



CHAPTER 3: AVIATION ACTIVITY FORECASTS

Introduction

The Aviation Activity Forecasts chapter of the Airport Master Plan analyzes current and future airport activity at the Grand Forks International Airport (GFK). Forecasting provides an airport with a general idea of the magnitude of growth, as well as fluctuations in activity anticipated over the forecast period. They assist the Airport in determining existing and planned future facility needs based on airport activity level estimates and projections. Forecasts attempt to develop a realistic estimate of future changes.



Allegiant Airlines MD-83 Departing GFK

Forecast projects are based on a “snapshot” of an existing aviation trends and socioeconomic climate. As such, forecasting tends to be a dynamic element of airport master planning. When conditions change dramatically, forecasts should be reviewed and updated accordingly to reflect the changed environment.

GFK has experienced strong growth since the last Master Plan was completed in 2008. Passenger enplanements have increased by nearly 70 percent from 2008 to 2014. Much of the growth can be attributed to Allegiant Airlines which began service in September 2008. Airport takeoffs and landings (operations), much of which is attributed to University of North Dakota (UND) flight training activity, have increased by over 43 percent during that same time period. In 2014 GFK was the 22nd busiest airport in the United States in terms of total annual airport operations with nearly 325,000.

The forecasts developed for the Airport will be important to adequately plan, size, and sequence development of future facilities to meet future projected growth. Development at airports, however, is demand-based from actual numbers rather than forecasts.

To thoroughly analyze and develop a probable aviation forecast, a technical review has been completed using several methods to help quantify the potential aviation activity over the next 20 years.

This chapter includes aviation activity forecasts for the following primary elements:

- [Passenger Enplanements](#)
- [Passenger Aircraft Operations](#)
- [Air Cargo](#)
- [Other Commercial Operations](#)
- [Based Aircraft](#)
- [General Aviation](#)
- [Military](#)
- [Critical Design Aircraft](#)
- [Peak Activity](#)

UND flight training activity is classified by FAA as ‘Air Taxi’, a commercial operation. Operations are discussed in the [Other Commercial Operations](#) and [General Aviation](#) sections of this Forecast chapter.



Forecast Rationale

Forecasting the demand for airport use is a critical step in airport development. It allows an airport to examine its ability to satisfy the needs of the aircraft and people it serves, and to determine the approximate timing of necessary improvements by projecting airport user activity levels.

Forecasts developed for airport master plans and/or federal grants must be approved by the Federal Aviation Administration (FAA). It is the FAA's policy, listed in [FAA AC 150/5070-6B, Airport Master Plans](#), that FAA approval of forecasts should be consistent with the Terminal Area Forecasts (TAF). Master plan forecasts for operations and based aircraft are considered to be consistent with the TAF if they meet the following criteria:

1. Forecasts differ by less than 10 percent in the five-year forecast and 15 percent in the 10-year period, or
2. Forecasts do not affect the timing or scale of an airport project, or
3. Forecasts do not affect the role of the airport as defined in the current version of [FAA Order 5090.3, Field Formulation of the National Plan of Integrated Airport Systems](#).

Forecasts that are considered to be inconsistent with the TAF require additional FAA review to confirm the planning assumptions and appropriate methodologies are used. Approval can occur at the FAA local (Bismarck) or regional (Chicago) level.

Furthermore, [FAA Order 5090.3C](#) states forecasts should be:

1. *Realistic*
2. *Based on the latest available data*
3. *Reflect the current conditions at the airport*
4. *Supported by information in the study*
5. *Provide an adequate justification for the airport planning and development*

The TAF model used for this report is from the 2015 FAA TAF published in January 2016.

Factors Affecting Forecasts

FAA provides general guidance in evaluating factors that affect aviation activity. [FAA AC 150-5070-6B](#) states:

“Planners preparing forecasts of demand or updating existing forecasts should consider socioeconomic data, demographics, disposable income, geographic attributes, and external factors such as fuel costs and local attitudes towards aviation.”

For purposes of this forecast, the following defining factors have been used to develop the forecast:

1. Based on availability of data when the project began (August 2015), Federal fiscal year 2014 (October 1, 2013 through September 30, 2014) has been used as the baseline year.
2. FAA data from 2015 and 2016 has been used to validate forecast assumptions and update the forecast baseline and enplanement forecasts.
3. The forecast period is 20 years encompassing years 2015 through 2034.
4. The most recent 2014 estimates and future projections of socioeconomic and demographic trends have been utilized for the airport service area.
5. The core airport service area is considered the Grand Forks, ND - East Grand Forks, MN Metropolitan Statistical Area (MSA) for this forecasting effort. The MSA includes Grand Forks County, ND and Polk County, MN.



The total GFK domestic passenger catchment area covers 81 zip codes in northeastern North Dakota and northwestern Minnesota as identified in the latest Passenger Demand Analysis (PDA)¹. The Grand Forks-East Grand Forks MSA was used because of the availability of data. A total of 76.3 percent of the GFK domestic catchment area population resides within the MSA, providing a representative sample of socioeconomic and demographic trends for the entire catchment area.

The forecasts prepared for the airport assume an unconstrained scenario where facilities are available for use to meet demand. Any constrained forecasts prepared will be noted throughout the document. Time periods include short-term (5-year), mid-term (10-year) and long-term (20-year) resulting in forecasts for year 2019, 2024 and 2034. Forecasts may be developed using a composite of methodologies over the planning period.

Because aviation activity fluctuates due to unforeseen industry changes, the forecasts developed in this section will be developed into Planning Activity Levels (PALs) in future chapters to identify activity demand triggers for future facility improvements. By planning airport development around PALs, phases of construction/airfield development are based on triggering events and not necessarily based on a specific timeframe. Phases of airfield development are implemented based on activity demand and not a period in time. Due to the variability of forecasting and changing demand, this method is seen as a more realistic way of planning demand-driven development for an airport.

Forecasting Methods

Various methodologies are used to develop aviation forecasts. Forecasts should not be considered predictions of the future but rather an educated projection of future activity. Some of the following forecasting methods were applied for this analysis, including trend extensions, market share analysis, regression analysis, socioeconomic methodologies and professional judgment.

TREND EXTENSIONS

A trend extension forecast identifies historical growth patterns and projects those patterns into the future. Often, a trend line can be drawn through a graph of the historical data to reveal an overall trend, which can then be extended into the immediate future to develop a forecast.

MARKET SHARE ANALYSIS

Market share analysis assumes a relationship between local and national/regional forecasts. The market share approach to forecasting is a top-down method where activity at an airport is assumed to be tied to growth in some external measure (typically a regional, state, or national forecast).

REGRESSION ANALYSIS

Regression analysis is a statistical technique for estimating the relationships among variables. It identifies correlations between known independent variables (e.g., socioeconomic or demographic estimates and projections) and dependent variables (e.g., passenger enplanements). A correlation (R-squared) value of 95 percent and above indicates a strong correlation between the independent and dependent variables.

PROFESSIONAL JUDGMENT

Judgmental methods are educated estimations of future events based on the industry knowledge, experience and intuition of the forecaster. This method permits the inclusion of a broad range of relevant information into the forecasting process, and is usually used to refine the results of the other methods.

¹ Grand Forks International Airport Passenger Demand Analysis - 2012 (December 2012, Mead & Hunt)



Socioeconomic Forecasts

Socioeconomic information within the airport service area can provide insight into factors that affect aviation activity at an airport. Commonly evaluated metrics include population, employment, income, gross regional product and retail sales. Historic trends, current data and forecast estimates are evaluated in this section to identify socioeconomic trends that may affect aviation activity forecasts at GFK. Growth rates are used as a method to compare the airport service area with other regional, statewide and national trends. Data from Woods & Poole Economic was used to collect metrics. This data was evaluated against available local data. Population data, for example, was additionally gathered from the Metropolitan Planning Organization (MPO).

Population

Population is a basic indicator of the number of people who may utilize the airport. The population within the Grand Forks MSA was 98,461 in 2010. As of 2014, the population grew to 101,842 yielding a 0.67 annual growth rate according to the U.S. Census.

Table 3-1 – Population Projections

Metric	2014	2019	2024	2034	CAGR
Population					
Grand Forks MSA**	101,842	105,255	109,321	118,055	0.76%
Grand Forks-EGF**	64,418	68,128	72,194	80,928	1.15%
North Dakota*	700,316	728,560	756,980	811,640	0.74%
United States*	320,976,914	337,251,000	353,870,000	386,893,000	0.94%

Source: *Woods & Poole Economics (2014), **U.S. Census, Grand Forks-East Grand Forks Metropolitan Planning Organization (2011), KLJ Analysis
CAGR = Compounded Annual Growth Rate

In lieu of Woods & Poole MSA data, local MPO data was used for projections. The MPO projects a growth rate of 1.2 percent annually through the year 2040 for the cities of Grand Forks and East Grand Forks². Other elements equal, this alone would increase the MSA population by 0.76 percent annually on average. This would be similar to other statewide population growth rate projections.

Employment

Grand Forks MSA has a diverse economy including government/defense, health care, retail trade/accommodation/food service, construction and agricultural-related manufacturing industries. The top three employers in the MSA are the UND, Altru Health System and Grand Forks Air Force Base, each employing approximately 4,000 people. Additionally, the Grand Forks MSA has several aviation-related employers including UND Aerospace, Cirrus Aircraft and Northrup Grumman. The Grand Skies development near the Grand Forks Air Force Base is a business park dedicated to the growth of Unmanned Aerial Systems (UAS) related businesses.

Target sectors for future growth, according to the Grand Forks Region Economic Development include:

- Aviation and aerospace, including unmanned systems
- Energy and environment
- Technology-related industry, including data centers
- Professional services
- Value-added agricultural businesses

² Street and Highway Plan Update, Grand Forks-East Grand Forks MPO



It is forecast total employment will continue to grow in Grand Forks MSA around one percent annually. Local projections at the MPO also confirm a growth rate of just over 1 percent annually.

Table 3-2 – Total Employment Projections

Metric	2014	2019	2024	2034	CAGR
Total Employment					
Grand Forks MSA	70,803	74,629	78,539	86,582	1.01%
North Dakota	549,331	588,660	630,850	724,380	1.39%
United States	183,038,000	195,707,000	209,252,000	239,219,000	1.35%

Source: Woods & Poole Economics. CAGR = Compounded Annual Growth Rate

Income

Per Capital Personal Income (PCPI) was also considered as a factor affecting aviation activity. Those who have more disposable income may have a higher propensity to utilize the time savings of aviation, or simply more disposable income for leisure.

PCPI within the MSA is lower than the statewide and national average. PCPI in the MSA is expected to grow at a higher average annual rate resulting in overall PCPI approaching national averages in 20 years. North Dakota state average continues to be higher than the national average PCPI.

Table 3-3 – Per Capita Personal Income Projections

Metric	2014	2019	2024	2034	CAGR
Per Capita Personal Income (2009 Dollars)					
Grand Forks MSA	\$39,260	\$42,287	\$45,985	\$55,016	1.70%
North Dakota	\$46,067	\$49,016	\$52,648	\$61,552	1.46%
United States	\$41,079	\$43,763	\$47,112	\$55,398	1.51%

Source: Woods & Poole Economics. CAGR = Compounded Annual Growth Rate.

Gross Regional Domestic Product

Gross Regional Domestic Product (GRDP) is the measure of the overall size of an economy as measured by the market values of all final goods and services produced within a given geographic area. This variable measures the economic vitality of a community and is considered as a factor affecting aviation activity. Markets that have more economic output or a growing economy may have a higher need for aviation for travel.

The GRDP output growth rate for Grand Forks MSA is slightly lower than statewide and national averages.

Table 3-4 – Gross Regional Domestic Product Projections

Metric	2014	2019	2024	2034	CAGR
Gross Regional Domestic Product (2009 Dollars, in millions)					
Grand Forks MSA	\$4,637	\$5,106	\$5,625	\$6,830	1.95%
North Dakota	\$41,033	\$45,837	\$51,273	\$64,397	2.28%
United States	\$15,356,264	\$17,158,238	\$19,186,357	\$24,045,489	2.27%

Source: Woods & Poole Economics. CAGR = Compounded Annual Growth Rate.

Retail Sales

Similar to income, increased retail sales are usually an economic indicator that people are able and willing to spend their money. It also is an indication that disposable income is higher and people have higher confidence in job outlook in their area.



Retail sales projections for Grand Forks MSA is slower than statewide and national averages. It is foreseen that a higher percentage of economic output will be through non-retail sales.

Table 3-5 – Retail Sales Projections

Metric	2014	2019	2024	2034	CAGR
Retail Sales (2009 Dollars; in millions)					
Grand Forks MSA	\$1,666	\$1,744	\$1,825	\$1,995	0.91%
North Dakota	\$12,116	\$13,211	\$14,406	\$17,133	1.75%
United States	\$4,617,326	\$5,087,776	\$5,606,159	\$6,806,758	1.96%

Source: Woods & Poole Economics. CAGR = Compounded Annual Growth Rate

Passenger Enplanements

Passenger airline enplanements represent the number of revenue passengers boarding commercial service aircraft that depart an airport. Enplanement figures are vital for project planning at commercial service airports because the numbers help determine size and space requirements for the terminal building, as well as validate the airport's FAA classification and funding.

Passenger Demand

A Passenger Demand Analysis (PDA) was completed for GFK in December 2012. The PDA identified travel patterns of airline passengers within GFK's focus market for air service, known as the "catchment" area. The PDA reviewed origin airport, airline traveled and destination statistics of travelers within the catchment area. An air service situational analysis was also completed. Key findings from the PDA include:

- Total GFK domestic catchment area includes 81 zip codes in northeastern North Dakota and northwestern Minnesota with a population of 128,417 in 2012. Additional trans-border passengers bound for U.S. leisure destinations come from southern Manitoba, Canada including the Winnipeg area.
- Total true market demand in the domestic and international catchment area is estimated to be 483,724 annual passengers or 663 passengers daily each way.
- Top true market destinations not served by non-stop service from GFK include Denver (CO) Chicago (IL), Dallas (TX), Seattle (WA), Los Angeles (CA) and Orlando (FL). The top international destination is Cancun, Mexico.
- GFK is able to capture 56 percent of total passengers who reside in the GFK catchment area. The remaining passengers used alternative airports. A total of 20 percent used Minneapolis-St. Paul International Airport (MSP), 19 percent from Fargo-Hector International Airport (FAR) and 5 percent to other airports.
- GFK had the highest airfare in 21 of the catchment area's top 25 markets compared to alternative airports, and the price to fly from GFK was priced higher by \$100 or more in 11 markets.



GFK Domestic Catchment Area (Mead & Hunt)



- Due to GFK's proximity to Canada (80 miles south of the U.S.-Canadian border), Allegiant Airlines captures at least half of its leisure-market traffic from trans-border travelers who reside in Canada.
- The GFK catchment area may be able to support new service. New potential leisure destinations include Allegiant Airlines service to St. Petersburg, FL (PIE) or Fort Lauderdale-Hollywood International Airport (FLL) in the short-term based on Canadian demand data.
- Other opportunities include service to Denver International Airport (DEN) or Chicago-O'Hare (ORD) hub airports. Longer-term destinations include Dallas-Fort Worth International Airport (DFW), and Los Angeles International Airport (LAX) on Allegiant based on Canadian demand data.

Since the PDA was completed, United Airlines initiated twice-daily service to Denver on 50-seat regional jets in October 2012. Due in part to low passenger loads, the service ceased in December 2013.

Historical Data

GFK annual passenger enplanements were steady, between 85,684 and 100,651 through the 1990's. A dip in passenger traffic was seen in 2001 resulting from the September 11th attacks with 74,953 enplanements. From 2002 to 2007 passenger traffic held relatively steady between 82,089 and 92,202 enplanements with a low point seen in 2007 with 82,089 annual enplanements. From 1990 to 2008 Delta Air Lines (formerly Northwest Airlines) and its regional carriers provided the only scheduled service airline serving GFK. These steady figures indicate GFK historically was a mature market.

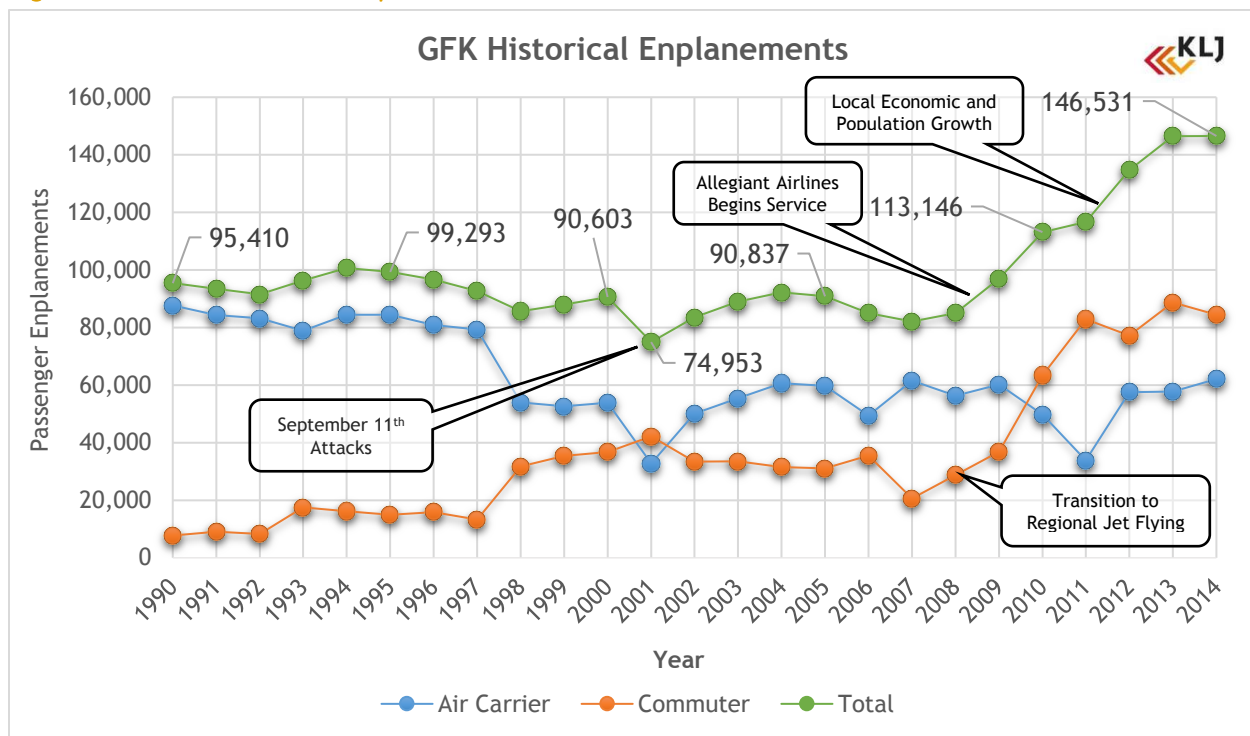
In September 2008 Allegiant Airlines began service from GFK, providing direct flights from GFK to leisure destinations. Service to Las Vegas (LAS) began in 2008, with service to Phoenix-Mesa (AZA) and Orlando-Sanford (SFB) added since then. Nearly 60,000 passengers boarded Allegiant Airlines flights at GFK in 2014. More than half of their passenger traffic is drawn from trans-border travelers in Canada. United Airlines regional service was also introduced briefly from 2012-2013 which added 17,825 enplanements in 2013.

Additionally, the population locally has increased with the Grand Forks MSA seeing a 3.4 percent increase from 2010 to 2015. In the last 10 years from 2003 to 2014, the local economy has grown at a rate exceeding national averages with statewide GRDP growing at over twice the national average. Statewide growth has been supported by oil and gas extraction in the Bakken Formation in northwestern North Dakota.

As a result of these changes since 2007, passenger enplanements have grown dramatically with a record high of 148,486 in 2014 according to the January 2015 FAA TAF. GFK achieved an annual growth rate of 7.69 percent from 2007 to 2014.



Figure 3-6 – GFK Historical Enplanements



Source: [FAA Terminal Area Forecast](#) (January 2016)

FAA defines commercial passenger enplanements and operations in two categories: Air Carrier and Air Taxi/Commuter. Generally, air carrier aircraft is scheduled service in more than 60 seat aircraft and commuter is scheduled service in 60 or fewer seat aircraft.

Regional jets of less than 60 seats such as the 50-seat CRJ-200 operated by Delta Air Lines regional carriers are considered Air Taxi/Commuter aircraft. Total Air Taxi/Commuter enplanements have risen with the replacement of larger aircraft with smaller regional jets since 2007.

Table 3-7 – GFK Historical Passenger Data

Year	Air Carrier	Commuter	TOTAL	Load Factor
1990	87,669	7,741	95,410	N/A ³
1995	84,386	14,901	99,293	N/A
2000	53,815	36,799	90,603	N/A
2005	59,765	31,072	90,837	62.75%
2007	61,512	20,577	82,089	61.55%
2010	49,745	63,401	113,146	81.93%
2014	62,075	84,456	146,435	86.59%
1990-2014 CAGR	-1.07%	10.47%	1.80%	N/A
2007-2014 CAGR	0.13%	22.35%	8.61%	5.00%

Source: [FAA Terminal Area Forecast](#) (January 2016), [Bureau of Transportation Statistics](#)

Passenger load factors indicate the actual number of passengers as compared to available seats. Load factors at GFK have increased due in part to increased passenger demand as well as a reduction in overall available seats by the airlines to remain profitable. In 2014, Allegiant Airlines alone achieved

³ Load Factors, as indicated by the Bureau of Transportation Statistics, are only recorded back to 2002. Data prior to 2002 is not readily available.

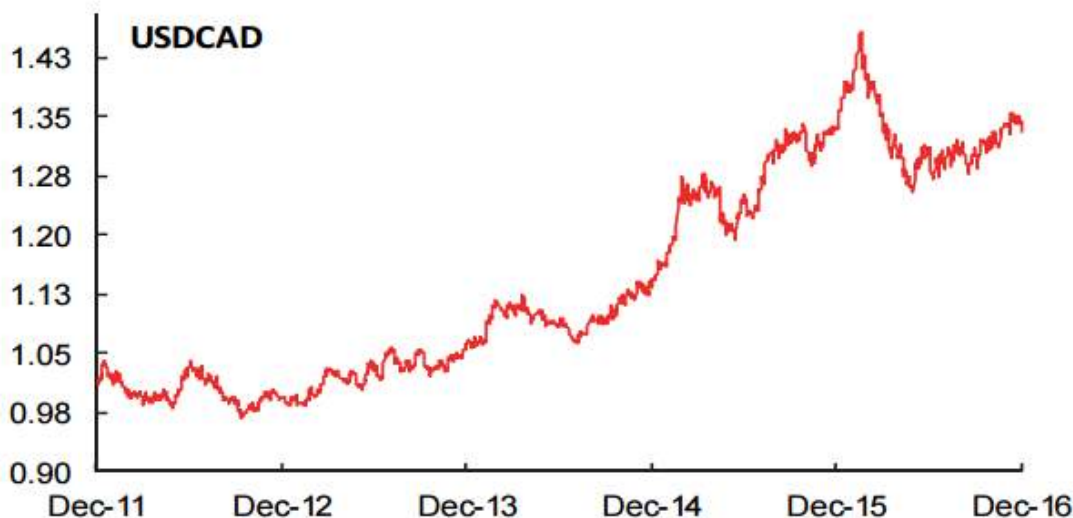


87.28 percent load factor for all flights at GFK while Delta Air Lines achieved 82.94 percent. The national average is 82.71 percent.

Recent Trends

Data was reviewed for 2015 and 2016 to verify trends are still valid. Since the middle of 2014, the exchange rate between United States dollars (USD) and Canadian dollars (CAD) has been increasing. This means it is more expensive for Canadians to travel from GFK as compared to those in the United States.

Figure 3-8 – U.S. Dollar (USD) to Canadian Dollar (CAD) Exchange Rate History



Source: Scotiabank

GFK passenger enplanements have seen decreases since 2014. Decreases in enplanements is estimated to be a result of the USD-CAD exchange rate with fewer Canadian leisure travelers using GFK. The following trends were noted through November 2016:

- Total GFK CY 2015 enplanements were 142,639, a 2.6% decrease from CY 2014 (146,435).
- CY 2016 year-to-date GFK enplanements through November were 117,209, a 10% decrease from November 2015 (130,183) and down 13.7% from November 2014 (133,263).
- CY 2016 year-to-date Allegiant Airlines enplanements at GFK through November (44,087) is down 12.7% from 2015 (50,524) and down 17.7% from 2014 (53,567).
- CY 2016 average year-to-date load factor through November is 70.6% for Delta and 77.1% for Allegiant.


Forecasts

An updated forecast of enplaned passengers has been prepared using available data, several methodologies and professional judgment from industry trends. The enplanement forecasts prepared for GFK are unconstrained to represent actual demand at GFK. These forecasts supersede previous forecasting efforts completed by GFK in 2008 and 2013.

CONSIDERATIONS

The considerations made for this master plan forecast have been developed from professional judgment in reviewing airport, regional and national trends and projections known at the time of forecast preparation. These include:



- The local Grand Forks economy is forecast to continue growth in population, employment and income as a result of diversified industries. Although growth rate is less than statewide projections, growth will still generally follow national projections.
 - The USD-CAD exchange rate is forecast to remain at an elevated level for at least the next five years, which continue diminished demand for Canadian passengers. Although subject to many external political and socioeconomic forces, the USD-CAD exchange rate is forecast to slowly lower through 2018 according to Scotiabank.
 - Airlines will continue to be driven by profitability. Trends include high emphasis on capacity analysis to achieve higher load factors and replacing aging aircraft with more fuel efficient aircraft.
 - The 50-seat regional jet aircraft type will continue to be phased out because it is less profitable than larger regional aircraft on the same route with higher passenger demand. Lower fuel prices have delayed this transition. By 2024, it is forecast there will be a significant reduction in usage of CRJ-200 or similar aircraft for short-haul routes. Eventually, these aircraft will replace by larger 65-76 seat regional jets such as the CRJ-700/-900 aircraft or Embraer E-series jets, which could result in reduced route frequency.
- 
- CRJ-900 Regional Jet (Airliners.net)*
- As the USD-CAD exchange rate reduces over time, Allegiant Airlines may grow service at GFK to meet leisure travel demands for the region including southern Manitoba. Aircraft fleet mix will transition from the MD-83 to the Airbus A319 or A320 aircraft by 2024.
 - New Allegiant routes have the potential to bring additional enplanements to GFK. The 2012 PDA identified new service to Fort Lauderdale (FLL) or Tampa-St. Petersburg (PIE). Growth in Allegiant enplanements is highly dependent on the USD-CAD exchange rate. Based on the top domestic destinations originating from GFK, in the 2012 PDA, a long-term destination could include Los Angeles (LAX). LAX was noted as the top domestic destination from GFK in the PDA.
 - Delta Air Lines will continue to serve GFK via its Minneapolis-St. Paul (MSP) hub, a mature route from GFK. The CRJ-200 aircraft is currently being replaced with CRJ-700/-900 aircraft on this route. As of March 2016, Delta's CRJ-900 aircraft makes two trips on average per day to GFK. Because of relatively high load factors, total available seats and flight frequency may fluctuate during the transition. Additional seats may be added in the future to meet growing demand. A more complete transition to CRJ-900 is anticipated to occur by PAL 2. Please refer to Chapter 4, Facility Requirements Chapter for details on proposed improvements that react to this change in aircraft operation.
 - Delta Air Lines equipment upgrades to increase capacity beyond 76 seats are not foreseen to be utilized regularly at GFK. The aircraft type that would be used for equipment upgrades would be the Boeing 717 (110 seats) or Airbus A319 (126-132 seats). Delta is utilizing larger aircraft to replace 50-seat jets to maintain capacity-neutral, meaning frequency would be reduced. These aircraft may be seen at GFK on an occasional basis, particularly for remain overnight (RON) operations and should be evaluated for planning purposes.



- Long-term air service to another hub airport is a possibility. This includes 65-76 seat regional jet service to Chicago-O'Hare (ORD), Denver (DEN) or Dallas-Ft. Worth (DFW). Each of these airports are top-10 destinations from GFK. The unsuccessful launch of United Airlines service to DEN indicates the GFK market may not yet be capable of sustaining service to DEN. It should be noted that subsidized air service from Devils Lake (90 miles west of GFK) to DEN that began in June 2014 is seen as successful.
- The launch of new air service routes is forecast to lower the leakage rate of GFK catchment area passengers using alternative airports.

Forecasting involves assumptions and risk. If any of the demand considerations identified above significantly change or new demand factors are introduced, then the forecasts should be reevaluated.

FORECAST METHODS

Projections of GFK enplanements beyond 2014 are developed using various forecasting methods. These include a 20-year historical growth rate projection, GFK market share of national enplanements from the FAA Aerospace Forecasts 2015-2035, and socioeconomic projections using state and regional population, employment, gross regional domestic product and per capita personal income. External data sources referenced include national FAA Aerospace Forecast 2015-2035, State Aviation System Plan, socioeconomic forecasts from Woods & Poole and population trend data from the local MPO.

Traditional forecasting methods may be limiting as they analyze local factors that affect aviation demand. For a market like GFK, changes in the aviation industry such as the introduction of Allegiant Airlines significantly affect actual enplanements by capturing passengers from new markets. The lowering of the market leakage to other airports, for example, would affect demand captured at GFK. The USD-CAD exchange rate also plays a significant factor. Various GFK-specific air service scenarios were analyzed accounting for potential new service using data from the PDA.

Selected forecast methods used for this effort are shown graphically in **Exhibit 3-9**. After analyzing the forecast methods, traditional forecast methods such as historical trends and regression are not recommended because of the new air service added at GFK since 2008. The air service method of forecasting is recommended.

Air Service Scenario #1 would be a conservative growth scenario. This scenario features additional capacity in the mid-term, and another new route in the long-term. Delta would transition its fleet to CRJ-900 aircraft and generally provide the same number of available seats.

Air Service Scenario #3 considers a high growth scenario. The scenario includes strong growth from Allegiant Airlines as well as new service to hub airports from United and American Airlines' regional affiliates. Delta would transition to the 76-seat CRJ-900 aircraft and add capacity with six daily flights, one of which would be upgraded to a 110-seat Boeing 717.

Air Service Scenario #2, using the 2012 PDA and adjustments for 2015-2016 enplanement trends, is the recommended forecast for passenger enplanement growth at GFK. This scenario is described below:

- Air Service Scenario #2 (Medium Growth):
 - Short-term: No significant changes in service levels or available seats from 2015, with some adjustments for improving load factors. From 2014, the average growth rate is 0.15 percent annually for the short-term.
 - Mid-term: Delta transitions to all 76-seat CRJ-900 aircraft for five daily flights to MSP. Allegiant adds a new Florida destination with twice-weekly service on an Airbus A320. Average growth rate is 2.95 percent annually for the mid-term.



- Long-term: Delta continues to increase capacity with a sixth daily CRJ-900 flight to MSP, and United adds service 10 times per week to Denver or Chicago-O'Hare in a CRJ-700. Allegiant adds a new twice-weekly service to Los Angeles on an Airbus A319. Average growth rate is 2.60 percent annually for the long-term.

The proposed airport enplanement forecast along with comparisons to the local and national FAA enplanement forecast is shown in the GFK Passenger Enplanements Forecast Table located below.

Table 3-9 – GFK Passenger Enplanement Forecasts

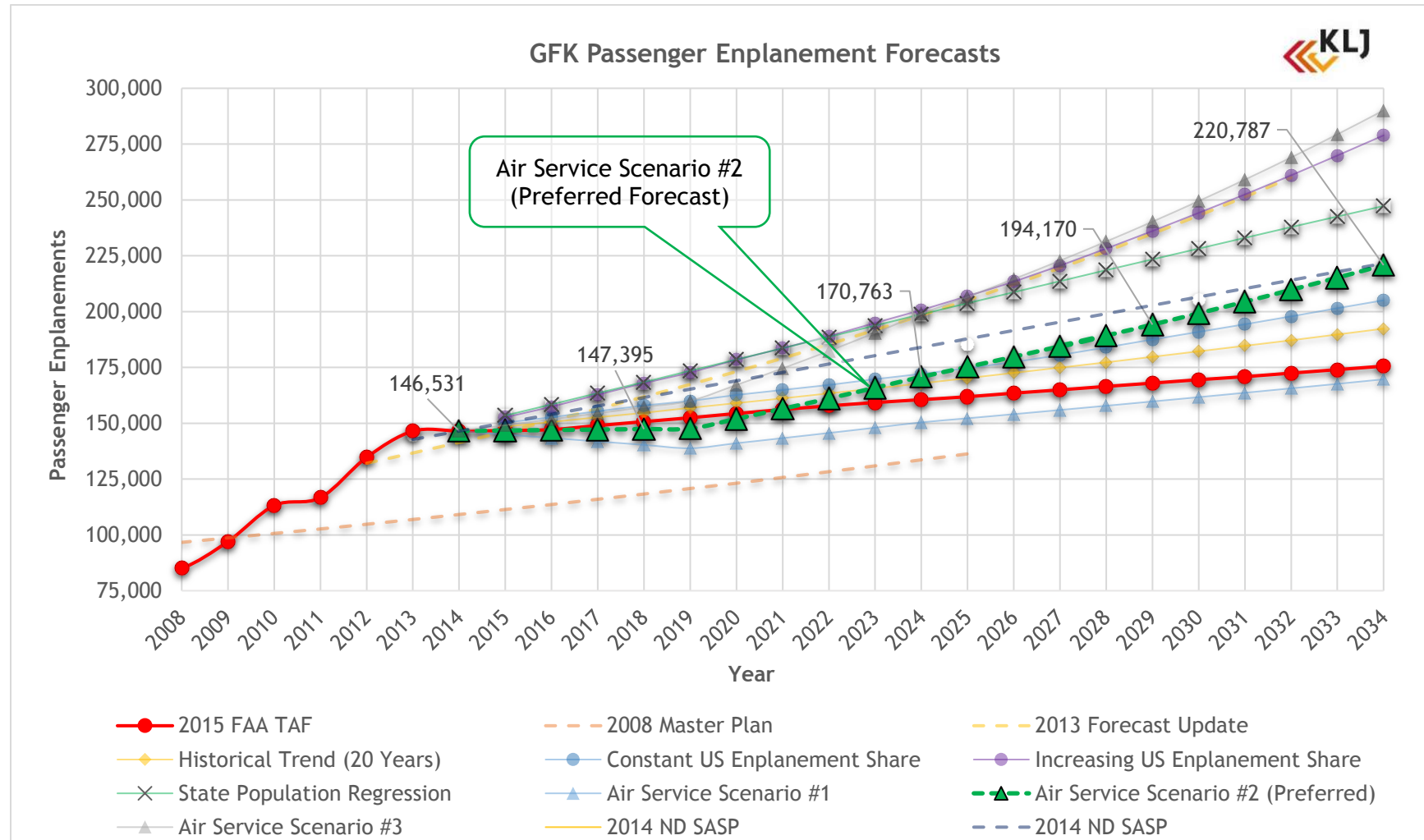
Metric	2014	2019	2024	2034	CAGR
GFK Airport Forecast	146,531	147,612	170,763	220,787	2.07%
U.S. Domestic Enplanements (in millions)	668.3	729.5	784.9	935.3	1.69%
GFK Market Share	0.022%	0.020%	0.022%	0.024%	-

Source: [FAA Aerospace Forecasts 2015-2035](#), KLJ Analysis

The preferred forecast yields an average annual growth rate of 2.07 percent for a total of 220,787 enplanements at the end of the 20-year planning period. Growth is anticipated as a result of additional capacity to existing destinations and new service to leisure destination in the mid-term, and to a hub airport in the long-term. This service is supported by existing true market passenger demand and GFK's proximity to Canada supporting service to additional leisure destinations. This scenario assumes the USD-CAD exchange rate improves for Canadians and GFK retains a higher percentage of passengers within the catchment area to support new air service.



Exhibit 3-10 – GFK Passenger Enplanement Forecasts



Source: [FAA Terminal Area Forecast](#) (January 2016), [FAA Aerospace Forecasts 2015-2035](#), Woods & Poole Economics, 2012 GFK Passenger Demand Analysis, 2013 GFK Forecasts of Aviation Demand, 2008 Airport Master Plan, KLJ Analysis



Passenger Aircraft Operations

Commercial aviation consists of civil aviation that involves operating an aircraft for hire to transport passengers or cargo. These operations are scheduled or unscheduled. Commercial operations forecasts include aircraft operations and the classification of passenger enplanements. A Passenger Operation is a takeoff or landing of an aircraft with more than nine seats conducting a commercial passenger carrying operation on a scheduled or unscheduled basis.



Commercial Passenger Operations at GFK Terminal

In general, according to FAA definitions, commercial aircraft are defined as air carrier or air taxi/commuter. Air carrier aircraft provide scheduled passenger service in more than 60 seat aircraft. Air taxi/commuter aircraft provide on-demand flights in 60 or fewer seats or 18,000 or fewer pounds of cargo. These definitions apply to both passenger enplanements and commercial operations. FAA reported a total of 101,288 Air Taxi operations, which counts other unscheduled charter aircraft and UND flight training aircraft in the baseline year of 2014. These UND Air Taxi operations represent itinerant aircraft operations only. Local area traffic is classified differently.

Historical Data

GFK scheduled passenger aircraft departure data from the Bureau of Transportation Statistics was analyzed for historical operational trends. Departures in aircraft less than 40 seats are virtually nil as a result of Delta/Northwest regional carriers phasing out the Saab 340 turboprop aircraft from service. Departures in the 50-seat CRJ-200 regional jet are the highest category at GFK. The year 2013 was a peak when United was providing CRJ-200 service to Denver. The use of air carrier aircraft has increased with regular scheduled service in the 76-seat CRJ-900 regional jet (Delta Airlines), 151-199 seat aircraft operated by Allegiant Airlines and the 215-seat Boeing 757-200 also operated by Allegiant.

Table 3-11 – Historical Passenger Aircraft Fleet Mix & Operations

Seating Capacity	2010	2011	2012	2013	2014
Air Taxi/Commuter					
Less Than 40 Seats	0.2%	0.0%	0.0%	0.0%	0.0%
40-60 Seats	76.1%	83.1%	82.5%	85.7%	74.8%
Departures	1,780	2,143	2,126	2,566	1,764
Air Carrier					
61-99 Seats	2.5%	6.0%	0.2%	0.3%	6.8%
100-120 Seats	3.8%	0.0%	0.0%	0.0%	0.0%
121-150 Seats	16.6%	9.7%	5.4%	0.4%	0.6%
151-199 Seats	0.6%	1.2%	11.8%	13.6%	16.5%
200+ Seats	0.0%	0.0%	0.0%	0.0%	1.3%
Departures	551	436	450	428	594
Total Departures					
Departures	2,331	2,579	2,576	2,994	2,358

Source: [Form 41 Traffic Data: T-100 Domestic Segment - Bureau of Transportation Statistics](#)

During the last five years, the average number of seats per departure had been fluctuating with changes in service. A general increase has been noted reflecting new Delta Air Lines service in CRJ-900 aircraft, Allegiant Airlines service in larger aircraft, and a general effort by airlines to fill aircraft by changing flight frequency. The passenger load factor, the measure of the number of passenger seats as



compared to the available seats, increased overall the past five years to 85.39 percent in 2014. In 2015, however, the BTS-reported load factor dropped to 80.14 percent.

Table 3-12 – Passenger Aircraft Flight Analysis

Metric	2010	2011	2012	2013	2014
Air Taxi/Commuter					
Total Seats Available	88,920	107,134	106,294	128,285	88,140
Total Departures	1,780	2,143	2,126	2,566	1,764
Avg. Seats Per Departure	49.96	49.99	50.00	49.99	49.97
Avg. Passengers Per Departure	36.55	36.45	36.61	34.59	42.67
Passenger Load Factor	73.17%	72.90%	73.22%	69.20%	85.39%
Air Carrier					
Total Seats Available	70,332	53,996	70,458	69,279	85,310
Total Departures	551	436	450	428	594
Avg. Seats Per Departure	127.64	123.84	156.57	161.87	143.62
Avg. Passengers Per Departure	96.77	96.39	135.88	141.46	119.97
Passenger Load Factor	75.81%	77.83%	86.78%	87.39%	83.53%
Total					
Total Seats Available	159,252	161,130	176,752	197,564	173,450
Total Departures	2,331	2,579	2,576	2,994	2,358
Avg. Seats Per Departure	68.32	62.48	68.61	65.99	73.56
Avg. Passengers Per Departure	50.79	46.58	53.95	49.87	62.14
Passenger Load Factor	74.34%	74.56%	78.63%	75.58%	84.48%

Source: [Form 41 Traffic Data: T-100 Domestic Segment - Bureau of Transportation Statistics](#)

Note: Some numbers may not add up due to rounding

Passenger load factors have been increasing nationwide with the average domestic load factor increasing from 80.4 to 84.4 percent in the past five years. With the growth of Allegiant Airlines with historically high load factors, GFK's overall passenger load factor currently is higher than the national average at 84.5 percent. Air taxi/commuter load factors increased dramatically in 2014.

The average size of the aircraft has increased with the introduction of larger airplanes from Allegiant Airlines and the CRJ-900 by Delta. Even with passenger growth, the increase in the average size of aircraft has translated into a relatively steady number of commercial aircraft operations. In 2015, the CRJ-900 operated at GFK a total of 1,102 operations as compared with 318 operations in 2014.

Also of note is a significant discrepancy in the year 2014 data between how passengers are counted between air taxi/commuter and air carrier. FAA's current definition of regional air taxi/commuter flights is 60 seats or less. Air carriers would be defined as aircraft greater than 60 seats, which would include operations in the CRJ-900 regional jet. The FAA's figures do not match up with actual aircraft seat size. For this analysis, the 60-seat cutoff is used for this study.

Forecasts

The commercial operations forecast for GFK will take into account both new airline service anticipated at GFK, as well as changes in the industry aircraft fleet mix.

Over the next 10 years, regional airlines are expected to retire the CRJ-200 aircraft. This effort is being completed due to the number of takeoff/landing cycles and relative poor fuel efficiency compared to higher capacity regional jet aircraft. A continued period of lower fuel prices may slow this transition. This transition has begun at Delta with two daily routes transitioning to a larger CRJ-900 aircraft at GFK. This change results in fewer aircraft operations assuming the same number of available



seats. Any new route established at GFK to a hub airport in the long-term is expected to be operated in a 65 to 76-seat regional jet.

Allegiant Airlines caters to high capacity aircraft to accommodate leisure travelers on a limited frequency basis. This business model is expected to continue at GFK with increased service frequency to serve existing routes to Las Vegas, Phoenix and Orlando and new routes to Florida or Los Angeles in the long-term. Based on new aircraft orders, the overall fleet is expected to transition to Airbus A319/A320 aircraft. The 215-passenger Boeing 757-200 may still be flown on occasion to serve periods of higher demand through the mid-term.

Table 3-13 – Passenger Airline Fleet Mix Forecast (Operations)

Seating Capacity	2014	2019	2024	2034
Air Taxi/Commuter (<60 seats)				
Less Than 40 Seats	0.0%	0.0%	0.0%	0.0%
40-60 Seats	74.8%	40.0%	14.7%	0.0%
Total Air Taxi/Commuter	74.8%	40.0%	14.7%	0.0%
Air Carrier (>60 seats)				
61-99 Seats	6.8%	38.8%	56.4%	64.5%
100-120 Seats	0.0%	0.2%	0.2%	10.3%
121-150 Seats	0.6%	0.8%	1.0%	1.0%
151-199 Seats	16.5%	19.4%	27.0%	24.2%
200+ Seats	1.3%	0.7%	0.7%	0.0%
Total Air Carrier	25.2%	60.0%	85.3%	100.0%

Source: [Form 41 Traffic Data: T-100 Domestic Segment - Bureau of Transportation Statistics](#)

Note: Some numbers may not add up due to rounding

As a result of industry changes, the air taxi/commuter passenger commercial operations are expected to be completely replaced by air carrier operations by the end of the planning period.

The forecast number of enplanements and fleet mix are used to develop air carrier and air taxi/commuter passenger airline operations projections. The current passenger load factor at GFK is 84.5 percent. FAA Aerospace Forecasts project domestic revenue passenger load factors will increase from a national average of 84.4 percent to 85.7 percent in the planning period. The 2015 GFK load factor was 80.14 percent. Load factor downturns in 2015 are forecast to rebound slightly in the short-term to 82 percent. GFK's mid-term and long-term load factor is expected to grow at a similar rate to the national average.



Table 3-14 – Passenger Airline Flight Analysis Forecast

Metric	2014	2019	2024	2034	CAGR
Air Taxi/Commuter (<60 seats)					
Total Enplanements	74,479	34,859	12,790	0	-100.0%
Total Departures	1,745	850	308	0	-100.0%
Total Operations	3,490	1,700	616	0	-100.0%
Average Seats Per Departure	50.0	50.0	50.0	0.0	-100.0%
Air Carrier (>60 seats)					
Total Enplanements	72,052	112,753	157,973	220,787	5.76%
Total Departures	633	1,275	1,787	2,549	7.21%
Total Operations	1,267	2,551	3,575	5,097	7.21%
Average Seats Per Departure	136.2	107.8	106.5	101.9	-1.44%
Total					
Total Seats (est.)	173,458	180,015	205,738	259,749	2.04%
Total Enplanements	146,531	147,612	170,763	220,787	2.07%
Passenger Load Factor	84.48%	82.00%	83.00%	85.00%	0.03%
Total Departures	2,378	2,126	2,096	2,549	0.35%
Total Operations	4,756	4,251	4,191	5,097	0.35%
Average Seats Per Departure	73.6	84.7	98.2	101.9	1.64%

Source: [Form 41 Traffic Data: T-100 Domestic Segment - Bureau of Transportation Statistics, FAA Terminal Area Forecast](#) (January 2016), KLJ Analysis

Note: Some numbers may not add up due to rounding

The preferred forecast yields total commercial passenger operations growing at a 0.39 percent annual growth rate, as compared to enplanements growing at 2.07 percent annually. Air carrier enplanements are forecast to replace all air taxi/commuter enplanements, indicating all scheduled passenger commercial aircraft will be greater than 60 seats in size. The average size of each scheduled passenger commercial departure will increase from 73.6 seats to 101.9 seats per departure as the 50-seat regional jet is retired.

Air Cargo

Transporting materials and goods can be accomplished by air, truck, rail, water or a combination of modes. Products that are high value, light weight and time sensitive typically drive air cargo demand. Cargo can be carried on dedicated air freight aircraft or in the belly of commercial service aircraft.

FedEx moved its air operations from GFK to Fargo's Hector International Airport in November 2016. This is expected to have a significant effect on air cargo activity at GFK, including mainline as well as feeder aircraft that rely on FedEx. Activity forecasts have been updated to reflect this recent change.



FedEx Airbus A300 (Airliners.net)

Historical Activity

GFK currently serves as the regional air cargo hub for FedEx. The airport is also a regular destination for UPS and other contract cargo carriers. FedEx shipping operations are based on the southwest portion of the airfield. FedEx air cargo is delivered in mainline aircraft such as the Airbus A300 from their hub in Memphis, TN. Air cargo for FedEx is transferred from mainline aircraft to ground vehicles and feeder aircraft to deliver to regional communities. Contract carriers such as Corporate Air (FedEx),



Mountain Air Cargo (FedEx), Encore Air Cargo (UPS) and Alpine Air Cargo (UPS) fly various regional contract cargo routes through GFK. GFK does not serve as a significant air mail destination.

Demand has increased air cargo freight through GFK's FedEx regional hub. Through contract carriers, FedEx serves several destinations from GFK including but not limited to Minot, Williston, Bismarck, Dickinson and Fargo in North Dakota. Other destinations include Thief River Falls, MN, Bemidji, MN and Winnipeg, Manitoba. The busiest feeder route is to Bismarck with 10 departures from GFK per week. On a typical busy weekday there are two daily arrivals in FedEx mainline aircraft, one in the early morning and one in the late-afternoon. There are several daily feeder aircraft departures from GFK, most of them concentrated in the early morning.

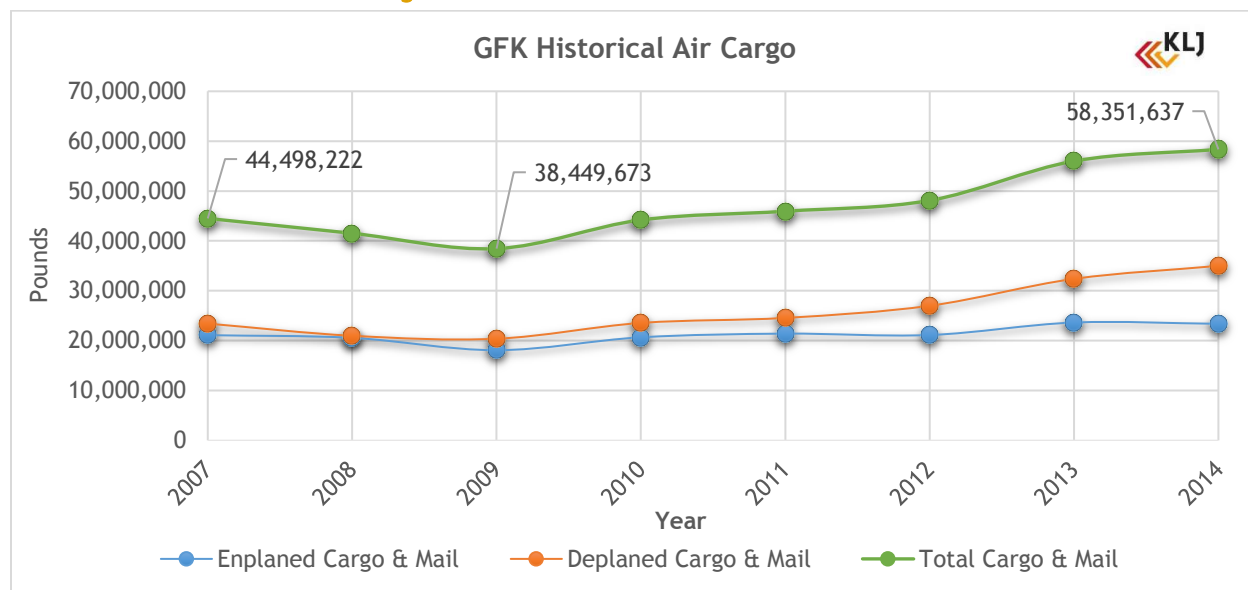
According to Bureau of Transportation Statistics data, total enplaned and deplaned air freight and mail at GFK has increased 8.70 percent annually for the past five years. This total cargo reflects the growing economy of North Dakota. Total GFK air cargo hit a low in 2009 as a result of the economic recession which affected overall demand.

Table 3-15 – Historical Air Cargo Freight & Mail

Year	Freight & Mail (lbs.)
2007	44,498,222
2009	38,449,673
2014	58,351,637
Historical CAGR	3.94%

Source: [Form 41 Traffic Data: T-100 Domestic Segment - Bureau of Transportation Statistics](#)

Exhibit 3-16 – Historical Air Cargo



Source: [Form 41 Traffic Data: T-100 Domestic Segment - Bureau of Transportation Statistics](#)

Total air cargo processed at GFK has increased at an average rate of 3.94 percent annually since 2007. Total operations from GFK have increased 2.45 percent annually over the past five years indicating additional cargo payload per flight. Air cargo operations in air carrier aircraft have decreased by nearly 22 percent indicating larger cargo aircraft types are being flown. Since 2013, FedEx has replaced their older Boeing 727 aircraft with a mix of newer and higher payload Boeing 757-200, Airbus A310 and Airbus A300 aircraft into the GFK market. In 2015 the vast majority of these flights were performed in the Airbus A300 and A310 aircraft, with only 24 annual operations in the Boeing 757-200 aircraft.



Table 3-17 – Air Cargo Aircraft Fleet Mix & Operations

Aircraft Type	2010	2011	2012	2013	2014	2015
Air Carrier						
Airbus A300-600F	0	0	0	3	396	917
Airbus A310	0	0	0	47	236	366
Boeing 757-200	1,228	1,199	1,205	1,435	324	24
Boeing 727-200	36	35	58	24	0	0
ATR-72 Turboprop	0	0	0	2	32	23
Total Air Carrier	1,264	1,234	1,263	1,511	988	1,330
Air Taxi						
ATR-42	2	3	8	5	54	408
Cessna 208 Caravan	4,474	4,068	4,509	4,721	4,822	3,170
Beechcraft 1900	592	586	611	709	1,088	1,460
Metroliner III, Other	671	782	1,590	1,114	815	N/A
Total Air Taxi	5,739	5,439	6,718	6,549	6,779	N/A
Total Cargo Operations	7,003	6,670	7,981	8,060	7,739	N/A

Source: [FAA Traffic Flow Management System Counts \(TFMSC\)](#). 2015 data added for reference.

Note: Some numbers may not add up due to rounding

Air cargo feeder aircraft operations are classified as air taxi operations. These operations are performed in aircraft with a maximum payload capacity of 18,000 pounds or less. The majority of the operations are conducted in Cessna 208 Grand Caravan turboprop aircraft operated for FedEx. Data from 2015 shows a shift to the larger ATR-42 aircraft with over 400 annual operations. Feeder operations have historically grown to support the additional cargo tonnage with little change in aircraft fleet mix.

Forecast

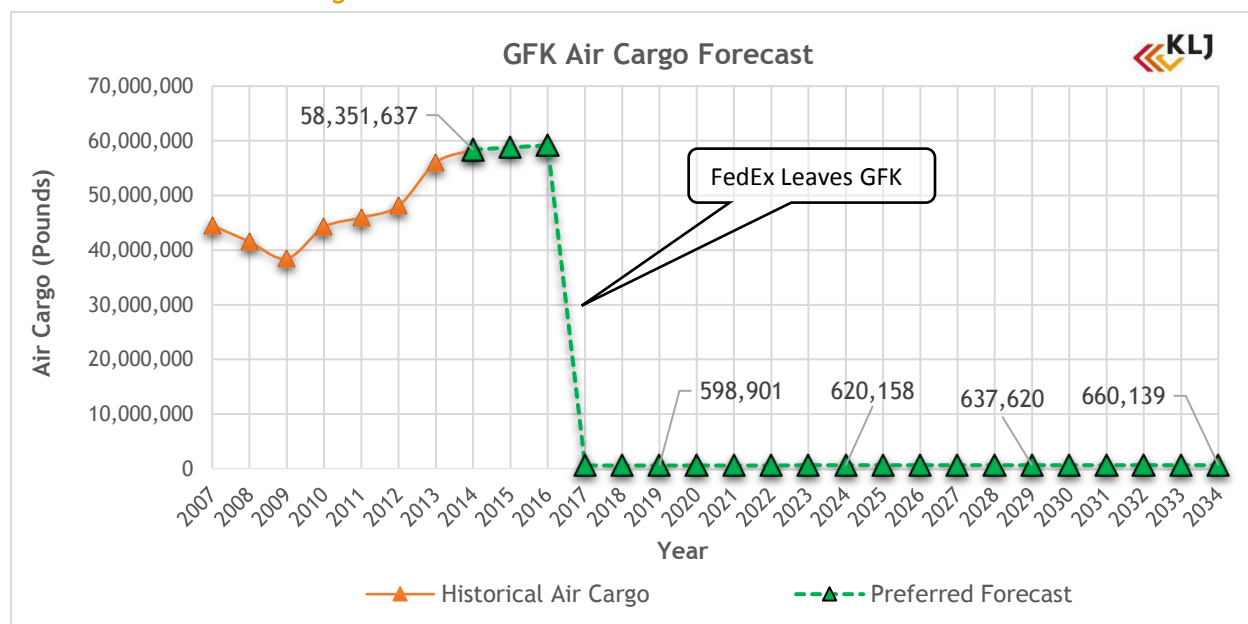
According to FAA Aerospace Forecasts 2015-2035, revenue-ton miles (RTM) flown by domestic U.S. all-cargo carriers is forecast to grow by 0.70 percent annually for the next 20 years. Several forecasting methods were reviewed for trends. In light of FedEx leaving GFK, traditional forecast methods are not applicable.

The GFK forecast of total processed air cargo assumes FedEx will move its operations to Fargo in the short-term by 2017. No significant new operation is expected in the future. Remaining processed mainline air cargo at GFK is expected to occur from on-demand operations only. Total air cargo at GFK is expected to be a fraction of what the airport has handled historically.

The preferred forecast assumes steady growth will continue at GFK matching national RTM growth trends of 0.70 percent average annual growth rate. The new baseline for processed mainline air cargo is expected to be around 600,000 pounds in total derived from on-demand cargo processing.



Exhibit 3-18 – GFK Air Cargo Forecast



Source: [Form 41 Traffic Data: T-100 Domestic Segment - Bureau of Transportation Statistics](#), KLJ Analysis

Table 3-19 – Air Cargo Forecast

Metric	2014	2019	2024	2034	CAGR
Total Enplaned & Deplaned Cargo	58,351,637	598,901	620,158	660,139	-20.08%

Source: KLJ Analysis

The above forecast should be used for broad planning purposes as much of the air cargo actually processed is not tracked for feeder aircraft using available data.

Operations & Fleet Mix

Overall processed tonnage and air cargo trends correlate with estimated flight operations and fleet mix. Operations in air cargo aircraft are split by FAA into air carrier and air taxi categories. In general, mainline large jet aircraft operated by FedEx are classified as air carrier and smaller feeder propeller-driven aircraft are classified as air taxi. Air cargo operations are not tracked separately by FAA.

Without a regional air cargo hub, the preferred forecast for air carrier operations assumes the fleet mix will transition to only a few mainline FedEx or UPS aircraft to serve on-demand air cargo needs. No operational growth is expected in the future, therefore more cargo per flight is expected.



Encore Air Cargo
Fairchild Metroliner III (Airliners.net)

Much of the smaller feeder aircraft activity was needed to transport freight and mail to/from FedEx flights. With FedEx leaving GFK, feeder air taxi cargo aircraft are expected to transition to feature only regular feeder aircraft for UPS out of the Sioux Falls hub. These flights are expected on turboprop aircraft such as the Fairchild Metroliner III. On-demand flights in the FedEx Cessna 208 Caravan single-engine turboprop are also possible along with other smaller air cargo aircraft. Total air cargo feeder operations are forecast to grow at the same share as national air cargo RTM forecasts.



Table 3-20 – Air Cargo Aircraft Fleet Mix & Operations Forecast

Metric	2014	2019	2024	2034	CAGR
Air Carrier (AC)					
Airbus A300-600F	396	0	0	0	-100.00%
Airbus A310	236	0	0	0	-100.00%
Boeing 757-200	324	10	10	10	-15.96%
ATR-72 Turboprop	32	0	0	0	-100.00%
Total AC	988	10	10	10	-20.52%
Air Taxi (AT)					
ATR-42 Turboprop	54	0	0	0	-100.00%
Turboprop	6,577	634	656	704	-10.52%
Multi-Engine Piston	87	51	53	56	-2.15%
Turbojet	135	127	131	141	0.21%
Total AT	6,799	811	840	901	-9.60%
Total					
Total Cargo Operations	7,767	821	850	911	-10.16%
Total Freight & Mail	58,351,637	598,901	620,158	660,139	-20.08%
Cargo Per AC Operation	59,060	59,890	62,016	66,014	0.56%

Source: KLJ Analysis

Note: Some numbers may not add up due to rounding

Other Commercial Operations

Background

Other commercial forecasts involve aircraft used for on-demand passenger and cargo operations. These operators provide a for-profit service, typically unscheduled charter or air taxi flights operated under Federal Aviation Regulation (FAR) Part 135 with nine or fewer seats. Corporations that operate their own aircraft for in-house business flights are classified as General Aviation. For purposes of consistency with FAA guidance only itinerant (point-to-point) operations are evaluated.



Valley Med Flight Fixed-Wing Airplanes

AIR CHARTER

Numerous operators operate commercial services to and from GFK including on-demand air charter operators. These operators are hired to transport people and goods by air. Operators are located nationwide. An example of a commercial operator based at GFK is Valley Med Flight who provides providing on-demand medical evacuation flights to the region.

UNIVERSITY OF NORTH DAKOTA

The John D. Odegard School for Aerospace Sciences at UND runs an extensive flight training school from GFK. The aviation department is known around the world. The school attracts aerospace students worldwide for flight training. International flight training resumed at UND in 2007 for Far Eastern Air Transport and Tokai University. As of September 2015, UND owns and operates a fleet of 96 airplanes. Much of their fleet includes single-engine, multi-engine and helicopter used for pilot flight training. Many students continue to complete their flight training at GFK, however in the past five years, satellite campuses have been expanded regionally and around the country to accommodate the demand. Since



UNIVERSITY OF NORTH DAKOTA



2005, these flight training operations began to be classified as commercial air taxi operations by the FAA.

Currently there is a shortage of pilots to fulfill aviation needs in the United States. This is projected to continue and worsen over time. UND Aerospace is on the forefront of providing world-class flight training to pilots combined with a four-year degree.

Historical Data

According to FAA data, from 2005 through 2015 total nationwide air taxi and commuter operations declined by 28 percent. Much of this decline is driven by the commercial airline industry's reduction in flight frequency.

UND flight training activity makes up the vast majority of operations at GFK. UND flight training total hours reached a peak in 2013 (July 1, 2013 - June 30, 2014) with 97,721 total flight hours. Much of this growth is attributed to international students. The peak achieved in 2013 represents 88 percent growth from a 15-year low of 51,840 flight hours seen in 2007. According to UND, total demand for flight hours in 2014 was around 95,000 however there were not enough flight instructors to meet demand. Total flight hours correspond well to total airport operations.

Based on the FAA and UND activity data, GFK's estimated historical annual air taxi operations are indicated below, excluding scheduled passenger and air cargo flights.

Table 3-21 – Other Commercial Itinerant Operations Metrics

Type	2010	2011	2012	2013	2014	CAGR
UND Flight Training Hours	96,685	90,563	87,522	97,721	89,964*	-1.79%
Other Commercial Operations	84,698	88,147	91,326	96,842	91,031	1.82%
Non-UND Other Comm. Ops.	620	1,041	1,009	1,059	1,056	14.24%

Source: University of North Dakota, [FAA Traffic Flow Management System \(TFMS\)](#), KLJ Analysis

*Actual 2014 demand estimated at 95,000 hours

NOTE: Excludes Scheduled Passenger and Cargo Flights. CAGR = Compounded Annual Growth Rate

Total other commercial operations, excluding large air cargo and passenger aircraft, was over 1,000 in 2014 based on FAA Traffic Flow Management System data. These flights are assumed to be itinerant in nature. After a jump in 2011 these flights have been steady.

In 2014, there were an estimated 290,000 annual flight operations at GFK attributed to UND traffic alone. Total UND itinerant flight operations is estimated to be around 90,000 in 2014 by removing other known air taxi operations. This represents takeoffs and landings from outside the local area. Local operations are estimated to be almost exclusively driven by UND flight operations. Local operations totaled 204,073 in 2014. An estimated 98 percent of local operations are generated from UND Aerospace.

Recently released data from 2015 shows a downturn with an estimated 86,203 annual other commercial operations at GFK. This is a 5 percent drop from 2014 activity. The downturn is related to lack of available flight instructors to meet actual demand. This forecast is adjusted to reflect actual 2015 data.



Forecasts

The FAA issues nationwide “Aerospace Forecasts” on an annual basis covering the next 20 years. According to FAA Aerospace Forecasts 2015-2035, forecasts of general aviation and air taxi hours flown is forecast to increase an average of 1.32 percent annually through 2035. The FAA’s activity metric correlates to airport operations.



*University of North Dakota Fleet
(und.edu)*

Much of the preferred forecast at GFK will be driven by the UND flight training operations. According to UND representatives, the maximum number of flight hours before significant airports delays are seen is 100,000. After this point flights experience air traffic control delays. Capacity constraints include the configuration of runways and restricted airspace to the west from the Air Force Base. Traditional student enrollment has been increasing since 2011 and is expected to grow due to pilot shortage forecasted for years to come.

The local demand for air charter activity is difficult to predict. Specific individuals or businesses that require on-demand air service are those that find it more effective to fly to a destination (including GFK) rather than drive or take a commercial flight. As the local economy continues to grow, it is generally predicted so will the demand for commercial air charter flights operating to/from GFK.

OPERATIONS

Other commercial operations forecast numbers are developed by taking the baseline calculated figure and reviewing overall air taxi industry trends to develop a forecast. The preferred forecast method is to use national FAA air taxi and general aviation trends from the FAA Aerospace Forecasts. This method yields a compiled annual growth rate of 1.32 percent modeling activity in smaller aircraft similar to those operating as an air charter.

This forecast represents a constrained scenario for UND Aerospace at GFK. Existing constraints include airspace restrictions, total airfield capacity and the ability for UND Aerospace to staff enough Certified Flight Instructors (CFIs) to meet training demands. Future growth in this scenario is expected to be capped at about 100,000 total flight hours due to airspace and airport constraints.

In this constrained scenario, growth is expected at a 1.32 percent rate from 2015 to 2024 matching FAA national activity trends. After ten years, capacity constraints will restrict growth rates by half for the next five years (0.66 percent). After 15 years there will be no growth in UND operations at GFK. Capacity restrictions may force UND to be selective or move students to other training sites. At this time, significant airfield capacity improvements at GFK are not supported by UND Aerospace alone.

Table 3-22 – Other Commercial Operations Forecast

Metric	2014	2015	2019	2024	2034	CAGR
UND Itinerant	89,966*	85,238*	89,829	95,916	99,123	0.48%
Other Air Charter	1,053	1,067*	1,124	1,201	1,369	1.32%
TOTAL	91,019	86,305	90,953	97,116	100,492	0.49%
UND Local**	199,992*	187,646*	197,751	211,152	218,212	0.44%

Source: University of North Dakota, KLJ Analysis

*Estimated, **Counted under ‘Civil Local’ operations per FAA standards

Note: Some numbers may not add up due to rounding



With no capacity constraints, UND Aerospace operations would be forecast to grow at FAA national growth rates of 1.32 percent from 2015 onward, or an overall 10 percent increase over the constrained scenario in the long-term. The high commercial forecast scenario is described below.

Table 3-23 – Other Commercial Operations Forecast (High Scenario)

Metric	2014	2015	2019	2024	2034	CAGR
UND Itinerant	89,966*	85,238*	89,829	95,916	109,356	0.97%
Other Air Charter	1,053	1,067*	1,124	1,201	1,369	1.32%
TOTAL	91,031	86,305	90,953	97,116	110,725	0.98%
UND Local**	199,992*	187,646*	197,751	211,152	240,739	0.93%

Source: University of North Dakota, KLJ Analysis

*Estimated, **Counted under 'Civil Local' operations per FAA standards

Note: Some numbers may not add up due to rounding

FLEET MIX

The estimated other itinerant commercial aircraft fleet mix is determined based on UND and non-UND aircraft in this operational category. UND aircraft conducting itinerant operations are estimated to be 80 percent single-engine, 15 percent multi-engine and 5 percent helicopter. Of the non-UND other commercial operations the estimated fleet mix is 25 percent turbojet, 23 percent are turboprop, 22 percent piston and 5 percent helicopter.

Table 3-24 – Other Commercial Itinerant Fleet Mix & Operations Forecast

Metric	2014	2019	2024	2034	CAGR
Other Commercial Itinerant					
Single-Engine Piston	72,057	71,953	76,829	79,408	0.48%
Multi-Engine Piston	13,642	13,632	14,555	15,060	0.49%
Turboprop	527	562	600	684	1.32%
Turbojet	242	259	276	315	1.32%
Helicopter	4,551	4,548	4,856	5,025	0.49%
Total Operations	91,019	90,953	97,116	100,492	0.49%

Source: University of North Dakota, [FAA Traffic Flow Management System \(TFMS\)](#), KLJ Analysis

Note: Some numbers may not add up due to rounding

Based Aircraft

A based aircraft is an operational and airworthy aircraft claiming an airport as its home for a majority of the year.

Historical Data

Per the 2015 FAA Aerospace Forecast, from 2009 to 2014 the total number of piston-driven aircraft declined by 2.73 percent annually with turbine-driven aircraft increasing at a 0.94 percent. Deliveries of turbojet aircraft recently had its first increase since 2008. Single engine piston deliveries had its third consecutive year of an increase in aircraft deliveries. The FAA TAF anticipates an annual growth rate of 0.83 percent through 2035. It can be assumed that additional aircraft deliveries yield a constant increase in overall based aircraft in the United States.

Statewide, based aircraft in North Dakota have increased by nearly 66 percent since 1990 according to the FAA TAF, equating to an average annual growth rate 2.14 percent.

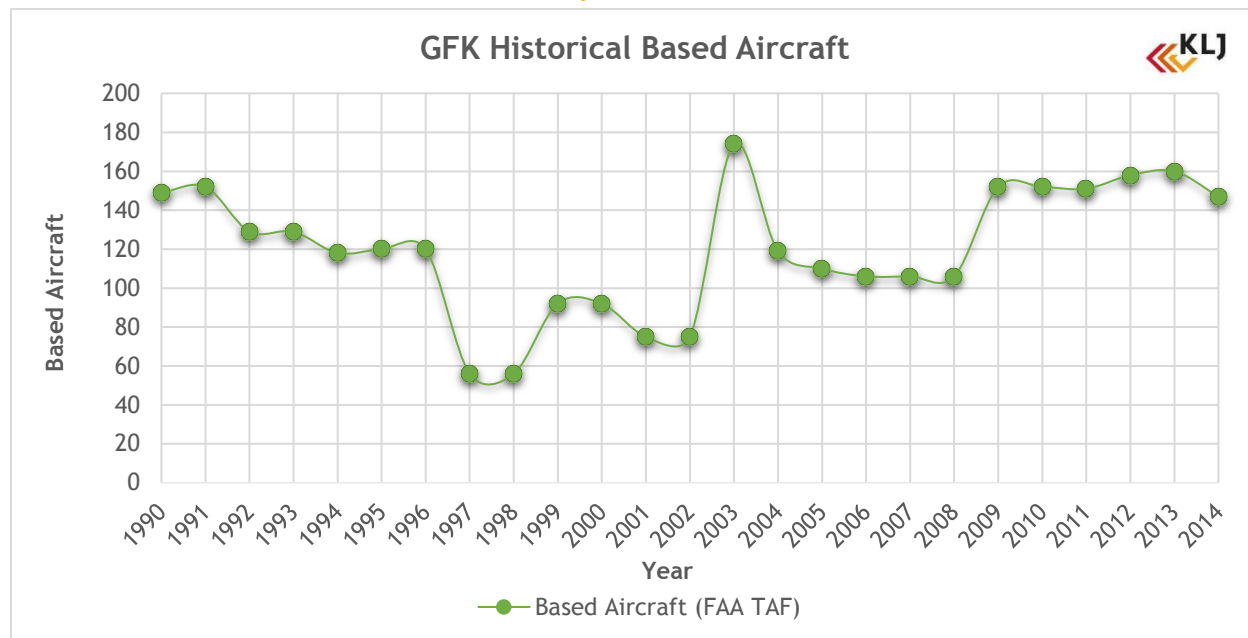
According to the FAA's TAF records, historical based aircraft numbers at GFK has been fluctuating over the years. The drawback of this information from the FAA is the inability to explain why there have



been fluctuations in the data. A chart (Exhibit 3-24) reflecting this historical data shows these variations. Between the years of 1990 and 2013, FAA based aircraft numbers at GFK have increased from 149 to 161. FAA reporting methods have changed over the years. Some pilots may have chosen to sell their aircraft; some may have moved or claimed another geographical location as their base.

According to [FAA Form 5010-1, Airport Master Record](#) using data from June 2014 there are currently 147 aircraft reported based at GFK. This is the best available data therefore 147 will be the established baseline for this forecast. This based aircraft count also matches the FAA TAF (January 2016) and figures from year 2014.

Exhibit 3-25 – Historical FAA TAF Based Aircraft



Source: [FAA Terminal Area Forecast](#), [FAA Form 5010-1 Airport Master Record](#)

Table 3-26 – Based Aircraft Fleet Mix

Aircraft Type	Based Aircraft	Percent of Total
Single-Engine	95	64.6%
Multi-Engine	21	14.3%
Jet	19	12.9%
Helicopter	12	8.2%
Ultralight/Other	0	0.0%
Total Based Aircraft	147	100.0%

Source: [FAA Form 5010-1 Airport Master Record](#)

Forecast

Nationwide, the FAA TAF projects overall based aircraft to increase 0.85 percent annually through year 2040. FAA estimates for the State of North Dakota are similar with an increase of 0.76 percent annually for the same time period. The latest State Aviation System Plan (SASP) update concluded that based aircraft in North Dakota will increase on average 1.11 percent annually through year 2035. Locally, the 2013 GFK Forecasts of Aviation Demand projected a growth rate of 1.53 percent annually.



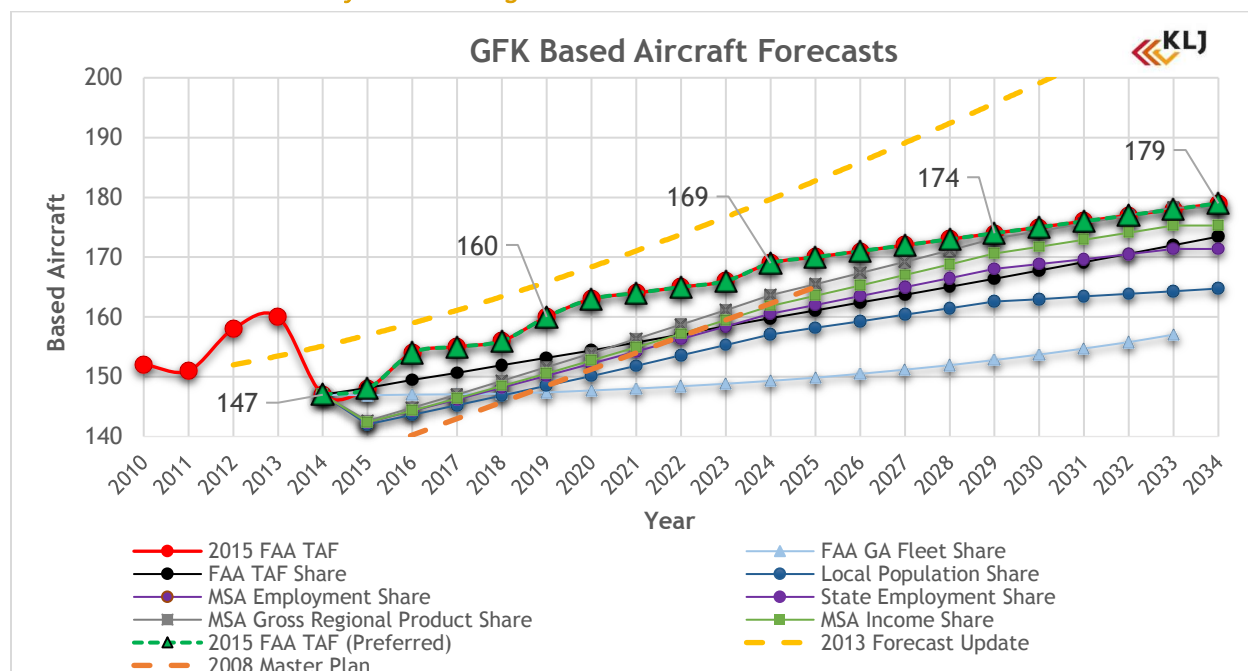
The highest growth sectors in total aircraft types nationally are turboprop, turbojet, rotorcraft, experimental and sport aircraft. Overall single-engine and multi-engine piston aircraft are forecast to decline.

The proposed based aircraft forecast involves a few key elements, with the first one being the FAA's January 2016 TAF projections through 2034. The TAF shows based aircraft growth from 147 to 179 equating to a 0.99 percent annually growth rate, higher than the FAA's estimate for nationwide based aircraft growth of 0.85 percent annually. The SASP excerpt for GFK forecasts a 1.21 percent annual based aircraft growth rate.

One forecasting method is to look individually at UND Aerospace and other based aircraft. In September 2014 UND based 99 aircraft at GFK, or 67 percent of the total GFK based aircraft. It is forecast UND Aerospace based aircraft will reflect the same rate as UND flight hours assuming steady aircraft utilization, which is one aircraft for every 909 flight hours. The remaining number of based aircraft would then be forecasted by reviewing local and regional socioeconomic elements including population, employment, gross regional domestic product and income trends. Forecasting methods utilized to estimate non-UND aircraft include trend and share analysis of available data. These methods were then combined with the UND aircraft forecast to develop overall based aircraft forecast methods. This method results in 175 based aircraft at the end of the planning period.

The analysis completed in this study falls in-line with the same trends as the FAA's Terminal Area Forecast (TAF). As a result, the preferred forecast method is to accept the FAA TAF from January 2016 in order to maintain consistency. The calculated growth rate is 0.98 percent annually for a total of 179 based aircraft at the end of this study's planning period. Based aircraft growth rate is forecast to be greater than national FAA averages.

Exhibit 3-27 – Based Aircraft Forecasting Methods



Source: KLJ Analysis, [FAA Terminal Area Forecast](#)

The forecast based aircraft fleet mix is shown in the following table. Growth assumes turbojet aircraft will grow at a higher rate based on national trends.



Table 3-28 – Based Aircraft Forecast

Metric	2014	2019	2024	2029	2034	CAGR
Single-Engine*	95	104	110	112	115	0.97%
Multi-Engine*	21	23	25	25	25	0.94%
Jet	19	21	23	24	26	1.64%
Helicopter	12	12	12	12	13	0.28%
Ultralight/Other	0	0	0	0	0	-
Total Based Aircraft	147	160	169	174	179	0.99%

Source: KLJ Analysis. CAGR = Compounded Annual Growth Rate

*Includes both piston and turboprop driven aircraft for FAA reporting purposes.

In an unconstrained UND Aerospace high forecast scenario, based aircraft would grow to keep pace with flight training activity. This would lead to the acquisition of 21 additional aircraft. The high forecast is identified in the following table, which uses data from 2015 activity trends as a revised baseline.

Table 3-29 – Based Aircraft Forecast (High Scenario)

Metric	2014	2019	2024	2029	2034	CAGR
Single-Engine*	95	98	105	113	121	1.21%
Multi-Engine*	21	21	23	25	26	1.08%
Jet	19	20	22	24	26	1.60%
Helicopter	12	11	12	12	13	0.60%
Ultralight/Other	0	0	0	0	0	-
Total Based Aircraft	147	151	162	174	187	1.20%
UND Fleet	99	99	105	113	120	0.97%
Other	48	52	56	62	66	1.63%

Source: KLJ Analysis. CAGR = Compounded Annual Growth Rate

*Includes both piston and turboprop driven aircraft for FAA reporting purposes.

General Aviation

General Aviation (GA) is non-commercial aviation activity not classified in another category. At airports with a local Air Traffic Control Tower (ATCT) like GFK, takeoffs and landings (operations) are counted and classified. GA operations are split into two categories: Civil local and GA itinerant.

Local operations are performed by aircraft that remain in the local traffic pattern and stay within a 20-mile radius. These operations typically include practice landings, touch-and-go operations, practice approaches and maneuvering within the local area in non-military aircraft. Local operations are usually performed by recreational and flight training aircraft. Civil local operations at GFK are almost entirely conducted by UND flight training aircraft.

Itinerant operations are performed by a landing aircraft arriving from outside the airport area (20 miles) or a departing aircraft that leaves the airport area. Itinerant operations are conducted in all types of aircraft. Non-commercial GA activity is considered by FAA to be non-UND aircraft.

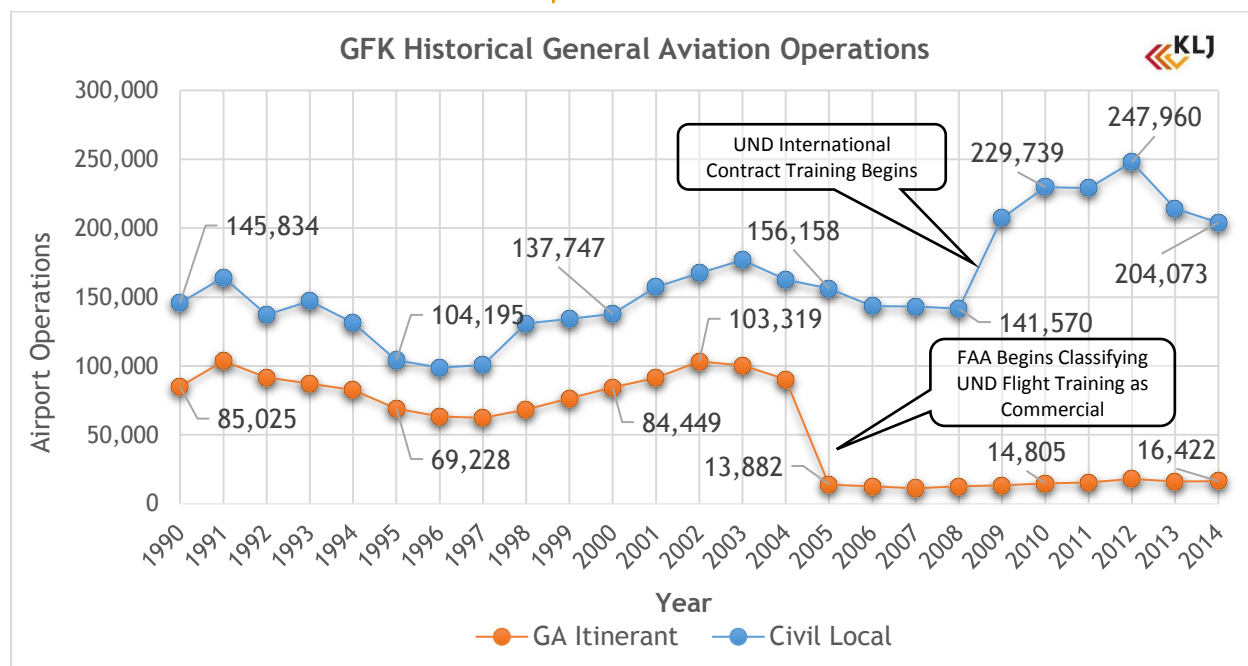
Historical Data

The 2015 FAA Aerospace Forecasts reported total general aviation and air taxi hours flown nationally have decreased a total of 17.2 percent from 2007 to 2014. This is a general measure of activity. At towered airports, total operations have decreased by 22.6 percent nationally. A total of 54.5 percent of general aviation operations nationally is considered itinerant.



GFK has seen increasing civil local activity since 2008 when international contract training began for UND. This activity peaked in 2012 with 247,960 civil local operations. Since 2005, GA itinerant classification reflects only non-UND activity. This number increased since a low point in 2007 by nearly 46 percent to 16,422 annual operations, equating to a 1.88 percent average annual growth rate. GA itinerant operations peaked in 2013 with over 18,000 annually.

Exhibit 3-30 – Historical General Aviation Operations



Source: [FAA Air Traffic Activity Data System \(ATADS\)](#)

Forecast

GENERAL AVIATION ITINERANT

The FAA TAF (January 2016) estimates national GA itinerant operations will increase nationally by 0.35 percent annually through the 20-year planning period. The FAA Aerospace Forecasts predicts total general aviation hours flown to increase by 1.4 percent annually for the next 20 years, mostly in turboprop, turbojet, rotorcraft, experimental and sport aircraft types.

For GFK, the FAA TAF (January 2016) forecasts GA itinerant activity to drop to around 12,000 annual operations in 2016 then increase back to nearly 17,000 annually in year 2034 for an average annual growth rate of 0.14 percent. The 2014 North Dakota SASP projects a 1.21 percent annual operations growth rate.

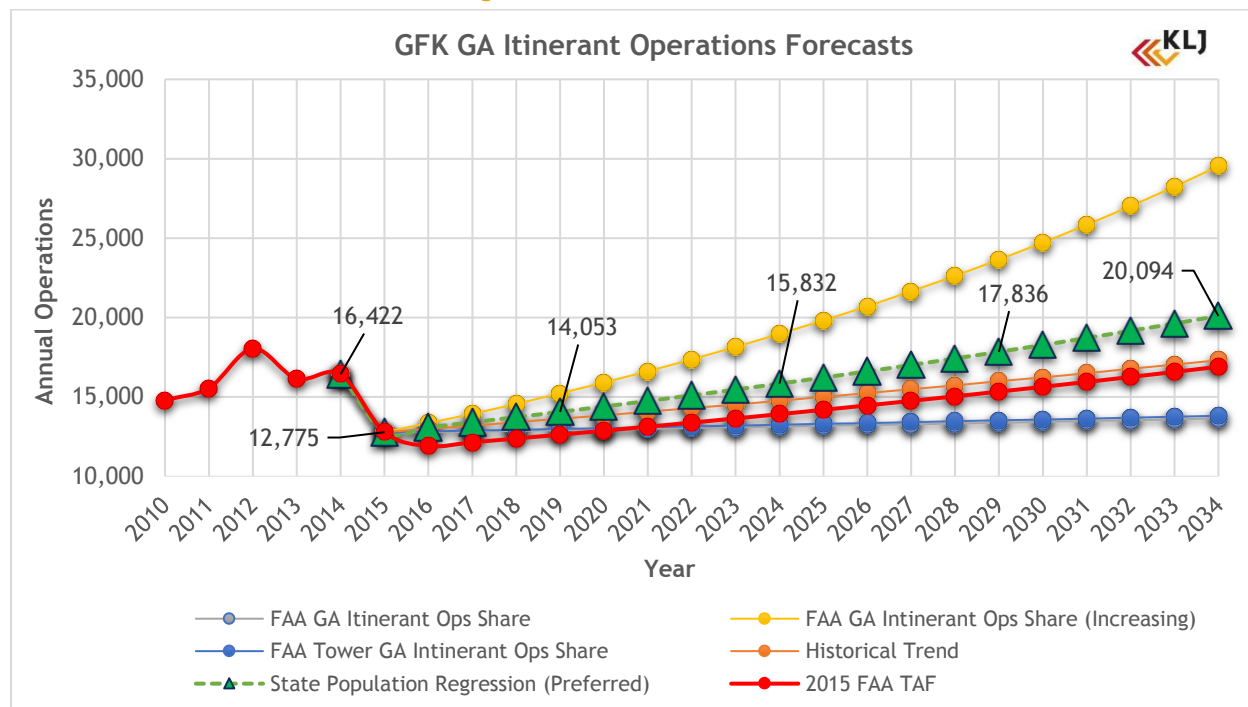
GA itinerant operations are non-UND traffic, thus this figure is expected to be reflective of local and regional socioeconomic elements including population, employment, gross regional product and income trends. A regression evaluation showed that State Population provides the highest correlation of socioeconomic factors. Other methods utilized include trend and share analysis of available data.

Actual 2015 figures recently released show a downturn with 12,775 annual GA itinerant operations at GFK. This forecast baseline is adjusted to reflect actual 2015 data.



The preferred forecast method for GA itinerant operations is the State population regression model growth rate. This model averages 2.41 percent annual growth for the planning period beyond 2015. The 20-year average growth rate is 1.01 percent from year 2014.

Exhibit 3-31 – GA Itinerant Forecasting Methods



Source: KLJ Analysis, [FAA Terminal Area Forecast](#) (January 2016)

Table 3-32 – General Aviation Itinerant Operations Forecast

Metric	2014	2015	2019	2024	2034	CAGR
Total GA Itinerant Operations	16,442	12,775	14,053	15,832	20,094	1.01%

Source: KLJ Analysis. CAGR = Compounded Annual Growth Rate

CIVIL LOCAL

Nationwide, the FAA TAF (January 2016) estimates total civil local operations will increase nationally by 0.38 percent annually through the 20-year planning period. The FAA Aerospace Forecasts predicts total general aviation hours flown to increase by 1.32 percent annually for the next 20 years.

For GFK, the recently updated FAA TAF forecasts GA civil local activity to drop to below 180,000 annual operations in 2016 then increase back to nearly 225,000 annually in year 2034 for an average annual growth rate of 0.45 percent.

The vast majority of civil local operations are from UND flight training traffic. An estimated 98 percent of local operations are generated from UND. Other civil local traffic is limited due to the sheer volume of airplanes operating in and around GFK. These aircraft are typically flying within the GFK rectangular airport traffic pattern to practice takeoffs and landings. According to tower staff, approximately 90 percent are conducting “touch-and-go” operations to practice landings and remain in the airport traffic pattern.

Actual 2015 figures recently released show an activity downturn with 191,475 annual GA local operations at GFK. This forecast baseline is adjusted to reflect actual 2015 data.



Civil local operations are expected to be reflective of trends from UND Aerospace activity. This was evaluated in the commercial operations section based on national FAA air taxi and general aviation activity trends from the FAA Aerospace Forecast. UND civil local activity represents a constrained scenario for UND Aerospace at GFK. Growth beyond 2015 is expected at a 1.32 percent rate until 2024 matching FAA national activity trends. After 2024, capacity constraints will restrict growth rates by half for the next five years (0.66 percent). After 15 years there will be no growth in UND operations at GFK due to capacity constraints. Non-UND traffic would continue to grow at 1.32 percent annually.

Table 3-33 – Civil Local Operations Forecast

Metric	2014	2015	2019	2024	2034	CAGR
UND Local	199,992*	187,646*	197,751	211,152	218,212	0.44%
Other Civil Local	4,081*	3,830*	4,036	4,309	4,913	0.93%
TOTAL	204,073	191,475	201,787	215,461	223,125	0.45%

Source: University of North Dakota, KLJ Analysis, CAGR = Compounded Annual Growth Rate

*Estimated based on 98% of total civil local traffic

Note: Some numbers may not add up due to rounding

With no capacity constraints, (High Scenario) UND Aerospace airport operations would be forecast to grow at FAA national growth rates of 1.32 percent from 2015. Activity in 2015 was lower than 2014, resulting in a lower net average growth rate. This calculates to 245,652 civil local operations attributed to UND by the end of the forecast period, a 10 percent increase over the constrained forecast.

Table 3-34 – Civil Local Operations Forecast (High Scenario)

Metric	2014	2015	2019	2024	2034	CAGR
UND Local	199,992*	187,646*	197,751	211,152	240,739	0.93%
Other Civil Local	4,081*	3,830*	4,036	4,309	4,913	0.93%
TOTAL	204,073	191,475	201,787	215,461	245,652	0.93%

Source: University of North Dakota, KLJ Analysis, CAGR = Compounded Annual Growth Rate

*Estimated based on 98% of total civil local traffic

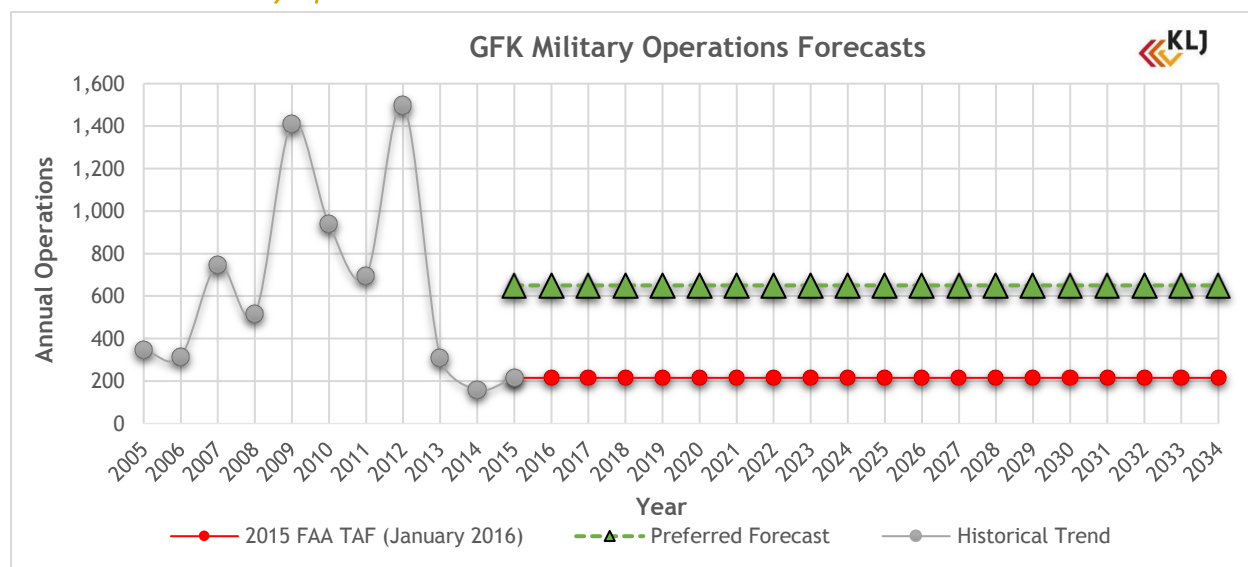
Note: Some numbers may not add up due to rounding

Military

The vast majority of military activity for the Grand Forks area is handled by the Grand Forks Air Force Base located to the west of GFK. There has historically been recorded local and itinerant military operations at GFK. Military aircraft operate from GFK however it is very likely it will not be significant enough to affect airport development or design standards. Military missions are difficult to predict, therefore GFK military operations are forecast to remain steady and follow average figures from the last 10 years through 2015. This assumes the same type of historical activity will occur at GFK. Military operations are estimated to be 56.9 percent itinerant and 43.1 percent local.



Exhibit 3-35 – Military Operations Forecast



Source: KLJ Analysis, [FAA Terminal Area Forecast \(January 2016\)](#)

Military operations are estimated to be 75 percent in small single or multi-engine aircraft. The remaining 15 percent of operations are classified as turboprop or turbojet for military transport. Based on average historical military operations data, between 2005 and 2015, total military operations are forecasted to be approximately 650 on an annual basis through the planning period.

Table 3-36 – Military Operations Forecast Summary

Metric	2014	2015	2019	2024	2029	2034	CAGR
Itinerant Military Operations	154	201	370	370	370	370	-
Local Military Operations	4	14	280	280	280	280	-
Total Operations	158	215	650	650	650	650	-

Source: KLJ Analysis, CAGR = Compounded Annual Growth Rate

Operations Summary

The total annual operations forecast for GFK is summarized in the table below, including a breakdown between operations types.

Table 3-37 – Total Operations Forecast Summary

Metric	2014	2019	2024	2029	2034	CAGR
Commercial Operations	103,543	96,122	102,261	106,029	106,607	0.15%
GA Itinerant Operations	16,422	14,053	15,832	17,836	20,094	1.01%
Civil Local Operations	204,073	201,787	215,461	222,814	223,125	0.45%
Military Operations	158	650	650	650	650	7.33%
Total Operations	324,196	312,613	334,205	347,330	350,477	0.39%
UND Aerospace	289,958	287,676	307,171	317,442	317,442	0.45%
Other Operations	34,238	24,936	27,034	29,888	33,035	-0.18%

Source: KLJ Analysis, CAGR = Compounded Annual Growth Rate

Note: Some numbers may not add up due to rounding



Table 3-38 – Total Operations Forecast Summary (High Scenario)

Metric	2014	2019	2024	2029	2034	CAGR
Commercial Operations	103,543	96,122	102,261	109,325	116,851	0.61%
GA Itinerant Operations	16,422	14,053	15,832	17,836	20,094	1.01%
Civil Local Operations	204,073	201,787	215,461	230,062	245,652	0.93%
Military Operations	158	650	650	650	650	7.33%
Total Operations	324,196	312,613	334,205	357,874	383,248	0.84%
UND Aerospace	289,958	287,676	307,171	327,987	350,213	0.95%
Other Operations	34,238	24,936	27,034	29,888	33,035	-0.18%

Source: KLJ Analysis, CAGR = Compounded Annual Growth Rate

Note: Some numbers may not add up due to rounding

Critical Design Aircraft

The critical design aircraft is identified as the most demanding aircraft or family of aircraft to regularly use the airport. A critical design aircraft type or family must operate at least 500 annual operations at the airport to be considered “regular” use by FAA for improvements to be justified for FAA funding.

Existing

As supported by the 2015 FAA Traffic Flow Management System Counts (TFMSC) data, the overall existing critical design aircraft is a family of airplanes with regular service to GFK. The design airplane has an FAA Airport Reference Code (ARC) of D-IV made up of FAA Aircraft Approach Category (AAC) D with approach speed up to 166 knots and Airplane Design Group (ADG) IV with a wingspan up to 171 feet. The design aircraft has an FAA Taxiway Design Group (TDG) classification of 5 and a maximum takeoff weight of 370,376 pounds in the Airbus A300.

Table 3-39 – Existing Critical Design Aircraft

Aircraft Type (Operator)	2015 IFR Operations	FAA AAC	FAA ADG	FAA TDG	MTOW	MLW
Boeing 737-800 (Charter)	38	D	III	3	174,200	146,300
Boeing MD-83/88 (Allegiant)	502	D	III	4	160,000	139,500
CRJ-200 (Delta)	2,746	D	II	3	53,000	47,000
Airbus A300-600 (FedEx)	917	C	IV	5	370,376	315,922
Airbus A310 (FedEx)	366	C	IV	5	361,557	273,372
Boeing 757-200 (FedEx, Allegiant)	42	C	IV	4	255,000	210,000
Airbus A319 (Allegiant)	162	C	III	3	166,449	134,482
Airbus A320 (Allegiant)	134	C	III	3	171,961	145,505
CRJ-700/900 (Delta)	1,102	C	III	3	84,500	75,000
Total AAC-D	3,286					
Total ADG-IV	1,325					
Total TDG-5	1,283					
Design MTOW	370,376 lbs.					
Design MLW	315,922 lbs.					

Source: KLJ Analysis, FAA Traffic Flow Management System Counts (TFMSC) Data at GFK (January 2014 - December 2014). IFR = Instrument Flight Rules, AAC = Aircraft Approach Category, ADG = Airplane Design Group, TDG = Taxiway Design Group, MTOW = Maximum Takeoff Weight (pounds), MLW = Maximum Landing Weight
Aircraft operations exceeding FAA regular use threshold are shown in **Green**



Figure 3-40 – Existing Critical Design Aircraft Family

Airbus A300-600 (ARC C-IV)



Airbus A310 (ARC C-IV)



Boeing MD-83 (ARC D-III)



CRJ-200 (ARC D-II)



Photography Source: Airliners.net

Other aircraft types were also evaluated. There were 1,040 documented annual operations in corporate jet aircraft at GFK in 2015 operating for general aviation or commercial purposes. The majority of these aircraft have an FAA ARC of B-II. The Beechcraft 1900 operated by many commercial cargo carriers is an FAA ARC B-II airplane with 1,460 documented annual operations in 2015. The ATR-42/72 air cargo turboprop, an ARC B-III airplane, had 432 operations in 2015 which is just below the FAA's regular-use threshold.

UND Aerospace flight training operations are in small single- and multi-engine airplanes with maximum gross weights below 12,500 pounds.

Future

The future critical design aircraft will continue to be driven by scheduled passenger and air cargo service at GFK. The following assumptions will affect the future design aircraft:

- Delta Air Lines retiring CRJ-200 and replacing it with CRJ-700/900 aircraft.
- Delta Air Lines utilizing a Boeing 717 for remain overnight (RON) flights in the long-term.
- Allegiant Airlines replacing the MD-83 aircraft with Airbus A319 and A320 in the next 10 years.
- FedEx ceasing the majority of mainline air cargo service in the short-term.

As shown in the table below, the future design aircraft is expected to be driven by passenger airlines rather than air cargo aircraft. The design aircraft is expected to transition to an FAA ARC D-III, TDG-4



aircraft in the short-term and to a TDG-3 aircraft in the mid-term. The long-term design aircraft is a C-III, TDG-3 aircraft as the MD-83 and CRJ-200 aircraft are phased out of service at GFK.

Table 3-41 – Future Critical Aircraft Operations Breakdown

Representative Aircraft	Design	2014	2019	2024	2029	2034
Boeing MD-83 (Allegiant)	ARC D-III, TDG-4	456	416	286	0	0
CRJ-200 (Delta)	ARC D-II, TDG-3	3,526	1,716	624	0	0
Airbus A300-600 (FedEx)	ARC C-IV, TDG-5	396	0	0	0	0
Airbus A310 (FedEx)	ARC C-IV, TDG-5	236	0	0	0	0
Boeing 757-200 (Allegiant)	ARC C-IV, TDG-4	51	31	31	0	0
Boeing 757-200 (FedEx)	ARC C-IV, TDG-4	324	10	10	10	10
Airbus A319/A320 (Allegiant)	ARC C-III, TDG-3	326	416	858	1,196	1,248
Boeing 717-200 (Delta)	ARC C-III, TDG-3	0	10	10	10	530
CRJ-700/900 (Delta)	ARC C-III, TDG-3	320	1,664	2,392	3,432	3,328

Source: KLJ Analysis, CAGR = Compounded Annual Growth Rate,

Aircraft operations exceeding FAA regular use threshold are shown in Green

Note: Representative airplanes identified. Demand forecast assumes unrestricted airport facility

All critical aircraft operations should be monitored very closely as changes in flight schedules and business operations may change airport use, aircraft type and operational frequency.

The design aircraft identified is the most critical family of aircraft to utilize the airport, however particular portions of the airport may be limited to smaller design aircraft. These aircraft-specific standards will be evaluated in **Chapter 4: Facility Requirements**.

Figure 3-42 – Future Critical Design Aircraft Family



Photography Source: Airliners.net



Annual Instrument Approaches

Annual instrument approaches (AIAs) are defined as an approach to an airport conducted in actual instrument meteorological conditions when an instrument approach is required. For purposes of this definition, an approach is initiated when the observed visibility is less than 3 miles or the cloud ceiling is less than the final approach fix. At GFK the Final Approach Fix for Runway 35L (RNAV) approach is at an altitude of 2,600 feet above mean sea level, or 1,755 feet above ground level. AIA figures are no longer tracked by Air Traffic Control but are a required element to an FAA forecast.

To determine AIAs, the number of itinerant operations are totaled from the estimates and forecasts and compared to annual operations. The number of instrument flights are then determined. Based on data from the FAA, 44.9 percent⁴ of flights are operating on an IFR itinerant flight plan at GFK. This has increased from 35.6 percent in 2009. The number of AIA's in the future is expected to grow as itinerant traffic increases and more instrument-rated pilots equip aircraft to utilize approaches with new GPS technology. Local weather conditions are then reviewed and analyzed for consideration of when initiation of an instrument approach is required. A total of 12.58 percent⁵ of the hourly weather observations are in conditions that require an instrument approach to be performed.

Table 3-43 – Annual Instrument Approach Forecast

Metric	2014	2019	2024	2029	2034	CAGR
Annual Operations	324,196	312,613	334,205	347,330	350,477	0.39%
Itinerant Operations	120,119	110,546	118,464	124,236	127,071	0.28%
% IFR Itinerant Operations	44.9%	46.40%	47.90%	49.40%	50.90%	0.63%
IFR Itinerant Operations	53,933	51,293	56,744	61,373	64,679	0.91%
IFR Approaches	26,967	25,647	28,372	30,686	32,340	0.91%
Instrument Approach Weather	12.58%					0.00%
Annual Instrument Approaches	3,392	3,226	3,569	3,860	4,068	0.91%
AIA as Percent of Itinerant	2.82%	2.92%	3.01%	3.11%	3.20%	0.63%

Source: [National Climatic Data Center](#), KLJ Analysis. CAGR = Compounded Annual Growth Rate

A large percentage of the IFR operations at GFK are conducting practice approaches in VFR conditions for flight training purposes. These operations are not reflected in the annual instrument approach count.

Peak Activity

Peak demand periods help quantify aviation activity during busy periods. Time periods evaluated include the peak month, design day and design hour characteristics for airport operations. Peak periods are defined in [FAA AC 150/5060-5, Airport Capacity and Delay](#). Peak activity is important when planning the size of facilities with fixed capacities.

- **Peak Month:** The calendar month when peak operations occur
- **Design Day:** The average day in a peak month (peak month / 30)
- **Busy Day:** The busy day of a typical week in a peak month (Design Day + 15 percent)
- **Design Hour:** The peak hour within the design day (1/16 of Design Day + 15 percent)

⁴ 53,993 IFR Itinerant Operations divided by 120,119 total operations in Federal Fiscal Year 2014.

⁵ 11,034 weather hours requiring an instrument approach divided by 87,690 total weather hours from 2005-2014.



GFK is a unique airport due to the sheer amount of flight training operations from UND Aerospace. Peak activity is typically seen during Visual Flight Rules (VFR) weather conditions conducive for practice takeoffs and landings.

Peak periods evaluated include the peak month, design day and design hour characteristics for passenger enplanements and airport operations. The results of the peak activity forecasts will be used to determine the airport facility requirements. The methodology developed is derived from [Airports Cooperative Research Program \(ACRP\) Report 25: Airport Passenger Terminal Planning and Design](#), which emphasizes the use of design periods to forecast use patterns rather than individual absolute peak periods.

Local data used includes these aviation forecasts, [FAA Air Traffic Activity Data System \(ATADS\)](#), as well as GFK monthly flight schedules from November 2012 through November 2015 and data provided by the airport.

Passenger Airlines

This analysis provides an estimate of peak passenger activity at GFK for planning purposes. Actual airline flight scheduling is based on passenger demand and individual airline requirements making it difficult to exactly identify specific peak hours in the future.

PEAK MONTH

The peak month of passenger airline activity was determined by reviewing the prior three years of monthly passenger enplanement figures for the airport. This method evaluates historic patterns of passenger activity to identify the peak month. The peak month was determined to be March 2014 with 10.57 percent of the annual enplanements for calendar year 2014, which is consistent with other calendar years reviewed. Note that the passenger peak in March was driven by Allegiant Airlines traffic and their use of relatively larger 177-seat Airbus A320 and 215-seat Boeing 757-200 jets on seasonal routes to warm weather destinations.

The peak month of scheduled passenger airport operations was determined by reviewing the prior three years of commercial monthly airport operation figures from the [Bureau of Transportation T-100 Domestic Segment](#) data. This method evaluates historic patterns of airport operations activity to identify the peak month. The peak month was determined to again be March 2014 with 9.87 percent of total passenger operations.

DESIGN DAY

The average peak day during the peak month is considered the design day. Design day activity is determined by evaluating actual flight schedules rather than using a pure average or an individual daily peak. Reviewing the average day during the peak month allows for planning for a peaking period rather than a single event which may cause overestimating.

The daily and weekly number of seats and activity levels are derived from the weekly March 2014 flight schedule provided by the airport. The average week activity in the peak month is 23.07 percent of monthly operations. The average peak day available seats (Monday, Thursday, Saturday) is determined to be 966 daily departing seats out of 5,874 weekly departing seats for 16.45 percent. This is when Allegiant Airlines schedules two departures in 166, 177 or 215 seat aircraft.

There are currently eight (8) scheduled airline departures during the average peak day and 52 each week. Using the March 2014 flight schedule, this consists of 15.38 percent of the overall weekly total operations. This baseline figure matches up more realistically to current design day operations for the peak seasonal months.



Table 3-44 – Peak Month, Design Day Passenger Airline Activity Forecast

Metric	2014	2019	2024	2029	2034
Passenger Airline Enplanements					
Annual	146,531	147,612	170,763	194,170	220,787
Peak Month (11.31%)	16,558	16,680	19,296	21,941	24,949
Avg. Week Peak Month	3,820	3,848	4,452	5,062	5,756
Design Day (16.45%)	628	633	732	833	947
Passenger Airline Operations					
Annual	4,756	4,251	4,191	4,638	5,097
Peak Month (9.87%)	469	420	414	458	503
Avg. Week Peak Month	108	97	95	106	116
Design Day (15.38%)	17	15	15	16	18

Source: [Bureau of Transportation T-100 Domestic Segment](#), GFK Airport Records, KLJ Analysis

DESIGN HOUR

The design hour is based on the flight schedules during a design day. Using the terminal planning guidance from [ACRP Report 25](#), peak hour assumes passengers arrive to the airport 60 minutes prior to departure and remain at the airport up to 60 minutes after arrival. An average week from the peak month March 2014 flight schedule was used to review a rolling peak in 10 minute intervals. The design hours were chosen based actual flight schedules. An evaluation of the number of arriving and departing seats over an average weekday (design day) is shown in the following exhibit.

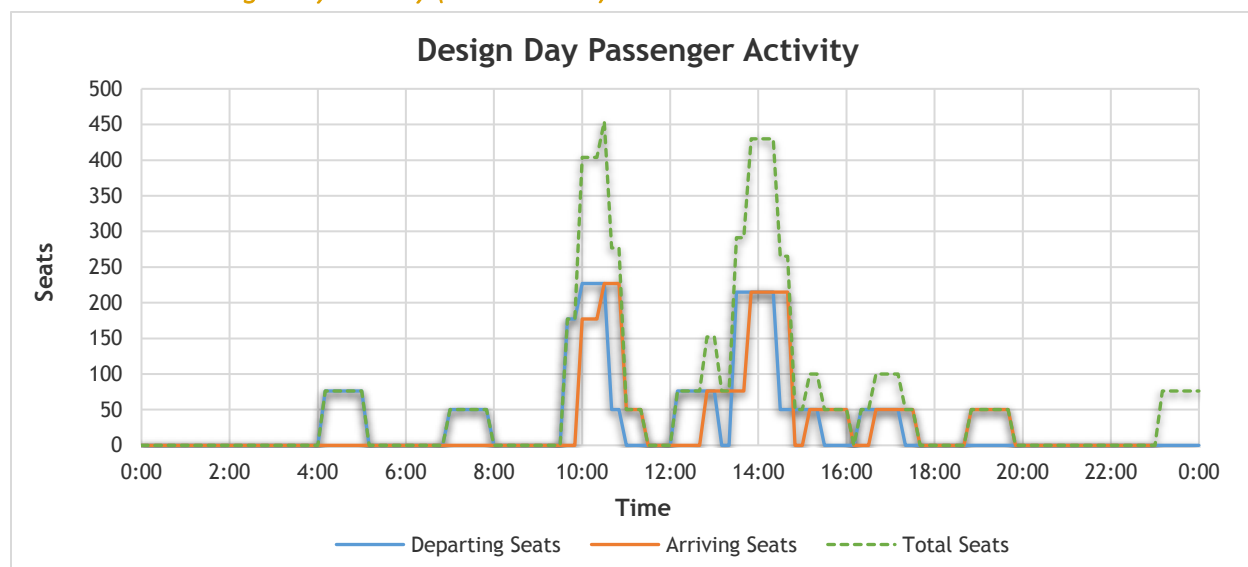
To be consistent with overall peak activity measures, the March 2014 flight schedule was used as a baseline. The schedule modified to reflect new fleet mix trends including Delta's 2015 replacement of the CRJ-200 with a CRJ-900 on two daily flights. This change was made more accurately reflect the actual design hour demand.

The peak hour departing seats on Mondays and Fridays in March is concentrated in the morning between 10:00 A.M. and 10:30 A.M. with a peak 10-minute block of 227 departing seats. Peak arriving passengers also occurs in the morning from 10:30 A.M. to 10:50 A.M. with a peak 10-minute block of 227 arriving seats. During this period an Allegiant Airbus A-320 and a Delta CRJ-200 are arriving and departing in a closely spaced period. The absolute peak occurs at 10:30 A.M. with 454 arriving and departing seats. This sample day had a total of 744 arriving and departing seats.

If a situation arose where the two largest aircraft (Allegiant Boeing 757 and Delta CRJ-900) arrived and departed within the same hour it would lead to 291 arriving and 291 departing seats for a total of 582 total seats.



Exhibit 3-45 – Design Day Activity (March 2014)



Source: [ACRP Report 25](#), GFK Airport, KLJ Analysis

The peak hour occurs at two points in the day with four (4) out of 16 daily operations within one hour when a Delta and Allegiant flight arrive and depart within the same hour.

Design hour passenger activity determinations are identified in the following table. These figures are especially important for terminal space planning. This will be evaluated further in the Facility Requirements chapter.

Table 3-46 – Design Day Passenger Airline Activity Forecast

Metric	2014	2019	2024	2029	2034
Passenger Airline Passengers					
Design Day Enplanements	628	633	732	833	947
Design Hour Enplanements (30.5%)	192	193	223	254	289
Design Hour Deplanements (30.5%)	192	193	223	254	289
Design Hour Passengers (28.9%)	363	366	423	481	547
Passenger Airline Operations					
Design Day (15.38%)	17	15	15	16	18
Design Hour (25.0%)	4.2	3.7	3.7	4.1	4.5

Source: [Bureau of Transportation T-100 Domestic Segment](#), GFK Airport Records, KLJ Analysis

Note: Some numbers may not add up due to rounding

Airport Operations

Peaking tendencies for total airport operations reviewed the preferred GFK airport activity forecasts along with the high forecast scenario for the long-term, driven by unconstrained UND Aerospace flight training operations at GFK.

PEAK MONTH

The peak month of airport operations was determined by reviewing the prior three years of monthly airport operations figures from the GFK ATCT. The peak month was determined to be July 2012 with 40,297 total operations, or 11.01 percent of the annual operations for calendar year 2012. The peak month varied between July 2012, June 2013 and October 2014 for the three years reviewed.



DESIGN HOUR

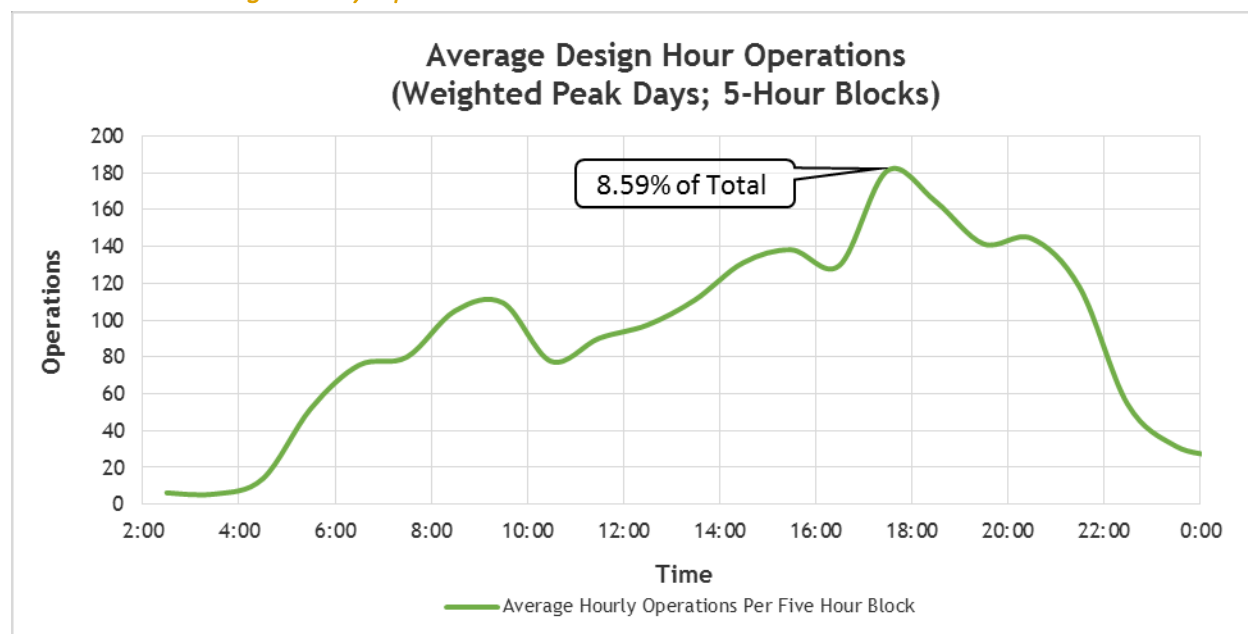
The design hour is based on the average hourly operations during a design day. To determine this figure, average hourly operations per five-hour block were reviewed for the top 25 operational days in the past three years. Averaging both the individual peak day and the top 25 days, average hourly operations consisted of 8.59 percent of the total daily operations. The individual average peak hour was 220 operations per hour (9.97 percent of daily total) during March 20, 2012.

Table 3-47 – Airport Operations Peak Forecast

Metric	2014	2019	2024	2029	2034	High
Annual Operations	324,196	312,613	334,205	347,330	350,477	383,247
Peak Month (11.01%)	35,694	34,419	36,796	38,241	38,588	42,196
Design Day (4.91%)	1,753	1,690	1,807	1,878	1,895	2,072
Design Hour (8.59%)	151	145	155	161	163	178

Source: [FAA Operations Network \(OPSNET\)](#), KLJ Analysis, CAGR = Compounded Annual Growth Rate

Table 3-48 – Average Hourly Operations



Source: [FAA Traffic Flow Management System Counts \(OPSNET\)](#)



Forecast Summary

Exhibit 3-49 – GFK Aviation Activity Forecast Summary

	Activity Levels					Average Annual Compound Growth Rates			
A. Forecast Levels	2014	2019	2024	2029	2034	0-5 Years	0-10 Years	0-15 Years	0-20 Years
Passenger Enplanements									
Air Carrier	72,052	112,753	157,973	194,170	220,787	9.37%	8.17%	6.83%	5.76%
Commuter	74,479	34,859	12,790	0	0	-14.09%	-16.15%	-	-
TOTAL ENPLANEMENTS	146,531	147,612	170,763	194,170	220,787	0.15%	1.54%	1.89%	2.07%
Operations									
Itinerant									
Air Carrier	2,255	2,561	3,585	4,648	5,107	2.58%	4.75%	4.94%	4.17%
Commuter/Air Taxi	101,288	93,561	98,676	101,382	101,499	-1.57%	-0.26%	0.01%	0.01%
Total Commercial	103,543	96,122	102,261	106,029	106,607	-1.48%	-0.12%	0.16%	0.15%
General Aviation	16,422	14,053	15,832	17,836	20,094	-3.07%	-0.37%	0.55%	1.01%
Military	154	370	370	370	370	19.18%	9.17%	6.02%	4.48%
Total Itinerant Operations	120,119	110,546	118,464	124,236	127,071	-1.65%	-0.14%	0.22%	0.28%
Local									
Civil	204,073	201,787	215,461	222,814	223,125	-0.23%	0.54%	0.59%	0.45%
Military	4	280	280	280	280	133.97%	52.96%	32.76%	23.68%
Total Local Operations	204,077	202,067	215,741	223,094	223,406	-0.20%	0.56%	0.60%	0.45%
TOTAL OPERATIONS	324,196	312,613	334,205	347,330	350,477	-0.72%	0.30%	0.46%	0.39%
Annual Instrument Approaches	3,392	3,226	3,569	3,860	4,068	-1.00%	0.51%	0.87%	0.91%
Peak Hour Operations	151	145	155	161	163	-0.73%	0.30%	0.46%	0.39%
Cargo/Mail (Pounds)	58,351,637	598,901	620,158	637,620	660,139	-59.98%	-36.52%	-26.00%	-20.08%
Based Aircraft									
Single Engine	95	104	110	112	115	1.78%	1.44%	1.10%	0.97%
Multi Engine	21	23	25	25	25	1.84%	1.47%	1.17%	0.84%
Turbojet	19	21	23	24	26	2.10%	1.98%	1.76%	1.64%
Helicopter	12	12	12	12	13	0.25%	-0.02%	0.18%	0.28%
Other	0	0	0	0	0	-	-	-	-
TOTAL BASED AIRCRAFT	147	160	169	174	179	1.71%	1.40%	1.13%	0.99%
B. Operational Factors	2014	2019	2024	2029	2034	2019	2024	2029	2034
Average Aircraft Size (seats)									
Air Carrier	136.2	107.8	106.5	99.7	101.9	-4.57%	-2.43%	-2.06%	-1.44%
Commuter	50.0	50.0	50.0	0.0	0.0	0.00%	0.00%		
Average Enplaning Load Factor									
Air Carrier	83.53%	82.00%	83.00%	84.00%	85.00%	-0.37%	-0.06%	0.04%	0.09%
Commuter	85.39%	82.00%	83.00%	84.00%	85.00%	-0.81%	-0.28%	-0.11%	-0.02%

Source: KLJ Analysis. Note: Some figures are rounded



Forecast Comparison with FAA TAF

Proposed aviation activity forecasts must be reviewed and approved by FAA. A forecast is consistent with the FAA TAF if the proposed activity is within a certain tolerance of the official TAF forecast. If the proposed forecast is inconsistent with the TAF, then differences must be resolved for the forecast to be adopted by the FAA. Key activity measures that are reviewed include passenger enplanements, based aircraft and total operations. The 2015 FAA TAF issued January 2016 is used for comparison.

PASSENGER ENPLANEMENTS

The airport's proposed forecast of enplanements is considered to be **consistent** with the 2015 FAA TAF for the 10-year forecast horizon.

BASED AIRCRAFT

The airport's proposed forecast of constrained based aircraft is considered to be **consistent** with the 2015 FAA TAF for the 10-year forecast horizon. The unconstrained forecast for facility planning purposes yields 187 based aircraft, 4.4 percent greater than the 2015 FAA TAF at the end of the planning period.

TOTAL OPERATIONS

The airport's proposed forecast of constrained total operations is considered to be **consistent** with the 2015 FAA TAF for the 10-year forecast horizon. The unconstrained forecast for facility planning purposes yields 383,248 operations, nearly 5 percent greater than the 2015 FAA TAF at the end of the planning period.

Table 3-50 – Comparing Airport Forecast to FAA TAF

Metric	Year	Airport Forecast	2015 FAA TAF	AF/TAF % Difference
<u>Passenger Enplanements</u>				
Base Year	2014	146,531	146,531	0.0%
Base Year + 5 Years	2019	147,612	152,472	-3.2%
Base Year + 10 Years	2024	170,763	160,559	6.4%
Base Year + 15 Years	2029	194,170	167,963	15.6%
Base Year + 20 Years	2034	220,787	175,567	25.8%
Growth Rate		2.07%	0.91%	
<u>Based Aircraft</u>				
Base Year	2014	147	147	0.0%
Base Year + 5 Years	2019	160	160	0.0%
Base Year + 10 Years	2024	169	169	0.0%
Base Year + 15 Years	2029	174	174	0.0%
Base Year + 20 Years	2034	179	179	0.0%
Growth Rate		0.99%	0.99%	
<u>Total Operations</u>				
Base Year	2014	324,196	324,196	0.0%
Base Year + 5 Years	2019	312,613	303,421	3.0%
Base Year + 10 Years	2024	334,205	323,272	3.4%
Base Year + 15 Years	2029	347,330	343,669	1.1%
Base Year + 20 Years	2034	350,477	365,390	-4.1%
Growth Rate		0.39%	0.60%	

Source: KLJ Analysis, [FAA Terminal Area Forecast](#) (January 2016)

Green cells indicate Airport Forecast is within the FAA's TAF tolerance



Forecast Approval

The proposed aviation forecasts identified in this chapter were approved by FAA on January 3, 2017 for use in this master planning effort.



U.S. Department
of Transportation
**Federal Aviation
Administration**

Federal Aviation Administration
Bismarck Airports District Office
2301 University Drive, Building 23B
Bismarck, ND 58504

January 3, 2017

Mr. Ryan Riesinger, Executive Director
Grand Forks International Airport
2301 Airport Drive
Grand Forks, ND 58203

Grand Forks International Airport
Grand Forks, North Dakota
Approval of Master Plan Forecast

Dear Mr. Riesinger:

The aviation forecast contained in the attached Grand Forks International Airport spreadsheet comparing the airport planning forecast and FAA TAF Forecast dated December 23, 2016 has been approved.

The Federal Aviation Administration concurs with the use of the forecast contained in the above referenced table for the remainder of your current master planning efforts.

If you have any questions, comments or concerns, please contact Mr. Scott Brownlee, Community Planner in our office at 701-323-7383.

Sincerely,

Laurie J. Suttmeier, Deputy Manager
Dakota-Minnesota Airports District Office
Bismarck Office

cc: NDDOT Aeronautics
KLJ – Fargo & St. Paul