years, the airport has consistently had more than 500 operations by aircraft in TDG 2B. Operations by aircraft in TDG 3 and higher have been increasing in recent years; however, they have not exceeded the 500 operations threshold as of 2022. Therefore, TDG 2B is the current TDG classification.

**The current critical aircraft is classified as D-III-2B.** Examples of aircraft that fall in this category include the Gulfstream 500, 550, and 650 models. The overall airport critical aircraft is also the critical aircraft for the primary runway, Runway 1-19.

A critical aircraft is also determined for any other runways. Runway 4 has available a critical instrument approach that is not available to Runway 1. Therefore, Runway 4-22 should have the greatest capability feasible to accommodate larger aircraft that might typically utilize an instrument approach to Runway 1. However, Runway 4-22 is shorter than the primary runway, therefore it has been historically planned to B-II design standards to accommodate a large portion of those that might otherwise use Runway 1-19. Therefore, it is recommended that Runway 4-22 continue to be planned to B-II standards at least until a comparable instrument approach is available to Runway 1.

## FUTURE CRITICAL AIRCRAFT

It is not unusual for an airport to transition from one critical aircraft to another. For MKC, the critical aircraft for the AAC and ADG are forecast to remain the same. That is AAC D and ADG III are expected to account for more than 500 annual operations throughout the planning period. This is primarily based on the fact that there are very few general aviation aircraft that exceed these parameters. In addition, charter operations by even larger aircraft are not anticipated to exceed the 500 operations threshold for either the AAC or ADG. Therefore, the future AAC and ADG will remain D-III.

| ARC | Aircraft | TDG | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A-I | B36T - Allison 36 Turbine Bonanza | 1A | 2 | 2 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 8 |
| | B60T - Beechcraft 60 Royal Turbine Duke | 1A | 0 | 0 | 0 | 0 | 0 | 2 | 20 | 0 | 0 | 0 |
| | EA50 - Eclipse 500 | 1A | 272 | 200 | 236 | 146 | 92 | 108 | 42 | 28 | 38 | 28 |
| | EPIC - Dynasty | 1A | 0 | 4 | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 4 |
| | EVOL - Lancair Evolution | 1A | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | EVOT - Lancair Evolution Turbine | 1A | 4 | 2 | 4 | 8 | 12 | 6 | 8 | 0 | 0 | 0 |
| | KODI - Quest Kodiak | 1A | 0 | 2 | 2 | 4 | 8 | 4 | 4 | 4 | 4 | 10 |
| | LNP4 - Lancair Propjet four-seat | 1A | 6 | 10 | 10 | 4 | 0 | 0 | 0 | 0 | 0 | 6 |
| | P46T - Piper Malibu Meridian | 1A | 58 | 88 | 128 | 156 | 104 | 104 | 176 | 98 | 104 | 122 |
| | SF50 - Cirrus Vision SF50 | 1A | 0 | 0 | 0 | 4 | 10 | 24 | 62 | 44 | 92 | 120 |
| | TBM1 - Socata TBM | 1A | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | TBM7 - Socata TBM-7 | 1A | 96 | 96 | 100 | 72 | 64 | 82 | 74 | 60 | 58 | 48 |
| | TBM8 - Socata TBM-850 | 1A | 174 | 208 | 194 | 146 | 106 | 74 | 102 | 44 | 34 | 32 |
| | TBM9 - Socata TBM | 1A | 0 | 2 | 0 | 14 | 38 | 42 | 46 | 32 | 60 | 58 |
| | Total | | 616 | 616 | 674 | 554 | 434 | 448 | 536 | 312 | 392 | 436 |
| A-II | C208 - Cessna 208 Caravan | 1A | 276 | 184 | 46 | 16 | 32 | 16 | 28 | 24 | 44 | 6 |
| | DH6 - De Havilland Canada DHC-6 Twin Otter | 1A | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | DHC6 - DeHavilland Twin Otter | 1A | 8 | 4 | 2 | 2 | 0 | 0 | 2 | 2 | 0 | 0 |
| | PC12 - Pilatus PC-12 | 1A | 300 | 334 | 502 | 536 | 610 | 662 | 840 | 1,372 | 1,606 | 1,686 |
| | Total | | 584 | 526 | 550 | 554 | 642 | 678 | 870 | 1,398 | 1,650 | 1,692 |
| A-III | DHC7 - De Havilland DHC-7 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 |
| | Total | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 |
| B-I | AC80 - Aero Commander Turbo 680 | 1A | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| | BE10 - Beech King Air 100 A/B | 1A | 94 | 84 | 68 | 68 | 68 | 74 | 30 | 12 | 8 | 6 |
| | BE40 - Raytheon/Beech Beechjet 400/T-1 | 1A | 1,124 | 1,016 | 884 | 788 | 682 | 836 | 932 | 882 | 1,188 | 1,244 |
| | BE9 - Beechcraft C99 Airliner; Beech Aircraft | 1A | 2 | 0 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| | BE90 - Beech King Air 90 | 1A | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| | BE9L - Beech King Air 90 | 1A | 1,250 | 1,010 | 1,044 | 712 | 738 | 688 | 598 | 772 | 966 | 982 |
| | C25M - Cessna Citation M2 | 1A | 0 | 0 | 0 | 0 | 22 | 52 | 48 | 36 | 80 | 110 |
| | C425 - Cessna 425 Corsair | 1A | 80 | 100 | 94 | 70 | 90 | 58 | 50 | 26 | 64 | 72 |
| | C500 - Cessna 500/Citation I | 2A | 20 | 12 | 6 | 8 | 8 | 8 | 10 | 2 | 14 | 18 |
| | C501 - Cessna I/SP | 2A | 76 | 68 | 68 | 42 | 26 | 20 | 22 | 8 | 48 | 36 |
| | C510 - Cessna Citation Mustang | 1A | 256 | 180 | 194 | 114 | 112 | 220 | 128 | 42 | 58 | 82 |
| | C525 - Cessna CitationJet/CJ1 | 1A | 910 | 1,144 | 774 | 444 | 398 | 366 | 406 | 170 | 296 | 424 |
| | C526 - Cessna 526 CitationJet | 1A | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 |
| | CL41 - Canadair CL-41 Tutor | 1A | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| | E50P - Embraer Phenom 100 | 1B | 998 | 1,122 | 1,240 | 1,294 | 2,208 | 2,506 | 2,288 | 1,236 | 1,420 | 1,184 |
| | FA10 - Dassault Falcon/Mystère 10 | 1B | 22 | 24 | 12 | 26 | 28 | 10 | 22 | 2 | 10 | 20 |
| | H25C - BAe/Raytheon HS 125-1000/Hawker 1000 | 1B | 2 | 12 | 14 | 26 | 12 | 10 | 12 | 4 | 14 | 18 |
| | HDJT - HONDA HA-420 HondaJet | 1A | 0 | 6 | 0 | 4 | 26 | 28 | 42 | 76 | 96 | 204 |
| | L29 - Aero L-29 Delfin | 1B | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | L39 - Aero L-139 Albatross | 1B | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | MU2 - Mitsubishi Marquise/Solitaire | 1A | 16 | 10 | 28 | 6 | 90 | 130 | 108 | 22 | 34 | 28 |
| | MU30 - Mitsubishi MU300/ Diamond I | 1A | 62 | 66 | 48 | 26 | 26 | 6 | 0 | 2 | 0 | 4 |
| | P180 - Piaggio P-180 Avanti | 2A | 184 | 102 | 88 | 46 | 68 | 74 | 46 | 36 | 36 | 26 |

| ARC | Aircraft | TDG | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-I Cont. | PA42 - Cheyenne III/IV; Piper Aircraft | 2A | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| | PAY1 - Piper Cheyenne 1 | 2A | 24 | 48 | 42 | 18 | 30 | 26 | 12 | 6 | 24 | 10 |
| | PAY2 - Piper Cheyenne 2 | 2A | 64 | 56 | 44 | 48 | 42 | 24 | 14 | 18 | 8 | 24 |
| | PAY3 - Piper PA-42-720 Cheyenne 3 | 2A | 26 | 28 | 36 | 42 | 44 | 18 | 14 | 8 | 14 | 0 |
| | PAY4 - Piper Cheyenne 400 | 2A | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| | PAYE - Cheyenne | 2A | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | PRM1 - Raytheon Premier 1/390 Premier 1 | 1A | 198 | 206 | 214 | 226 | 244 | 254 | 158 | 64 | 86 | 94 |
| | SBR1 - North American Rockwell Sabre 40/60 | 1A | 78 | 36 | 44 | 40 | 26 | 14 | 14 | 12 | 16 | 8 |
| | SJ30 - Swearingen SJ-30 | 1A | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| | TEX2 - Raytheon Texan 2 | 1A | 0 | 4 | 8 | 8 | 6 | 12 | 8 | 0 | 8 | 8 |
| | Total | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 |
| B-II | AC69 - Jet Prop /Gulfstream | 2A | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | AC90 - Gulfstream Commander | 2A | 20 | 36 | 24 | 38 | 32 | 12 | 18 | 6 | 2 | 4 |
| | B190 - Beech 1900/C-12J | 2A | 6 | 6 | 6 | 10 | 6 | 4 | 2 | 0 | 8 | 16 |
| | B350 - Beech Super King Air 350 | 2A | 388 | 456 | 488 | 462 | 478 | 398 | 352 | 300 | 454 | 614 |
| | BE20 - Beech 200 Super King | 2A | 1,914 | 1,918 | 1,828 | 1,388 | 1,486 | 1,514 | 1,552 | 1,206 | 1,954 | 2,088 |
| | BE30 - Raytheon 300 Super King Air | 2A | 98 | 108 | 142 | 98 | 154 | 162 | 134 | 124 | 172 | 128 |
| | BE9F - Beechcraft 1900 Freighter | 2A | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | BE9T - Beech F90 King Air | 2A | 62 | 86 | 54 | 50 | 58 | 64 | 46 | 20 | 20 | 56 |
| | C25A - Cessna Citation CJ2 | 2A | 394 | 544 | 944 | 1,374 | 1,308 | 1,306 | 944 | 830 | 928 | 318 |
| | C25B - Cessna Citation CJ3 | 2A | 282 | 404 | 534 | 516 | 482 | 496 | 612 | 424 | 604 | 1,056 |
| | C25C - Cessna Citation CJ4 | 1B | 32 | 48 | 134 | 160 | 214 | 188 | 144 | 76 | 160 | 178 |
| | C441 - Cessna Conquest | 1A | 148 | 150 | 166 | 164 | 142 | 130 | 98 | 44 | 62 | 96 |
| | C550 - Cessna Citation II/Bravo | 1A | 564 | 512 | 520 | 472 | 392 | 414 | 488 | 242 | 340 | 408 |
| | C551 - Cessna Citation II/SP | 1A | 4 | 0 | 12 | 4 | 4 | 6 | 4 | 6 | 4 | 34 |
| | C55B - Cessna Citation Bravo | 1A | 0 | 0 | 0 | 0 | 0 | 2 | 32 | 22 | 44 | 82 |
| | C560 - Cessna Citation V/Ultra/Encore | 2A | 1,168 | 1,122 | 558 | 644 | 622 | 534 | 588 | 510 | 810 | 818 |
| | C56X - Cessna Excel/XLS | 1B | 1,388 | 1,644 | 2,014 | 1,976 | 2,028 | 1,796 | 1,890 | 1,052 | 1,578 | 2,082 |
| | C680 - Cessna Citation Sovereign | 1B | 464 | 472 | 552 | 450 | 534 | 444 | 402 | 230 | 452 | 528 |
| | C68A - Cessna Citation Latitude | 1B | 0 | 0 | 0 | 4 | 156 | 262 | 592 | 622 | 1,038 | 1,036 |
| | C700 - Cessna Citation Longitude | 1B | 0 | 0 | 0 | 0 | 0 | 8 | 6 | 18 | 78 | 120 |
| | C750 - Cessna Citation X | 1B | 780 | 936 | 666 | 690 | 584 | 518 | 482 | 444 | 678 | 652 |
| | CL30 - Bombardier (Canadair) Challenger 300 | 1B | 450 | 492 | 616 | 580 | 546 | 596 | 526 | 360 | 418 | 612 |
| | CL35 - Bombardier Challenger 300 | 1B | 0 | 0 | 10 | 268 | 468 | 494 | 472 | 470 | 938 | 1,316 |
| | D328 - Dornier 328 Series | 1B | 0 | 0 | 10 | 2 | 14 | 12 | 4 | 2 | 2 | 0 |
| | E110 - Embraer EMB110 | 2A | 2 | 2 | 2 | 6 | 4 | 8 | 14 | 6 | 8 | 4 |
| | E120 - Embraer Brasilia EMB 120 | 3 | 4 | 2 | 14 | 8 | 6 | 16 | 16 | 12 | 12 | 12 |
| | E55P - Embraer Phenom 300 | 1B | 594 | 1,020 | 1,208 | 1,242 | 1,608 | 1,908 | 2,190 | 2,182 | 3,842 | 3,488 |
| | F2TH - Dassault Falcon 2000 | 2A | 408 | 380 | 424 | 490 | 404 | 356 | 484 | 308 | 504 | 604 |
| | F900 - Dassault Falcon 900 | 2A | 594 | 516 | 374 | 340 | 254 | 264 | 180 | 126 | 238 | 342 |
| | FA20 - Dassault Falcon/Mystère 20 | 1B | 48 | 42 | 308 | 80 | 58 | 70 | 42 | 56 | 48 | 14 |
| | FA50 - Dassault Falcon/Mystère 50 | 1B | 144 | 112 | 80 | 96 | 100 | 88 | 90 | 70 | 132 | 148 |
| | HA4T - Hawker 4000 | 1B | 288 | 304 | 318 | 286 | 450 | 342 | 420 | 220 | 324 | 422 |
| | J328 - Fairchild Dornier 328 Jet | 1B | 10 | 6 | 0 | 10 | 24 | 12 | 8 | 2 | 0 | 4 |
| | JS31 - BAe-3100 Jetstream | 1B | 0 | 4 | 8 | 18 | 14 | 0 | 2 | 0 | 0 | 0 |



Exhibit 2K
HISTORICAL TURBOPROP AND JET OPERATIONS

| ARC | Aircraft | TDG | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-II Cont. | JS32 - BAe Jetstream 31 | 1B | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | PC24 - Pilatus PC-24 | 1B | 0 | 0 | 0 | 0 | 4 | 4 | 48 | 44 | 54 | 66 |
| | SF34 - Saab SF 340 | 3 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| | SH33 - Shorts 330 | 1B | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| | SH36 - Shorts 360 | 1B | 0 | 0 | 2 | 2 | 4 | 12 | 2 | 0 | 0 | 2 |
| | SW2 - Swearingen Merlin 2 | 1B | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | SW3 - Fairchild Swearingen SA-226T/TB Merlin 3 | 1B | 22 | 10 | 18 | 28 | 22 | 4 | 4 | 4 | 2 | 8 |
| | SW4 - Swearingen Merlin 4/4A Metro2 | 1B | 58 | 52 | 72 | 44 | 50 | 72 | 56 | 46 | 66 | 44 |
| | Total | | 10,344 | 11,388 | 12,106 | 12,000 | 12,710 | 12,516 | 12,946 | 10,084 | 15,974 | 17,406 |
| B-III | AT43 - Aérospatiale/Alenia ATR 42-200/300/320 | 5 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | C2 - Grumman C-2 Greyhound | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | CN35 - CASA CN-235 | 1A | 0 | 0 | 6 | 2 | 4 | 0 | 0 | 0 | 0 | 0 |
| | CVLT - Convair CV-540/580/600/640, VC-131H | 3 | 0 | 6 | 4 | 0 | 0 | 0 | 0 | 0 | 4 | 0 |
| | DH8A - Bombardier DHC8-100 | 3 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | DH8C - Dash 8/DHC8-300 | 3 | 0 | 0 | 0 | 2 | 0 | 0 | 4 | 0 | 2 | 4 |
| | FA7X - Dassault Falcon F7X | 2A | 12 | 24 | 26 | 18 | 22 | 34 | 26 | 6 | 16 | 24 |
| | FA8X - Dassault Falcon 8X | 1B | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | GL5T - Bombardier BD-700 Global 5000 | 2B | 18 | 20 | 28 | 30 | 96 | 148 | 122 | 62 | 138 | 136 |
| | GL7T - Bombardier Global 7500 | 2B | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 8 | 0 |
| | GLEX - Bombardier BD-700 Global Express | 2B | 78 | 50 | 52 | 48 | 58 | 50 | 78 | 60 | 108 | 130 |
| | SB20 - Saab 2000 | 3 | 2 | 10 | 2 | 2 | 0 | 4 | 6 | 2 | 6 | 18 |
| | Total | | 1116 | 112 | 120 | 102 | 180 | 244 | 236 | 130 | 286 | 312 |
| C-I | H25A - BAe HS 125-1/2/3/400/600 | 1B | 12 | 10 | 12 | 8 | 2 | 8 | 4 | 2 | 0 | 4 |
| | HAR - Boeing AV-8 Harrier | 1B | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | HAWK - BAe Systems Hawk | 1B | 0 | 0 | 8 | 0 | 2 | 2 | 4 | 0 | 0 | 0 |
| | HS25 - BAe HS 125; British Aerospace | 1B | 0 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | LJ24 - Bombardier Learjet 24 | 1B | 2 | 0 | 2 | 28 | 2 | 0 | 0 | 0 | 0 | 0 |
| | LJ25 - Bombardier Learjet 25 | 1B | 20 | 20 | 22 | 0 | 4 | 0 | 0 | 0 | 0 | 0 |
| | LJ31 - Bombardier Learjet 31/A/B | 1B | 262 | 268 | 214 | 448 | 508 | 378 | 362 | 356 | 336 | 390 |
| | LJ40 - Learjet 40; Gates Learjet | 1B | 368 | 402 | 328 | 192 | 232 | 202 | 170 | 140 | 204 | 282 |
| | LJ45 - Bombardier Learjet 45 | 1B | 538 | 640 | 442 | 560 | 494 | 448 | 388 | 316 | 368 | 620 |
| | LJ55 - Bombardier Learjet 55 | 1B | 50 | 56 | 44 | 48 | 40 | 22 | 42 | 30 | 36 | 28 |
| | LJ60 - Bombardier Learjet 60 | 1B | 194 | 214 | 202 | 154 | 248 | 180 | 140 | 188 | 272 | 338 |
| | LR45 - Learjet 45 | 1B | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | LR55 - LearJet 55 | 1B | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| | WW23 - IAI 1123 Westwind | 1B | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| | WW24 - IAI 1124 Westwind | 1B | 230 | 230 | 310 | 272 | 200 | 194 | 174 | 134 | 268 | 90 |
| | Total | | 1,676 | 1,848 | 1,588 | 1,712 | 1,732 | 1,434 | 1,286 | 1,166 | 1,484 | 1,752 |
| C-II | A10 - Fairchild A10 | 1A | 4 | 8 | 6 | 6 | 8 | 2 | 16 | 2 | 8 | 18 |
| | A10C - Model A10 | 1A | 0 | 0 | 0 | 0 | 0 | 4 | 4 | 0 | 0 | 0 |
| | ASTR - IAI Astra 1125 | 1B | 60 | 46 | 30 | 22 | 28 | 78 | 82 | 56 | 76 | 120 |
| | C650 - Cessna III/VI/VII | 1B | 206 | 212 | 206 | 142 | 174 | 146 | 142 | 124 | 152 | 218 |
| | CL60 - Bombardier Challenger 600/601/604 | 1B | 624 | 694 | 608 | 528 | 688 | 690 | 626 | 376 | 608 | 536 |
| | CRJ1 - Bombardier CRJ-100 | 1B | 4 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | CRJ2 - Bombardier CRJ-200 | 1B | 4 | 6 | 8 | 6 | 8 | 16 | 8 | 2 | 10 | 6 |

| ARC | Aircraft | TDG | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-II Cont. | CRJ7 - Bombardier CRJ-700 | 2B | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 2 | 0 | 2 |
| | E135 - Embraer ERJ 135/140/Legacy | 2B | 72 | 56 | 70 | 158 | 34 | 10 | 16 | 8 | 20 | 16 |
| | E145 - Embraer ERJ-145 | 2B | 4 | 10 | 6 | 8 | 22 | 10 | 10 | 6 | 6 | 2 |
| | E35L - Embraer 135 LR | 2B | 0 | 0 | 16 | 16 | 16 | 18 | 20 | 16 | 38 | 26 |
| | E45X - Embraer ERJ 145 EX | 2B | 0 | 2 | 0 | 8 | 2 | 8 | 0 | 0 | 6 | 0 |
| | E545 - Embraer EMB-545 Legacy 450 | 1B | 0 | 0 | 0 | 14 | 62 | 160 | 164 | 110 | 154 | 194 |
| | E550 - Embraer Legacy 500 | 1B | 0 | 4 | 8 | 34 | 38 | 48 | 62 | 48 | 52 | 20 |
| | G150 - Gulfstream G150 | 1B | 42 | 54 | 78 | 82 | 98 | 88 | 76 | 58 | 72 | 76 |
| | G159 - Gulfstream Aerospace G 159/VC-4 | 1B | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | G280 - Gulfstream G280 | 1B | 6 | 62 | 88 | 88 | 88 | 126 | 162 | 92 | 212 | 264 |
| | GLF3 - Gulfstream III/G300 | 2A | 16 | 30 | 22 | 18 | 8 | 2 | 16 | 6 | 6 | 2 |
| | H25B - BAe HS 125/700-800/Hawker 800 | 1B | 1,886 | 1,832 | 1,736 | 1,498 | 1,304 | 1,008 | 1,012 | 630 | 808 | 806 |
| | L29B - Lockheed L-1329 Jetstar 731 | 1A | 72 | 68 | 64 | 32 | 0 | 2 | 0 | 0 | 0 | 0 |
| | LJ70 - Learjet 70 | 1B | 0 | 32 | 90 | 54 | 34 | 54 | 66 | 40 | 82 | 120 |
| | LJ75 - Learjet 75 | 1B | 4 | 26 | 108 | 130 | 280 | 312 | 290 | 266 | 372 | 308 |
| | STAR - Beech 2000 Starship | 3 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Total | | 3,010 | 3,144 | 3,146 | 2,846 | 2,892 | 2,784 | 2,772 | 1,842 | 2,682 | 2,734 |
| C-III | A319 - Airbus A319 | 3 | 14 | 4 | 6 | 2 | 2 | 2 | 2 | 0 | 2 | 0 |
| | A320 - Airbus A320 All Series | 3 | 22 | 30 | 24 | 14 | 16 | 12 | 16 | 8 | 14 | 16 |
| | A321 - Airbus A321 All Series | 3 | 0 | 0 | 8 | 0 | 4 | 0 | 8 | 0 | 2 | 0 |
| | B722 - Boeing 727-200 | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | B732 - Boeing 737-200/VC96 | 3 | 4 | 0 | 2 | 0 | 4 | 0 | 2 | 0 | 0 | 0 |
| | B733 - Boeing 737-300 | 3 | 0 | 2 | 0 | 0 | 6 | 0 | 0 | 0 | 6 | 2 |
| | B734 - Boeing 737-400 | 3 | 8 | 10 | 18 | 8 | 16 | 20 | 26 | 12 | 32 | 8 |
| | B735 - Boeing 737-500 | 3 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| | B737 - Boeing 737-700 | 3 | 0 | 6 | 6 | 8 | 10 | 0 | 16 | 10 | 10 | 38 |
| | B73Q - Boeing 737 Stage 3 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | BCS1 - Bombardier CS100 | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | CRJ9 - Bombardier CRJ-900 | 2B | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| | DH8D - Bombardier Q-400 | 5 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | E170 - Embraer 170 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 32 | 6 | 0 | 10 |
| | E190 - Embraer 190 | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 4 |
| | E75L - Embraer 175 | 3 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| | MD81 - Boeing (Douglas) MD 81 | 4 | 6 | 6 | 4 | 6 | 6 | 6 | 6 | 2 | 6 | 8 |
| | P3 - Lockheed P-3C Orion | 5 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 2 | 0 |
| | Total | | 54 | 70 | 70 | 40 | 70 | 42 | 108 | 38 | 74 | 88 |
| C-IV | A400 - Airbus A400M Atlas | 3 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| | B752 - Boeing 757-200 | 4 | 16 | 36 | 24 | 40 | 30 | 40 | 44 | 18 | 34 | 34 |
| | B763 - Boeing 767-300 | 5 | 2 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| | C130 - Lockheed 130 Hercules | 1B | 24 | 22 | 18 | 16 | 12 | 14 | 12 | 14 | 18 | 18 |
| | C17 - Boeing Globemaster 3 | 5 | 10 | 8 | 8 | 2 | 0 | 14 | 0 | 0 | 14 | 0 |
| | C30J - C-130J Hercules ; Lockheed | 1B | 0 | 4 | 10 | 2 | 6 | 6 | 0 | 8 | 24 | 4 |
| | EA30 - Airbus A300 All Series | 5 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | K35R - Boeing KC-135 Stratotanker | 4 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| | Total | | 52 | 70 | 64 | 60 | 50 | 76 | 58 | 40 | 90 | 56 |



Exhibit 2K
HISTORICAL TURBOPROP AND JET OPERATIONS

| ARC | Aircraft | TDG | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-V | A350 - Airbus 350 | 6 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | A36 - Airbus 360 | 6 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | B2 - Northrop B-2 Spirit | 6 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| | Total | | 2 | 8 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| D-I | F15 - Boeing F-15 Eagle | 1A | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| | F18 - Boeing FA-18 Hornet | 1A | 12 | 4 | 6 | 0 | 0 | 0 | 4 | 0 | 0 | 0 |
| | F18H - F/A 18 Hornet | 1A | 0 | 0 | 0 | 0 | 2 | 2 | 12 | 0 | 0 | 0 |
| | F18S - F18 Hornet | 1A | 0 | 0 | 0 | 2 | 2 | 2 | 4 | 14 | 0 | 2 |
| | F22 - Boeing Raptor F22 | 1A | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 0 | 0 |
| | F5 - Northrop F-5 Freedom Fighter | 1A | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | FA18 - F18 Hornet | 1A | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | LJ35 - Bombardier Learjet 35/36 | 1B | 236 | 176 | 156 | 176 | 154 | 144 | 142 | 140 | 186 | 134 |
| | LR35 - Learjet 35 | 1B | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| | T38 - Northrop T-38 Talon | 1A | 46 | 30 | 6 | 16 | 20 | 14 | 10 | 4 | 0 | 0 |
| | Total | | 296 | 212 | 172 | 194 | 180 | 162 | 174 | 164 | 186 | 136 |
| D-II | G450 - Gulfstream G450 | 2A | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | GALX - IAI 1126 Galaxy/Gulfstream G200 | 1B | 226 | 172 | 138 | 96 | 86 | 76 | 80 | 50 | 102 | 80 |
| | GLF2 - Gulfstream II/G200 | 1B | 28 | 22 | 16 | 28 | 8 | 12 | 12 | 2 | 8 | 2 |
| | GLF4 - Gulfstream IV/G400 | 2A | 462 | 460 | 548 | 626 | 644 | 724 | 540 | 382 | 630 | 696 |
| | Total | | 716 | 654 | 704 | 750 | 738 | 812 | 632 | 434 | 740 | 778 |
| D-III | B738 - Boeing 737-800 | 3 | 88 | 82 | 96 | 86 | 68 | 64 | 58 | 62 | 172 | 138 |
| | B739 - Boeing 737-900 | 3 | 0 | 4 | 4 | 14 | 26 | 26 | 34 | 34 | 48 | 56 |
| | G550 - Gulfstream G550 | 2B | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| | GA5C - G-7 Gulfstream G500 | 2B | 0 | 0 | 0 | 0 | 0 | 8 | 172 | 178 | 212 | 148 |
| | GA6C - G-7 Gulfstream G600 | 2B | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8 | 18 | 18 |
| | GLF5 - Gulfstream V/G500 | 2B | 154 | 142 | 134 | 208 | 298 | 228 | 182 | 154 | 254 | 322 |
| | GLF6 - Gulfstream | 2B | 4 | 6 | 20 | 12 | 26 | 26 | 46 | 50 | 36 | 110 |
| | MD83 - Boeing (Douglas) MD 83 | 4 | 8 | 4 | 2 | 6 | 0 | 0 | 0 | 0 | 0 | 10 |
| | MD88 - Boeing (Douglas) MD 88 | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Total | | 254 | 242 | 256 | 326 | 418 | 352 | 494 | 488 | 740 | 802 |
| D-IV | DC10 - Boeing (Douglas) DC 10-10/30/40 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| | Total | | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| D-V | B744 - Boeing 747-400 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| | Total | | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| E-I | AJET - Dassault-Bréguet/Dornier Alpha Jet | 1A | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 |
| | F16 - Lockheed F-16 Fighting Falcon | 1A | 2 | 4 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Total | | 2 | 4 | 0 | 8 | 6 | 0 | 0 | 0 | 0 | 0 |

*JETS AND TURBOPROPS*

| Type | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| Jets | 17,776 | 18,968 | 19,084 | 18,886 | 20,400 | 20,450 | 20,526 | 15,156 | 22,838 | 24,470 |
| TP | 5,438 | 5,268 | 5,320 | 4,322 | 4,650 | 4,538 | 4,556 | 4,382 | 5,948 | 6,324 |
| Total | 23,214 | 24,236 | 24,404 | 23,208 | 25,050 | 24,988 | 25,082 | 19,538 | 28,786 | 30,794 |

*AIRPORT REFERENCE CODE (ARC) SUMMARY*

| ARC | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| A-I | 616 | 616 | 674 | 554 | 434 | 448 | 536 | 312 | 392 | 436 |
| A-II | 584 | 526 | 550 | 554 | 642 | 678 | 870 | 1,398 | 1,650 | 1,692 |
| A-III | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 |
| B-I | 5,492 | 5,342 | 4,954 | 4,062 | 4,996 | 5,440 | 4,966 | 3,436 | 4,488 | 4,602 |
| B-II | 10,344 | 11,388 | 12,106 | 12,000 | 12,710 | 12,516 | 12,946 | 10,084 | 15,974 | 17,406 |
| B-III | 116 | 112 | 120 | 102 | 180 | 244 | 236 | 130 | 286 | 312 |
| C-I | 1,676 | 1,848 | 1,588 | 1,712 | 1,732 | 1,434 | 1,286 | 1,166 | 1,484 | 1,752 |
| C-II | 3,010 | 3,144 | 3,146 | 2,846 | 2,892 | 2,784 | 2,772 | 1,842 | 2,682 | 2,734 |
| C-III | 54 | 70 | 70 | 40 | 70 | 42 | 108 | 38 | 74 | 88 |
| C-IV | 52 | 70 | 64 | 60 | 50 | 76 | 58 | 40 | 90 | 56 |
| C-V | 2 | 8 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| D-I | 296 | 212 | 172 | 194 | 180 | 162 | 174 | 164 | 186 | 136 |
| D-II | 716 | 654 | 704 | 750 | 738 | 812 | 632 | 434 | 740 | 778 |
| D-III | 254 | 242 | 256 | 326 | 418 | 352 | 494 | 488 | 740 | 802 |
| D-IV | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| D-V | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| E-I | 2 | 4 | 0 | 8 | 6 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 23,214 | 24,236 | 24,404 | 23,208 | 25,050 | 24,988 | 25,082 | 19,538 | 28,786 | 30,794 |

*AIRCRAFT APPROACH CATEGORY (AAC)*

| AAC | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| A | 1,200 | 1,142 | 1,224 | 1,108 | 1,076 | 1,126 | 1,406 | 1,716 | 2,042 | 2,128 |
| B | 15,952 | 16,842 | 17,180 | 16,164 | 17,886 | 18,200 | 18,148 | 13,650 | 20,748 | 22,320 |
| C | 4,794 | 5,140 | 4,868 | 4,658 | 4,746 | 4,336 | 4,224 | 3,086 | 4,330 | 4,630 |
| D | 1,266 | 1,108 | 1,132 | 1,270 | 1,336 | 1,326 | 1,304 | 1,086 | 1,666 | 1,716 |
| E | 2 | 4 | 0 | 8 | 6 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 23,214 | 24,236 | 24,404 | 23,208 | 25,050 | 24,988 | 25,082 | 19,538 | 28,786 | 30,794 |

*AIRPLANE DESIGN GROUP (ADG)*

| ADG | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| I | 8,082 | 8,022 | 7,388 | 6,530 | 7,348 | 7,484 | 6,962 | 5,078 | 6,550 | 6,926 |
| II | 14,654 | 15,712 | 16,506 | 16,150 | 16,982 | 16,790 | 17,220 | 13,758 | 21,046 | 22,610 |
| III | 424 | 424 | 446 | 468 | 668 | 638 | 838 | 662 | 1,100 | 1,202 |
| IV | 52 | 70 | 64 | 60 | 50 | 76 | 60 | 40 | 90 | 56 |
| V | 2 | 8 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 |
| TOTAL | 23,214 | 24,236 | 24,404 | 23,208 | 25,050 | 24,988 | 25,082 | 19,538 | 28,786 | 30,794 |

*TAXIWAY DESIGN GROUP (TDG)*

| TDG | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1A | 6,126 | 5,782 | 5,416 | 4,326 | 4,184 | 4,446 | 4,606 | 4,166 | 5,400 | 6,034 |
| 1B | 10,338 | 11,520 | 12,170 | 11,910 | 13,928 | 13,768 | 13,926 | 10,322 | 15,676 | 16,600 |
| 2A | 6,220 | 6,412 | 6,262 | 6,282 | 6,182 | 6,050 | 5,626 | 4,332 | 6,498 | 6,884 |
| 2B | 330 | 286 | 326 | 490 | 554 | 516 | 648 | 546 | 844 | 910 |
| 3 | 156 | 160 | 186 | 144 | 164 | 146 | 220 | 152 | 312 | 312 |
| 4,5,6 | 44 | 72 | 44 | 56 | 38 | 62 | 56 | 20 | 56 | 54 |
| TOTAL | 23,214 | 24,236 | 24,404 | 23,208 | 25,050 | 24,988 | 25,082 | 19,538 | 28,786 | 30,794 |

Source: TFMSC 2013 through 2022 - Data normalized annually



Exhibit 2K
HISTORICAL TURBOPROP AND JET OPERATIONS

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Determining the future taxiway design group is a little more challenging because there are only a few general aviation aircraft that have a TDG higher than the current 2B TDG. Examples are the Embraer Lineage and Boeing Business Jet, which are general aviation variants of passenger transport aircraft. It is also assumed that charters using the Boeing 737 and 757 will continue to operate and both of these would contribute to the TDG 3 classification. The primary difference between TDG 2B and 3 is the standard taxiway width increases from 35 feet to 50 feet. The current ALP and the current Taxiway L construction project utilize the 50-foot-wide taxiway standard.

The trend over the last 10 years has been an increasing number of TDG 3 operations as documented in the TFMSC data summarized on **Exhibit 2K**. That data shows that in 2013 there were 200 operations by TDG 3 aircraft and in 2022 there were 366. By extrapolating that growth rate (6.23%), there would be more than 500 operations by TDG 3 aircraft by 2028. Even if an annual growth rate of 2.0 percent were applied, there would still be more than 500 annual operations by TDG 3 aircraft within the 20-year planning horizon. Therefore, it is recommended that a future TDG of 3 remain the future planning standard for the airport.

The analysis presented examined each of the three elements for classifying the airport design aircraft. **The future critical aircraft is characterized as D-III-3.** This could be represented by a single aircraft type or by a combination of aircraft types with more than 500 operations. The overall airport critical aircraft also applies to the primary runway, Runway 1-19.

The future critical aircraft for Runway 4-22 should at a minimum be maintained as B-II. However, additional analysis will be undertaken subsequently in this study to determine the appropriate future critical aircraft for Runway 4-22.

### RUNWAY DESIGN CODE

The RDC relates to specific FAA design standards that should be met in relation to a runway. The RDC takes into consideration the AAC, ADG, and the RVR. Each runway will have its own RDC and, in most cases, the critical aircraft will also be the RDC for the primary runway.

Runway 1-19 is 6,827 feet long and 150 feet wide. Runway 19 has an ILS instrument approach with visibility minimums of not lower than ¾-mile. While an instrument approach with ½-mile visibility minimums would be optimal for this airport, it has long been considered unfeasible due to required missed approach procedures. Based on current and forecast activity, the RDC for Runway 1-19 is **D-III-4000,** and it is planned to remain D-III-4000 through the planning period. Additional instrument approach analysis to be analyzed in the Facility Requirements section of this master plan will analyze the feasibility of lower visibility minimums for all runway ends.

Runway 4-22 is 5,050 feet long and 100 feet wide. This runway also has an ILS instrument approach with visibility minimums of ¾-mile to Runway 3. This runway is currently classified as a B-II runway on the current ALP, which is planned to be maintained throughout this master plan. The RDC for this runway now and in the future is **B-II-4000**.

### APPROACH AND DEPARTURE REFERENCE CODES

The approach and departure reference codes (APRC and DPRC) describe the operational capabilities of each runway and the adjacent parallel taxiways, where no special operating procedures are necessary. Essentially, the APRC and DPRC describe the current conditions at an airport in runway classification terms when considering the parallel taxiway. Runway 1-19 is served by parallel Taxiways L and G. Taxiway L is 400 feet from the runway centerline and Taxiway G is 412 feet from the runway centerline. Portions of Taxiways L and G are also parallel to Runway 4-22. Taxiway G is 358 feet from Runway 4-22 and Taxiway L is 400 feet. The runway/taxiway system meets the standards associated with the current and future APRC and DPRC.

### CRITICAL AIRCRAFT SUMMARY

**Table 2QQ** summarizes the airport and runway classification for MKC. The current critical aircraft is defined by those aircraft in D-III-2B, and the future critical aircraft is D-III-3. The current and future RDC for Runway 1-19 is D-III-4000. The current and future RDC for Runway 4-22 is B-II-4000.

**TABLE 2PP | Airport and Runway Classifications**

| | Current | Future |
|---|---|---|
| Airport Reference Code (ARC) | D-III-4000 | D-III-4000 |
| Airport Design Aircraft | D-III-2B | D-III-3 |
| **Runway Design Code (RDC)** | | |
| Runway 1-19 | D-III-4000 | D-III-4000 |
| Runway 4-22 | B-II-4000 | B-II-4000 |
| **Approach Reference Code (APRC)** | | |
| Runway 1-19 | D-IV-4000/D-V-4000 | D-IV-4000/D-V-4000 |
| Runway 4-22 | B-III-4000 | B-III-4000 |
| **Departure Reference Code (DPRC)** | | |
| Runway 1-19 | D-IV/D-V | D-IV/D-V |
| Runway 4-22 | B-III/D-II | B-III/D-II |

*Source: Current Airport Layout Plan; FAA AC 150/5300-13B, Airport Design*

## *SUMMARY*

This study has outlined the various activity levels that might reasonably be anticipated over the 20-year planning period, as well as the critical aircraft for the airport. Based aircraft are forecast to increase from 196 in 2023 to 226 by 2042, for an annual growth rate of 0.71 percent. Total operations are forecast to increase from 114,094 in 2022 to 157,008 by 2042, which is an annual growth rate of 1.70 percent.

The critical aircraft for the airport was determined by examining the FAA TFMSC database of flight plans. The current critical aircraft is described as D-III-2B and is best represented by large business jets, such as the Gulfstream 550. In the future, aircraft with wider wheelbases may frequent the airport, which would lead to a future critical aircraft of D-III-3.