Chapter Three – Aviation Demand Forecasts

3 | Section 1 – Introduction

For the Hector Airport, specific national, regional, and local data was examined and then combined with previous and current forecasts.

Estimating growth and aviation demand at the Hector Municipal Airport (1D6) is a crucial element in the master planning process to ensure reasonable allocation of future resources. If a forecast concludes that an airport will see strong growth or changes in the type of aircraft that are likely to use the airport in the future, steps need to be taken to be able to accommodate that demand. However, if the forecast concludes that growth will be particularly slow, then other steps to help ensure the continued viability of the airport, and perhaps attract additional use, might be in order. Future levels of activity are just one of several parts of the equation for proper airport planning. The size and speed of the forecast aircraft can also have dramatic effects on developmental efforts. Collecting the appropriate information and using reasonable judgement and approved methodologies to help anticipate the level of activity and the types of aircraft at Hector Municipal Airport are at the core of the airport master planning forecast process.

To best answer how the future might impact an airport, the FAA developed an approved airport master planning process. The intent of the FAA process is somewhat rigid, but also allows for some flexibility as well. Chapter 7 of the FAA Advisory Circular (AC) 150/5070-6B, *"Airport Master Planning"*, provides the guidance for master plan forecasts. The forecast chapter of an airport master plan is one of only two elements of an airport master plan that must be approved by the FAA. Approval is required because the forecasting chapter forms the foundation for the rest of the master plan's conclusions and establishes the justification for implementing the master plan's recommended facilities.

FAA guidance for aviation forecasting in an airport master plan prescribes specific items that must be forecast and the methodologies that should be used to determine future activity levels. FAA recognizes that forecasting methodologies for general aviation (GA) airports such as Hector Municipal must be flexible since there is a limited amount of data associated with GA airports when there is not an operational control tower or airline records. Instead, greater weight is placed on understanding local attributes of the airport, the general use of the facility, and the sponsor's understanding of the facility. Interviews with airport representatives and users provides a great deal of information related to the GA airport forecasting effort. Other national, regional, and local data is also examined to understand the broader context of aviation and to see if there are correlations between other published data and what is observed at the airport. All relevant data then becomes input for the various approved methodologies to identify reasonable forecasts of aviation activity through the end of the forecast period.

For Hector Municipal Airport, specific national, regional and local data was collected and compared to observed airport activity. The data was used to establish a baseline and a forecast for specific elements of aviation activity: aircraft operations, based aircraft, instrument operations, and the critical aircraft selection. Aircraft operations will be further subdivided into GA local and GA itinerant operations. Operations that occur more frequently at busier airports, such as air taxi and local military operations, will not be addressed in this report since the Hector Municipal Airport has only negligible numbers of operations for those types of activities and is not expected have any substantial numbers over the forecast period.

The Hector Municipal Airport Master Plan forecast methodology adheres to FAA Advisory Circular (AC) 150/5070-6B and the July 2001 FAA guidance paper entitled *"Forecasting Aviation Activity by Airport."* Historic air traffic data, prior forecasts, an examination of local, county, and applicable US Census data reflecting past future economic trends were used to augment the final forecast. Interviews with airport management and the owner of the Fixed Based Operator (FBO), based aircraft owners, Minnesota Department of Transportation (MnDOT) Aeronautics, Great Lakes Region FAA ADO specialists and other informed parties were especially helpful this forecast in the absence of reliable records or measurable or quantifiable data. The forecast relies on information obtained from the parties interviewed and incorporates their expertise and judgment, as well as that of the forecaster.

3 | Section 2 – National Aviation Trends

An important part of developing trends for statistical purposes is analyzing relevant issues from a national perspective, and then applying them, if warranted, to the regional and local perspective. Two of the most reliable and important tools for forecasting GA activity are the FAA as part of its FAA Aerospace Forecast (2018 - 2038) and FAA's Terminal Area Forecast. Demand at Hector Municipal Airport is influenced by aviation trends and other factors that are both local and global. As a GA airport, typical traffic includes all activity other than scheduled commercial airline and military aviation. Aircraft types used for GA flying vary from piston aircraft with a single engine to business jets and helicopters. **Figure 3-1** is reproduced from the FAA Aerospace Forecasts (2018-2038), a forecasting document published annually.

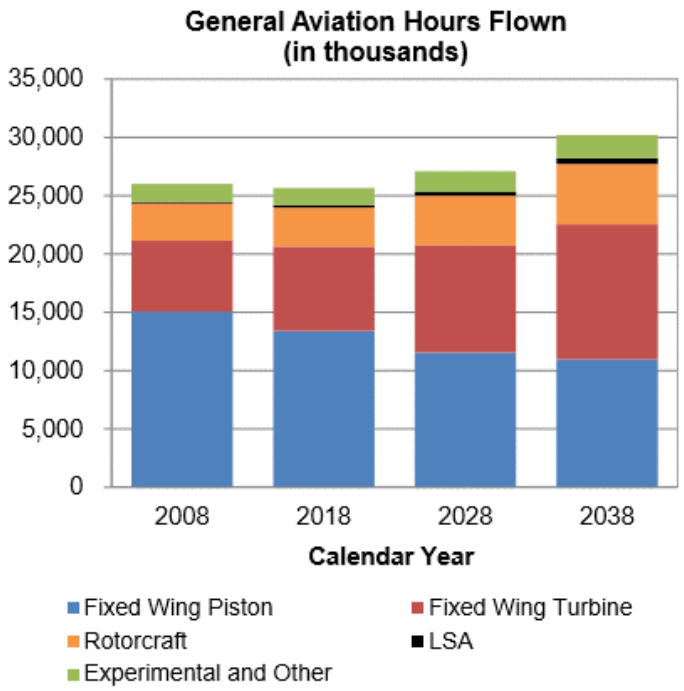

Figure 3-1: FAA Aerospace Forecast GA hours flown

The graphic depicts the expected trends in the number of hours per year that the average GA aircraft has or is expected to be flown. It is further broken down by the types of aircraft within the GA category. The graph clearly shows that even though fixed wing piston aircraft represent the vast majority of the GA fleet, they account for less than half of the hours flown by all GA aircraft. It also shows that the utilization of these aircraft is expected to decline through the 20-year forecast period. The GA segment in aviation is growing, however the growth is primarily in the categories of aircraft that have turbine (jet) engines and are flown for business purposes. These trends are important to GA operations forecasting since the mix of aircraft types that operate at Hector Municipal Airport will be affected by the factors that influence the level of growth or lack thereof. Airports with a mix of aircraft that have turbine engines may

grow in operations while piston airplane activity may remain flat or even decline over time.

Another metric that can have a lesser impact upon GA activity levels at an airport such as Hector is the trend in the numbers of active pilots (see **Figure 3-2**).

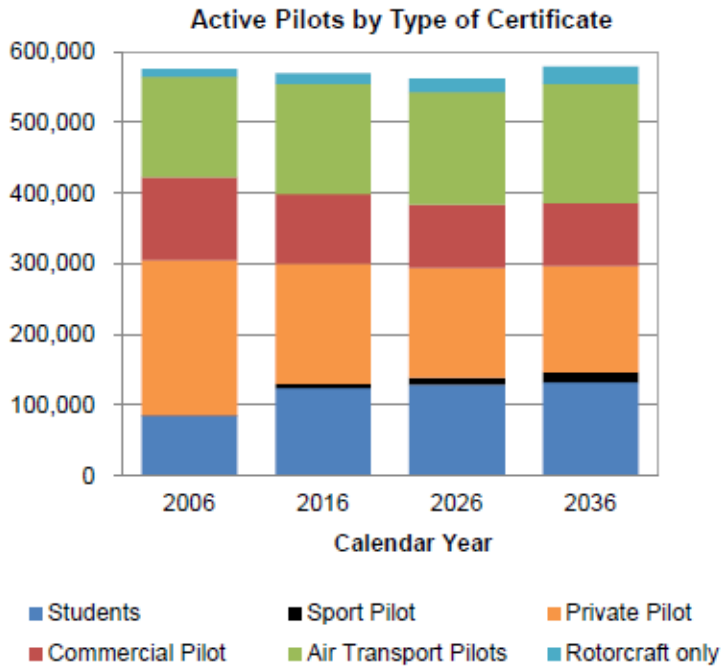

Figure 3-2: FAA Aerospace Forecast Active Pilots by Type

The industry is forecasting a decrease in total fixed wing pilots in the next 10 years followed by an overall increase over the forecast period as Air Transport Pilots who fly for airlines responds to the ongoing pilot shortage. Those holding a Private Pilot certificate are expected to significantly decline, however the Sport Pilot segment will see growth. This is good news since Hector is an ideal airport for increasing Light Sport Aircraft activity.

The GA industry suffered during the 2007 recession. GA activity had been stable with modest, sustained growth. Starting in 2010, a modest comeback has demonstrated recovery as businesses continue to use business aircraft and personal income has increased. Aircraft shipments and billings in the last five years offer reflection on the recovery process as well as today's conditions. **Figure 3-3** is reproduced from the FAA Aerospace Forecasts. The graph depicts the General Aviation Manufacturer Association (GAMA) report on aircraft shipments and billings since 2008. Even though there has been a dip in billings, GAMA is optimistic that emerging technologies in aircraft systems and engine design will bring a resurgence in production and billings. Electric hybrid engines and all-electric engines are poised to revolutionize the industry, especially in the small flight training aircraft that will be important to train the next generation of pilots.

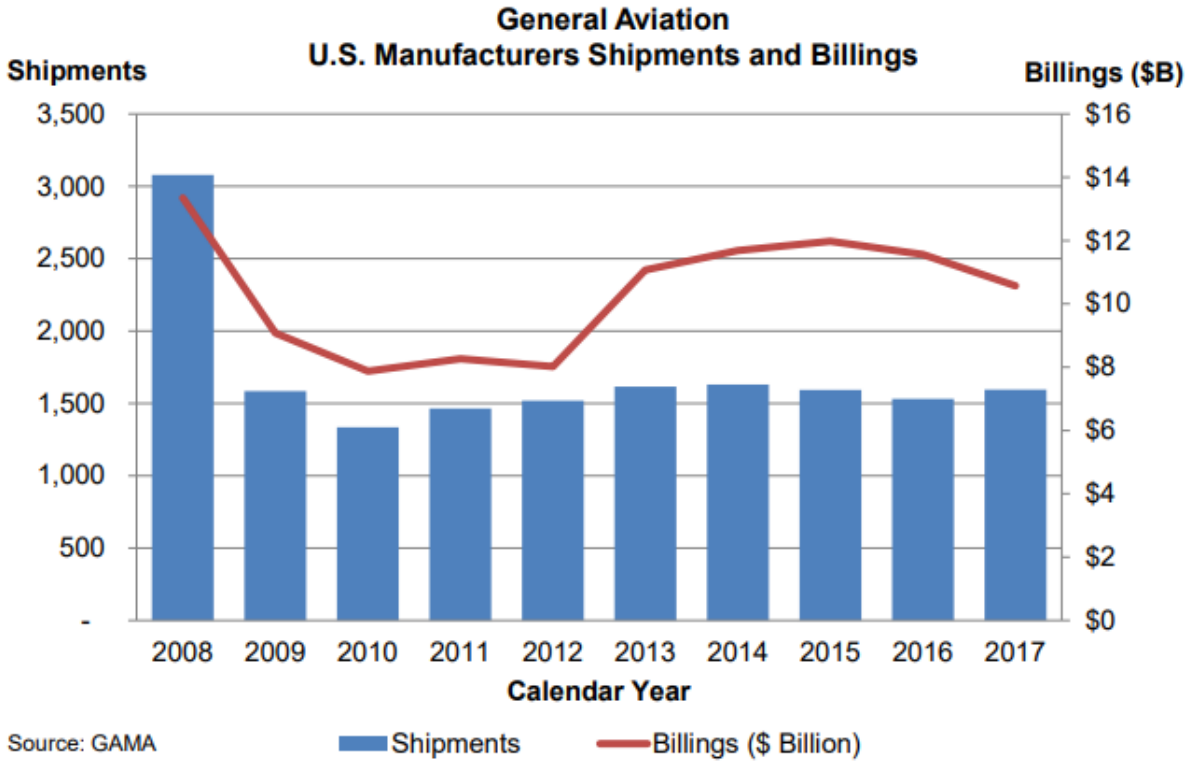

Figure 3-3: GAMA U.S. Shipments and Billings

Figure 3-4 is reproduced from the FAA Aerospace Forecasts. The graph depicts the outlook for active GA aircraft through 2038. An active aircraft is flown at least one hour per year. Each GA category is expected to add aircraft except for Fixed Wing Piston which is poised to experience a net loss of nearly 50,000 planes during the next 20 years. Many are owned by the private pilots that **Figure 3-2** shows will no longer be flying and owning aircraft. Adding to this trend is an imminent requirement to update all aircraft by 2020 to be allowed to fly in certain airspace as well as the fact that the special leaded aviation fuel burned by piston aircraft may become scarce or altogether replaced by a grade of fuel that older engines wouldn't be able to use without expensive modifications. For these reasons, among others, the GA fleet will be evolving to have a higher percentage of aircraft in the Fixed Wing Turbine, Rotorcraft, Experimental, and Light Sport Aircraft (LSA) categories. Of these, the Fixed Wing Turbine (agricultural aircraft), Experimental and LSA are the ones that could see growth at Hector.

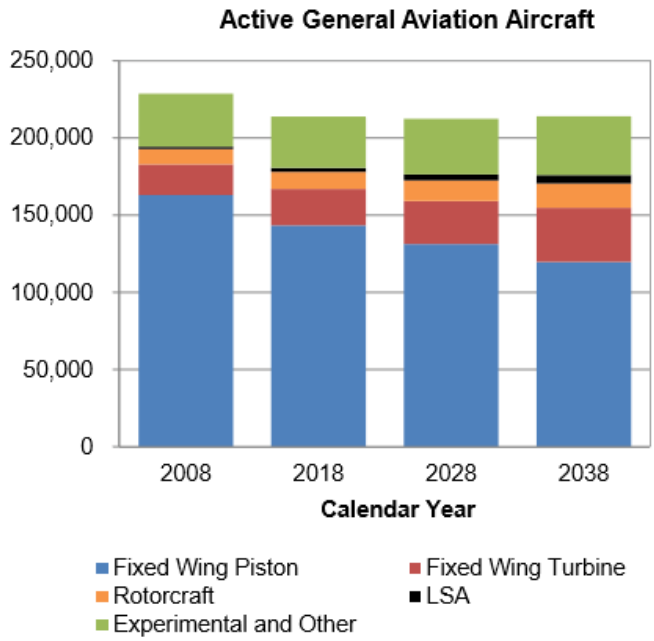

Figure 3-4: FAA Aerospace Forecast Active Pilots by Type

3.3.1 FAA Terminal Area Forecast

The FAA annually publishes the Terminal Area Forecast (TAF), which is a forecast that determines the overall nationwide aviation activity expected and allocates that among the various regions, states, and individual airport facilities that comprise the National Airspace System (NAS). This top-down forecast does not have the ability to consider all the factors that determine a particular airport's demand. In fact, many airports in the TAF do not show changing activity levels over time. This is one reason that the forecast in airport master plans is crucial. However, as a macro forecasting tool, the TAF is useful in order to make comparisons and use the growth rates within various segments of the NAS in master plan forecasts.

The TAF projection for based aircraft in the FAA's Great Lakes Region shows a modest average annual growth of 0.75 percent over the next 25 years. This regional estimate can vary from airport to airport given local factors, such as flight schools or charter operations, however, as a rough estimate of how based aircraft may increase over time at a particular airport, it is useful.

The FAA's TAF predicts total airport operations by region as well. An aircraft operation is a takeoff or landing and a "touch-and-go" counts as two operations. The FAA TAF anticipates a 0.6 percent average annual overall growth rate in total aircraft operations within the Great Lakes Region for the next 25 years. Again, applying this to an individual airport such as Hector gives only a rough estimation of how activity may change over time. Master plans examine additional factors and try to better correlate those factors with future demand levels.

Forecasters can also break out the same type of data by state. The FAA TAF forecasts for based aircraft data in the same format project an average annual growth rate of 0.34 percent while projections for GA local and itinerant (total) operations throughout the forecast period show a modest average annual increase of 0.63 percent.

3.3.2 Minnesota State Aviation System Plan

The State of Minnesota maintains a statewide aviation system plan that was last updated in 2013. Although much of the data gathered and used within the original study is nearly 6 years old, it is still very relevant as there have been no major economic or industry shifts in the recent years that would have significantly altered trends. The Forecast element of the study covered within Chapter 3 and the accompanying Appendix "C" highlighted several industry related topics and forecasts which are relevant to the Hector Master Plan. The methodologies that were used to generate the forecasts within the Minnesota State Aviation System Plan are similar to those employed within this Hector forecasting chapter. The methods utilize several bottom up, top down and individual airport circumstances to augment trending data. **Table 3-5** is reproduced from the State of Minnesota Aviation System Plan and provides forecasts for both based aircraft and operations.

GA BASED AIRCRAFT AND OPERATIONS		
YEAR	BASED AIRCRAFT	OPERATIONS
2010	5,100	1,743,000
2015	5,500	1,870,000
2020	5,700	1,978,000
2030	6,100	2,388,000
AVERAGE ANNUAL GROWTH RATE		
2010-2015	1.4%	1.4%
2010-2020	1.1%	1.3%
2010-2030	1.0%	1.6%

Table 3-5: Forecast of GA Based Aircraft and Operations;
Source: Figure 2-5 Minnesota State Aviation System Plan 2012

Comparative estimates of the difference between the forecast average annual growth rate of the FAA TAF forecasts and the State of Minnesota State Aviation System Plan shows that both forecasts are modest, and the two sets of data complement one another, lending to their overall validity. The State of Minnesota average based aircraft growth rate over the majority of the forecast period is 1.0 percent, while the operations growth rate is estimated at 1.6 percent.

In addition to this data, the Minnesota State Aviation System Plan further broke out airport operations forecast by class of aircraft. Single engine piston aircraft were estimated to grow at a slower overall rate than other class of aircraft over the forecast period, at 0.8 percent. The state system plan forecast is factoring in a slower growth rate for airports that have primarily single engine piston aircraft such as Hector.

The Minnesota State Aviation System Plan also provided some forecast data for individual GA airports as well. The results for the based aircraft forecasts that were published in the system plan can be found in **Table 3-6**.

Airport Name	2015 Estimated	2020 Estimated	2030 Estimated
Total Operations	7,699	7,874	9,279
Based Aircraft	41	42	43
Compound Annual Growth Rate	0.5%	0.5%	0.24%

Table 3-6: State of Minnesota Based Aircraft and Operations Forecasts for 1D6; Source: Minnesota State Aviation System Plan (Updated 2013)

The system plan recognized higher operations and based aircraft levels than Hector has today, which might otherwise suggest that there has been a significant drop in activity. However, the primary reason for this disparity is that based aircraft information recorded in the FAA Form 5010 Master Record for Hector, the primary source of inventory data entered for Hector in the system plan, reflected a higher count of based aircraft. More recently, FAA instituted a National Based Aircraft Inventory program that more accurately tracks individual airplanes and validates that any particular airplane is based at a specific airport. This fact does not negate the value of the information in the system plan report as the overall growth estimates would likely be very similar regardless of the initial based aircraft data utilized by the report.

3 | Section 4 – Other Local Factors

When forecasting future operations and based aircraft at GA airports, it is important to understand other potential influences and desires that could affect overall trends. Some may factor directly into forecasting estimates, while others may have less quantifiable metrics. Forecasters use professional judgement when considering these variables and validate statistics with direct input from local expertise. Forecasting operations at larger, commercial airports generally relies on an abundance of available data, however, smaller GA Airport forecasts can often have little data. This makes forecasting operations and based aircraft for GA airports much more dependent upon local input and forecaster discretion. At Hector in particular, the FBO business and the state of the agriculture industry are key drivers of aviation activity and demand.

3.4.1 FBO Activity

According to people interviewed for this forecast, the current economic outlook for the region surrounding Hector is relatively stable with a positive outlook for future conditions. Even with the recent downturn in corn prices, impacts to business at the Airport have been taken in stride. The FBO is now run by the agricultural spraying company Sky Apply. The importance of the FBO in creating and driving activity at Hector Municipal Airport cannot be overstated. Regardless of the statistical basis for growth at a macro level, it still requires a solid FBO that is able to meet the needs of the flying community and create an environment that naturally draws customers and generates interest in aviation with the next generation. Hector is currently undergoing a transition in FBO management, which has been smooth. That relationship is vital to the stability of the airport, and with a new master plan to address a few areas where compliance with FAA guidance needs attention, the City of Hector and the new FBO are building the foundation for continued success.

3.4.2 Hangar Availability at Hector

Forecasts generally look at demand as if there were no constraints at the airport. This way, if the constraints were addressed through facility development the true market demand would be understood. Considering past trends to understand whether demand had been suppressed by undersized facilities such as runway length or hangar availability, forecasters can weigh that along with the other considerations to see if a trend analysis approach would yield the best results.

Hangar space at an airport, and especially when there is a list of aircraft owners that are waiting for hangar space to become available, is a metric that can indicate the potential for short term growth. This information can also be used to anticipate where GA aircraft operations might be heading and can influence what near term future infrastructure development might be necessary at the airport. Hector Municipal Airport currently has a relatively steady amount of activity with 25 based aircraft and a current waiting list for three hangars or hangar positions. This signifies that activity at Hector is at least steady and most likely poised for growth.

The Airport has 2 public hangars housing 7 aircraft, several private hangars and one private T-hangar complex housing 4 aircraft. Private and public hangar rates at Hector are very reasonable in terms of costs for aircraft storage. There is a hangar waiting list and a need for additional hangars. The current hangars are currently at capacity and according to the FBO if new hangars were built they would fill quickly based on the interest in hangar development. The current hangar waiting list maintained by the City of Hector has 7 individuals who have paid a deposit and are waiting for hangars. Consideration is given as to how to address the shortage and identify new locations for hangars in subsequent chapters of this master plan.

3.4.3 Corn and Crop Futures

With so many people located around Hector directly tied to agriculture, corn prices in particular can have a dramatic effect on the local economy of Hector. Corn prices

have wide variations, and recent years have fluctuated from as high as $8.00/bushel to a more recent range between of $3.00 and $4.00/bushel. Many farmers consider $2.80/bushel a common "break even" harvest price. National trends and data suggest that agricultural prices, especially for corn, are expected to remain stable and are not likely to go lower in the near term. Once corn prices rebound, this will positively impact the local agricultural economy and in turn the activity at Hector Municipal Airport. **Figure 3-7** provides a chart of corn prices per bushel over several decades.

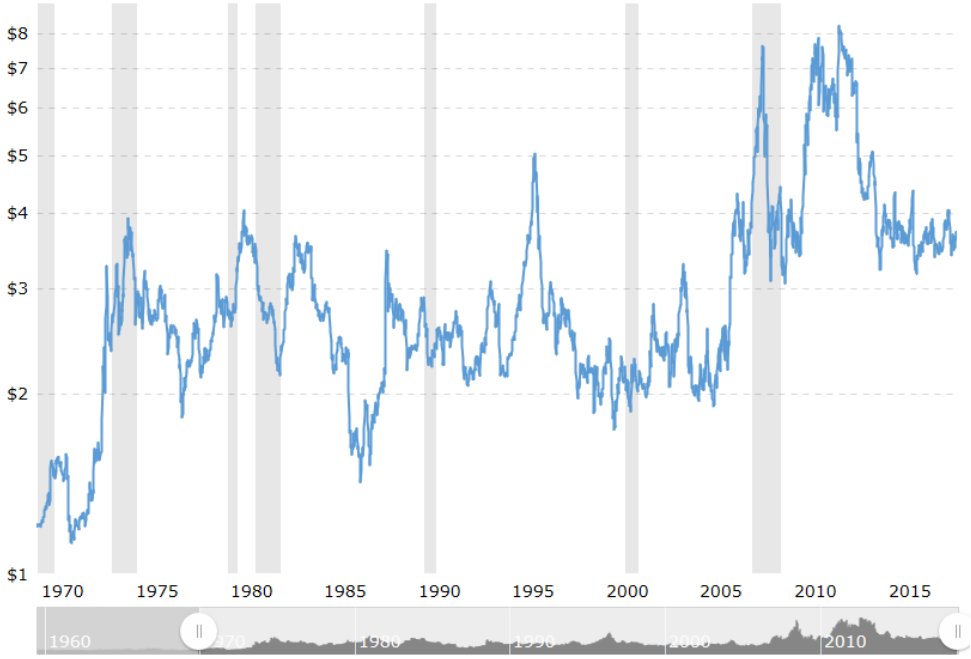

Figure 3-7: Corn price fluctuations since 1970; Source: www.macrotrends.net

3 | Section 5 – Local Aviation Trends

3.5.1 Based Aircraft

Table 3-8 provides a summary of active aircraft that were validated in the National Based Aircraft Inventory System in October 2018. In the past, based aircraft numbers at Hector have differed from those that have been entered by FAA in the FAA Form 5010 Master Record. Often at smaller GA airports, records are not updated over many years, which makes establishing trends difficult. In the same way, the FAA TAF may also not project any growth in future years, which makes the Master Plan forecast even more important.

Airport management updated the FAA records as required in the inventory system in October 2018 and reported 29 verified based aircraft and 4 ultra-light aircraft. This includes a multi-engine piston aircraft, a Baron 55, to be based on the airfield.

Based Aircraft	Number
Single Engine	27
Multi Engine	1
Jet	0
Helicopter	1
Glider	0
Military	0
Ultra-Light (Not validated by FAA)	(4)
TOTAL	**29**

Table 3-8: Hector Municipal Airport - Based Aircraft (2018);
Source: National Based Aircraft Inventory System (basedaircaft.com), 2018

Aircraft owners based at other airports have expressed interest in being based at Hector but have not yet moved because they prefer a longer runway. The airport manager believes that with a lengthened runway and proper hangar facilities additional businesses would choose to base their aircraft at Hector and could also spur interest in upgrading existing aircraft. Providing additional runway length would require additional planning and investment. A range of options will be explored in the Alternatives section of the Master Plan.

3.5.2 Aircraft Operations

Hector Municipal Airport has no air traffic control tower and no scheduled commercial passenger operations. Because this direct measurement of aircraft operations is not available, forecasters rely on estimates of activity and other sources. Local sponsor and tenant knowledge of the operations at the airport, supplemented with other available data, such as historical 5010 operations and fuel sales, is utilized to better understand aircraft operations. The method that the FAA uses to determine and record numbers of aircraft operations at airports is through the FAA Form 5010 Master Record (5010).

Type of Operation	Annual Operations
Air Carrier	0
Air Taxi	0
GA Local	6,000
GA Itinerant	1,000
Military	0
TOTAL	**7,000**

Table 3-9: Aircraft Operations; Source: FAA Terminal Area Forecast (2018-2038)

The FAA often contracts with individual state aeronautics divisions to perform 5010 inspections at all public use airports within the state, usually once every three years, as a way of updating and maintaining critical information about airports. As part of these inspections at smaller GA airports like Hector, trained inspectors will talk with

airport representatives to establish reasonable estimates as to the number and types of aircraft operations at the facility, as well as the number of based aircraft.

In Minnesota, the inspections are conducted by personnel from MnDOT Aeronautics. The 5010 form records the estimated total number of annual operations and then allocates them according to the type of operation (itinerant or local) and the type of aircraft (Air Carrier, Air Taxi/Commuter, GA, or Military). This historical information is then captured by the FAA in the TAF, which becomes the basis for the projections published annually. In some cases, the FAA TAF holds projections constant over an extended period due to uncertainty or because a forecast from a master plan or state system plan hasn't been prepared recently. This is true for Hector Municipal Airport. **Table 3-10** shows historical aircraft operations dating back to 2008, 2018 information reported for Hector Municipal Airport relevant to aircraft operations and based aircraft.

Year	Total Operations
2008-2017	7,000
2018 and beyond	7,000

*Note – 5010 Inspections are conducted every 3 years

Table 3-10: Hector Municipal Airport Historical Aircraft Operations; Source: FAA Terminal Area Forecast (2018-2038)

Lately, medivac roles have been carried out by a Pilatus type aircraft.

Medivac flights are one of the most critical needs that an airport provides to the residents of a community. The residents of Hector are no exception. Although medivac flights account for only a small number of the total flights in and out of the Hector Municipal Airport, they are one of the most important types of operations that the airport hosts. These flights are also made by aircraft that are among the largest that may use the Airport. Until recently, it was common to see Beechcraft King Air aircraft supporting this role. Lately, these medivac roles have been carried out by Pilatus type aircraft in the region. Both aircraft types represent significant increases in the size and performance requirements of aircraft that normally use the Hector Municipal Airport facilities. According to airport management, medivac flights occur approximately once per month.

The use of Hector Municipal Airport in support of agricultural spraying operations is one of the most important roles the facility serves. The highest demand for spraying occurs in July and August when the Airport remains congested during all daylight hours. A standalone area on the Airport for aviation agricultural spraying operations is maintained by the agricultural spraying company Sky Apply. Agricultural use of the Airport spans all aspects of the industry, including business related flights, crop spraying and FBO repairs of agricultural aircraft. Agricultural related aircraft typically seen at Hector include 502 and 301 Air Tractors, a 1984 Eagle, and other similar type aircraft.

3.5.3 IFR Operations

Instrument Flight Rules (IFR) activity is an important component of operations at the Hector Municipal Airport. The Airport does not have an instrument approach, but aircraft have filed flight plans to and from the airport. Having an instrument procedure at a GA airport would allow for the ability to reliably offer services that would normally not be found at airports without an instrument approach. This is especially true in terms of life saving medical flights. Although forecasting for instrument flight operations is not a mandatory component of an airport master plan, it can help show its importance. IFR data can be a great tool in better understanding the airport's importance to a community and provide enhanced examples of aircraft operations.

To allow for a better understanding of the types and numbers of IFR operations at the Hector Municipal Airport, and the aircraft that utilize the facility, all instrument flight plans filed with the FAA that originated from, or terminated at, the Airport were gathered for the most recent three years between 2015 to 2017. This information was obtained through the FAA Traffic Flow Management System Counts (TFMSC). Traffic Flow Management System Counts are designed to provide information on traffic counts by airport and includes various data about the types of aircraft, point of departure or arrival, N-numbers, owners and other various data. It captures data for flights that fly under Instrument Flight Rules (IFR) and are captured by the FAA's enroute computers. VFR and some non-enroute IFR traffic is excluded. TFMSC source data are created when pilots file flight plans and/or when flights are detected by the NAS, usually via RADAR.

Year	IFR Operations	Aircraft
2015	8	Cessna 172, Mooney
2016	17	Maule, Bonanza, Cherokee, Mooney
2017	18	Cessna 208, Bonanza, TBM 700, Cessna 182, Cherokee, Baron 55, Mooney

Table 3-11: Hector Airport IFR Flight Activity 2015 - 2017;
Source: FAA Traffic Flow Management System Counts (TFMSC)

The breadth and depth of recorded IFR activity in and out of Hector Municipal Airport over the past 3 years substantiates the importance of the consideration for instrument approach capabilities for the Hector Municipal Airport in the future.

3.5.4 Fuel Sales

Tracking fuel sales over time can help to determine historical trends in activity at an airport. Reliable past fuel sales information was not available for this forecast, however some bulk fuel delivery records and information provided by airport management do provide some insight. Sky Apply purchases Jet A fuel for their turbine-powered aircraft independently. They reported that they use about 14,000 gallons of Jet A fuel per year, the bulk of which is used to support the peak agricultural spraying season in August. This represents about 90 percent of their

total fuel consumption. The Jet A is delivered into a 9,400-gallon mobile tanker as there is no dedicated tank for their use. The other 10 percent of their fuel needs is AvGas, which until recently they purchased from the FBO. From this information, it seems that operational activity for Sky Apply has been steady over the past two years.

Three transactions for the FBO bulk delivery of AvGas to the FBO are also shown in **Table 3-12**. The data gathered doesn't provide enough information to establish a trend, but does show consistent activity that may be trending upward. The FBO is currently independent and unbranded. Fuel sales data as shown in **Table 3-12** below calculates to nearly 75% of the fuel being used at the airport is used by Sky Apply, the agricultural spraying business on the airfield.

Year	Month	Company	Quantity
2018	August	Ag (SKY APPLY)	14,000*
2018	June	FBO	4,000
2017	September	FBO	3,000
2017	August	Ag (SKY APPLY)	14,000*
2017	May	FBO	2,000

* Fuel is purchased independently and reported in round numbers.

Table 3-12: Bulk Fuel Deliveries 2017-2018; Source: City of Hector, Sky Apply

3 | Section 6 – Regional Demographic and Socioeconomic Influences

The estimated 2017 population of Minnesota is nearly 5,500,000 people, and the estimated population of Renville County is approximately 14,650. Renville County has a median household income of just over $54,000. As a northern mid-western state, Minnesota's population and economic workforce has similarities with both the more agriculturally based surrounding states, such as North Dakota, and also with some of the more historically manufacturing based states, such as Michigan. Renville County and Hector, however, are much more influenced by the agricultural market trends, with similar socio-economic characteristics to other nearby geographic counties within and outside Minnesota. **Figure 3-13** shows the recent changes in real gross domestic product by state and region throughout the US in 2017.

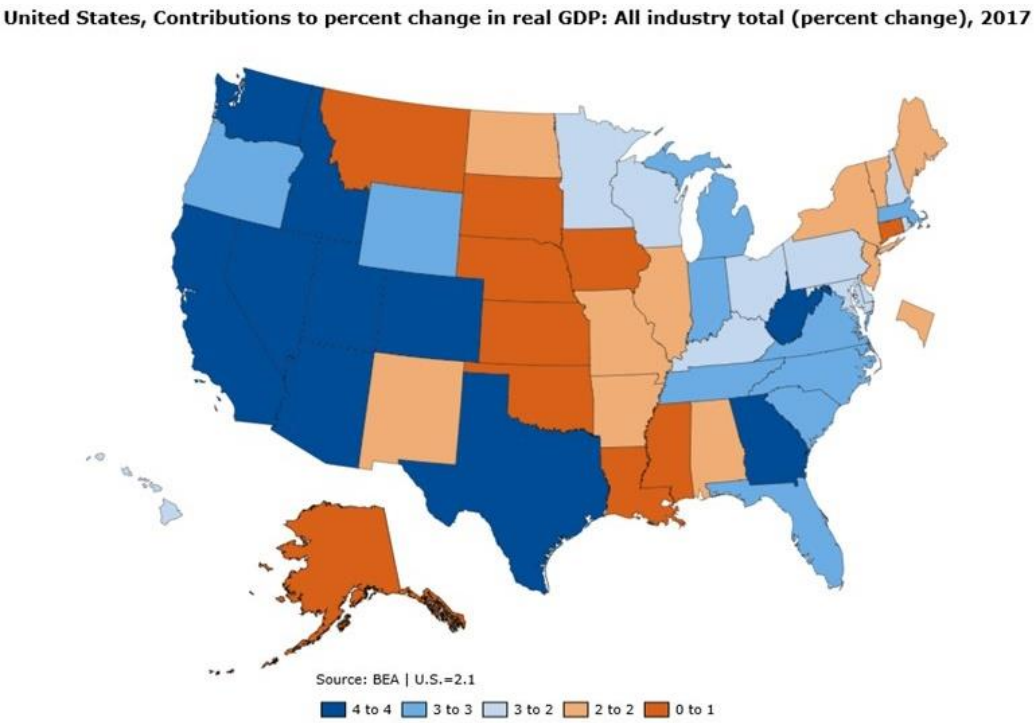

Figure 3-13: Percent Change in Real GDP by State

As can be seen from the graphic, Minnesota is contributing moderate growth to the GDP compared to other states.

Comparing state, regional, and county historical and forecast average annual employment trends can also be useful when forecasting. **Figure 3-14** provides a ten-year comparison of Renville County unemployment to the State of Minnesota, and other regional subsets. While unemployment percentages are tracking above the other demographic units, they seem to be moving together in a downward (positive) trend.

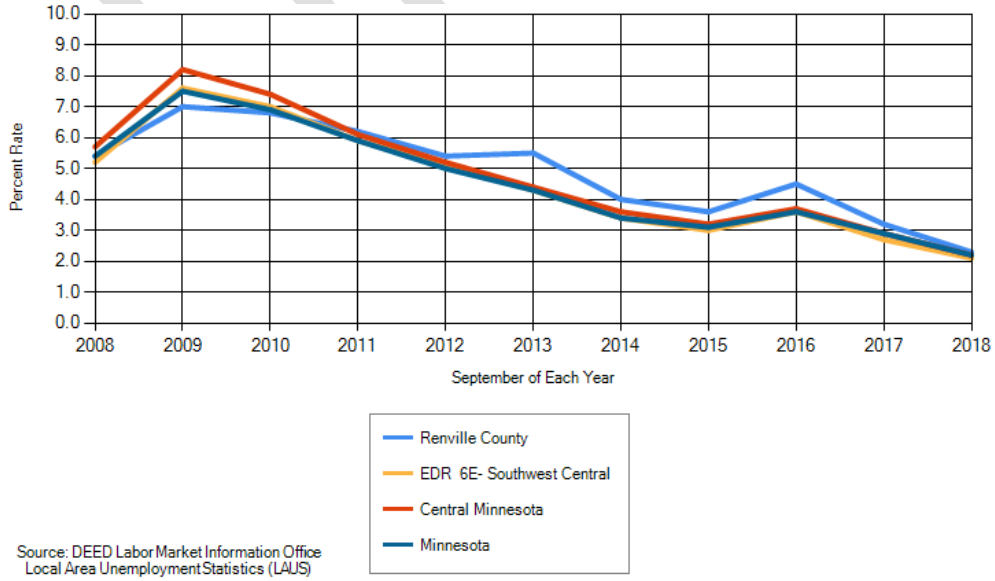

Figure 3-14: Annual Unemployment Rate Comparison (2008 thru 2018)

3 | Section 7 – Forecasting Methodology

FAA AC 150/5070-6B gives wide latitude in both the types and application of the methods that can be used when forecasting data within an airport master plan. The reason for this flexibility is to account the large variances in the types and complexities of airports and the large number of variables that can influence the forecasts. Professional judgement must be employed in determining the best methodology for the application of forecasts. There are several types of methodologies that the FAA recognizes, including:

1) Regression analysis – This is a statistical technique that ties aviation demand (dependent variables), such as enplanements, to economic measures (independent variables), such as population and income. This type of analysis should be restricted to relatively simple models with independent variables for which reliable forecasts are available.

2) Trend analysis and extrapolation – This type of method relies on projecting historic trends into the future. In trend analysis, a simple equation can be used with time as the independent variable. It is one of the fundamental techniques used to analyze and forecast aviation activity. While it is frequently used as a back-up or expedient technique, it is highly valuable because it is relatively simple to apply. Sometimes trend analysis can be used as a reasonable method of projecting variables that would be very complicated (and costly) to project by other means. This is especially true for smaller, GA airports.

3) Market share analysis or ratio analysis – This technique assumes a top-down relationship between national, regional, and local forecasts. Local forecasts are a market share (percentage) of regional forecasts, which are a market share (percentage) of national forecasts. Historical market shares are calculated and used as a basis for projecting future market shares. This type of forecast is useful when the activity to be forecast has a constant share of a larger aggregate forecast.

4) Smoothing – A statistical technique applied to historical data, giving greater weight to the latest trend and conditions at the airport; it can be effective in generating short-term forecasts.

For Hector Municipal Airport Master Plan forecasts, the lack of reliable past trend data makes it difficult to project past trends into the future or establish relationships with past demographic and socio-economic data for regression analyses. Existing information from the FAA TAF is not maintained on a regular basis for Hector. However, historical and forecast data that include Hector are available from sources discussed in prior sections of this chapter to establish Market Share forecasts. Growth rates from each of these forecasts are applied to Hector Municipal Airport's base year activity levels to establish a range of potential future activity levels. From that array, this forecast selected forecasts judged to be reasonable for the purposes of being the foundation for subsequent analyses within this master plan.

3 | Section 8 – Based Aircraft Forecast

As previously discussed, FAA publishes an official forecast for Hector in the annual FAA TAF. The TAF is used in conjunction with the FAA's National Plan of Integrated Airport Systems (NPIAS) as the means to identify future based aircraft and aircraft operations levels for each airport in the NPIAS. The FAA TAF can be aggregated to compare forecasts for multiple subsets of the national totals, from nationwide to region and down to the individual airport level.

Figure 3-15 depicts the range of forecasts for total based aircraft for Hector using the methodologies described above. Each result is briefly described below.

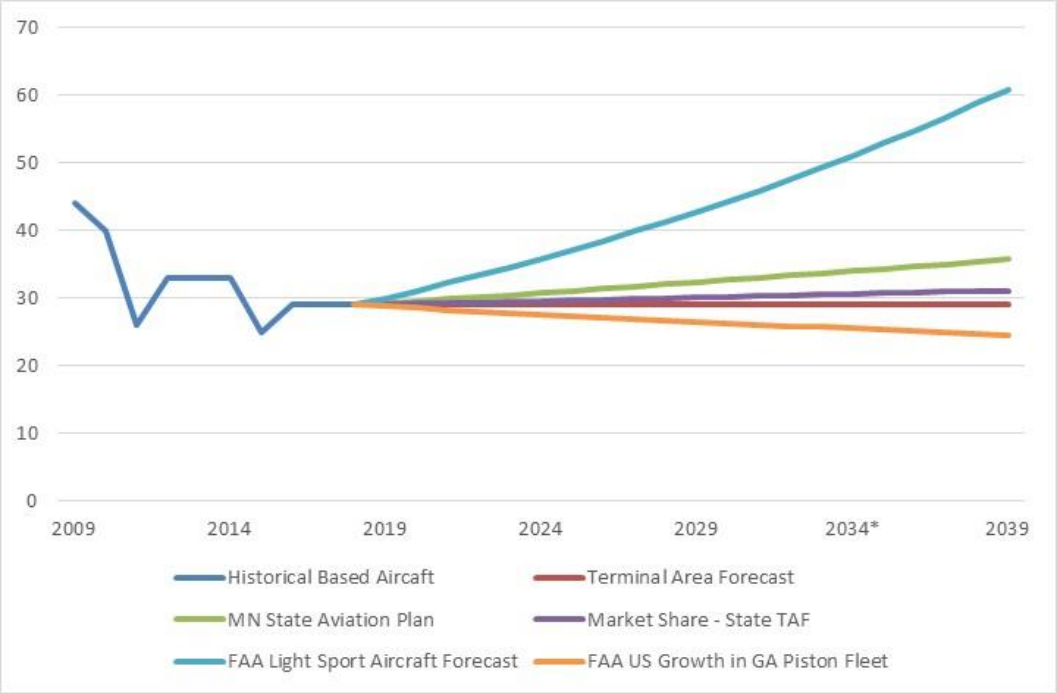

Figure 3-15: Based Aircraft Forecast Comparison

3.8.1 Market Share - Minnesota State Aviation System Plan

The Minnesota State Aviation System Plan, updated in 2013, projected the statewide growth of based aircraft for airports in Minnesota at 1.0%. This forecast assumes that Hector will also grow at 1.0% annually and add seven based aircraft over the forecast period for a total of **36** aircraft by 2039.

3.8.2 Market Share - FAA Light Sport Aircraft Forecast

The FAA Aerospace Forecast (2018-2038) projects that the based aircraft category of light sport aircraft, a type of aircraft well-suited to Hector, will increase by 3.6% nationwide. This forecast assumes that Hector will also grow at 3.6% annually and add 32 based aircraft over the forecast period for a total of **61** aircraft by 2039.

3.8.3 Terminal Area Forecast for Hector Municipal Airport

The FAA TAF (2018-2038) projects no growth in based aircraft levels and that Hector will still have a total of **29** aircraft in 2039.

3.8.4 FAA Forecast of US Growth in GA Piston Fleet

The FAA Aerospace Forecast (2018-2038) projects that the GA Piston fleet in the U.S. will actually decline by 0.8% annually over the forecast period. This forecast assumes that based aircraft at Hector will also decline 0.8% annually and lose six based aircraft over the forecast period for a total of **23** aircraft by 2039.

3.8.5 Market Share – TAF Forecast of Minnesota Based Aircraft – Preferred Forecast

The FAA TAF (2018-2038) forecasts that based aircraft for the State of Minnesota will grow by 0.34% annually through 2038. This forecast assumes that Hector will also grow at 0.34% annually and add two based aircraft over the forecast period for a total of **31** aircraft by 2038. Even though FAA is projecting contraction in the GA piston fleet over the forecast period, this preferred forecast provides for some growth, pulled upward by the prospect that there could be growth in the light sport segment of GA at Hector. This also recognizes that there is an active waiting list for hangar space containing the names of pilots not currently based at the Airport. **Table 3-16** lists the fleet mix for the based aircraft in the next 5-, 10-, and 20-year timeframes.

	SE	ME	Jet	Heli	Other	TOTAL
2018	27	1	0	1	0	**29**
2023	27	1	0	1	0	**29**
2028	28	1	0	1	0	**30**
2038	29	1	0	1	0	**31**

Table 3-16: Fleet Mix by Aircraft Type

3 | Section 9 – Operations Forecast

The recommended forecast for operations examined each traffic segment individually, which is briefly described below.

3.9.1 Air Taxi Forecast

The medivac operations that were discussed in Section in 2.5.2 and 2.5.3 would be classified as Air Taxi operations based on the type of certificate that medivac companies hold and the operating rules associated with the flights. The FAA TAF currently does not count any historical or future Air Taxi operations, however airport management estimates there are approximately 12 annual missions, for a total of 24 annual Air Taxi operations. These missions cannot be predicted, and this is not a significant number of operations. The preferred operations forecast will not

project any growth but will show 24 Air Taxi Operations through the planning period.

3.9.2 GA Operations Forecast

Forecasting aircraft operations at small GA airports often relies on establishing a past ratio of operations versus the number of based aircraft. If there is good reason to support the historical relationship, the ratio can be applied to future years to establish the forecast of operations. Master plan forecasts look at an array of different types of aircraft operations in addition to the annual total. This ratio is expressed as Operations per Based Aircraft (OPBA).

FAA has determined a general guideline for determining whether the OPBA ratio is reasonable:

- 250 operations per based aircraft for rural general aviation airports with little itinerant traffic
- 350 operations per based aircraft for busier general aviation airports with more itinerant traffic,
- 450 operations per based aircraft for busy reliever airports.

Table 3-17 provides historical and forecast data from the TAF for Hector between 1990 and 2035. Because FAA projects that there will be no growth in based aircraft or operations at Hector, OPBA remains constant at 241 throughout the planning period.

YEAR	OPERATIONS	AIRCRAFT	Operations per Based Aircraft (OPBA)
1990	7,300	19	405
1995	8,100	22	368
2000	8,100	15	540
2005	7,938	24	330
2010	7,000	40	175
2015	7,000	25	280
2020	7,000	29	241
2025	7,000	29	241
2030	7,000	29	241
2035	7,000	29	241

Source: FAA Terminal Area Forecast (2018-2038)

Table 3-17: FAA TAF Historical and Forecast Operations and OPBA: Hector Municipal Airport

Hector's existing OPBA falls below the typical 250 for airports with little itinerant traffic. This can be attributed to local pilots flying their small aircraft less frequently. FAA Aerospace Forecasts, the TAF, and the Minnesota State Aviation System Plan all predict that aircraft will be utilized far more over time. That results in a higher

growth rate for aircraft operations as compared to based aircraft. For this reason, the preferred GA operations forecast shows OPBA increasing from the existing 241 to 250 by the end of the forecast period. The resulting average annual growth rate in GA operations associated with the OPBA increase is 0.5%.

3.9.3 Military Operations Forecast

Military operations rarely occur at Hector Municipal Airport. The FAA does not forecast any military operations to occur at Hector, thus this master plan forecast will not include any military operations in the preferred forecast.

3 | Section 10 – Forecast Summary

In **Table 3-18**, a summary of the Hector Municipal Airport forecast of operations and based aircraft is presented. The variance between the master plan forecast and FAA TAF projections is also noted.

Hector Airport Master Plan Based Aircraft Forecasts				
Aircraft Type	**Base Year 2018**	**Short Term Forecast 2023**	**Intermediate Term Forecast 2028**	**Long Term Forecast 2038**
Single Engine	27	27	28	29
Twin Engine	1	1	1	1
Jet	0	0	0	0
Helicopter	1	1	1	1
Other	0	0	0	0
Total Based Aircraft Forecast	**29**	**29**	**30**	**31**
FAA TAF Based Aircraft Forecast	29	29	29	29
% Difference Between Forecast and TAF	**0%**	**0%**	**3%**	**7%**
Hector Airport Master Plan Aircraft Operations Forecasts				
Air Taxi	24	24	24	24
GA Local	6,000	6,120	6,266	6,606
GA Itinerant	976	1,056	1,110	1,170
Itinerant Military	0	0	0	0
Total Aircraft Operations Forecast	**7,000**	**7,200**	**7,400**	**7,800**
TAF Aircraft Operations	7,000	7,000	7,000	7,000
% Difference Between Forecast and TAF	**0%**	**3%**	**6%**	**11%**

Table 3-18: Hector Aviation Forecasts Thru 2038

This forecast will be submitted to the FAA on their FAA TAF Comparison worksheet, so a review and approval process may be completed before subsequent planning tasks are initiated.

3 | Section 11 – Critical Aircraft and Airport Reference Code

Interviews with airport management, FAA, and MnDOT Aeronautics staff provided an understanding about the types of aircraft operating in and out of Hector Municipal Airport. Planners also reviewed IFR data from the last year for all IFR flights originating or ending at Hector Municipal Airport.

FAA master plan guidance states that the most demanding aircraft to regularly operate at an airport during the planning period is the "critical aircraft". At Hector, the critical aircraft will determine, in part, the design standards to be applied in subsequent chapters of this study. The FAA defines "regular" or "substantial" use as at least 500 annual itinerant operations. The critical aircraft, also known as the design aircraft, is defined in terms of an Airport Reference Code (ARC), which corresponds with approach speed and wingspan categories.

The critical aircraft determination is an important aspect of an airport master plan as it potentially sets ultimate dimensional requirement standards for an airport, such as the distance between runways and taxiways and the size of certain other areas protecting the safety of aircraft operations and passengers. The ARC is made up of two components – a letter representing the Aircraft Approach Category (AAC) and a Roman numeral representing the Airplane Design Group (ADG). These letters and Roman numerals are described in **Table 3-19**. The AAC is determined by the approach speed, or 1.3 times the stall speed of the aircraft in its landing configuration at its maximum landing weight. The ADG is typically defined by the aircraft wingspan, but tail height could potentially be the more demanding factor.

The critical aircraft may be a family of aircraft with similar characteristics that, when combined, represent the 500 regular annual itinerant operations. Further, the ARC may be composed of the most demanding AAC from one group of similar aircraft and the most demanding ADG from another group of similar aircraft, as long as each component meets the regular use threshold.

Aircraft Approach Category	Approach Speed	Representative Aircraft
A	Less than 91 knots	Cessna 150, 172, Beech Bonanza
B	91 to 120 knots	King Air, Piper Navajo, Gulfstream I
C	121 to 140 knots	Learjet, Citation X, Boeing 737
D	141 to 165 knots	Boeing 747, Gulfstream V
Airplane Design Group	**Wingspan**	**Representative Aircraft**
I	Less than 49 feet	Cessna 150, 172, 206
II	40 to 78 feet	King Air, Dassault Falcon 900
III	79 to 117 feet	Boeing 737, DC-3, Gulfstream V

Airplane Design Group may be determined by tail height, if more demanding than wingspan:	
Airplane Design Group	**Tail Height**
I	Less than 20 feet
II	20 to 29 feet
III	30 to 44 feet

Table 3-19: Airport Reference Code (ARC) Components; Source: FAA AC 150/5300-13A, Airport Design; Note: Aircraft Approach Category E (166 knots or more) and Airplane Design Groups IV, V, and VI (118 feet or more) are not shown.

Nearly all aircraft currently operating at Hector are single engine aircraft with an ARC of A-I (small). However, agricultural spray operations are a significant element of Hector's traffic, especially during peak periods in the summer. These are comparatively large aircraft with turbine engines and the ability to takeoff with heavy loads of spray chemicals. According to Sky Apply they operate the air tractor 502 with a 52' wingspan and an Eagle Aircraft Company agricultural aircraft with a 57' wingspan, which places them in the A-II ARC. Sky Apply reports 5,000 annual operation at 1D6, with the peak of their spray season utilizing six A-II (small) agriculture aircraft for ten days, landing and taking off once per hour with a peak season operation A-II (small) count of 1,920 operations by Sky Apply. There is one B-I (small) aircraft based at Hector, which is a Beechcraft Baron 55. The airport estimates that the Baron is operated fewer than 500 operations per year and would not likely increase in utilization in the future. Regular use of Hector by itinerant aircraft that are ARC B-I (small) or larger have not been noted.

Table 3-20 summarizes a review of the aircraft based at Hector along with records of IFR operations in 2018.

Aircraft	Type	Engine Type	Airport Reference Code
Cessna 172, Cessna 182, Maule, Piper Cherokee, Air Tractor 301	Single Engine	Piston	A-I (small)
Beech Baron 55	Twin Engine	Piston	B-I (small)
Air Tractor 502, Eagle	Single Engine	Turbine	A-II (small)

Table 3-20: Hector Based Aircraft Review

Due to the significant amount of operations by ARC A-II (small) agricultural spray aircraft in the busy summer months, such as the Air Tractor 502 and Air Tractor Eagle with a MTOW of less than 12,500 pounds, the current and forecasted ARC is A-II (Small). Even though Hector Municipal Airport will primarily see operations by aircraft within ARC A-I (small) throughout the year, the A-II (small) agricultural aircraft activity exceeds the regular use threshold of 500 annual itinerant operations necessary to be named the design aircraft. The implications of this forecast are presented in the next chapter, Facility Requirements.