



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 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](#)

University of North Dakota 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 (where available) has been used to validate forecast assumptions and update the forecast baseline.
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.

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.

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,

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



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 to 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 2015, the population grew to 101,842 yielding a 0.67 annual growth rate.

Table 3-1 – Population Projections

Metric	2014	2019	2024	2034	CAGR
Population					
Grand Forks MSA*	98,198	98,388	98,385	97,512	-0.04%
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), **GF-EGF Metropolitan Planning Organization (2011)
CAGR = Compounded Annual Growth Rate

The data from Woods & Poole Economics does not project upward trends in the MSA population. Local MPO data 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 University of North Dakota, 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

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.

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



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 on 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 tend 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:



GFK Domestic Catchment Area (Mead & Hunt)

- 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 \$100 or higher in 11 markets.
- 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 recovered and remained relatively steady between 83,516 and 92,202 enplanements. A low point was 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.

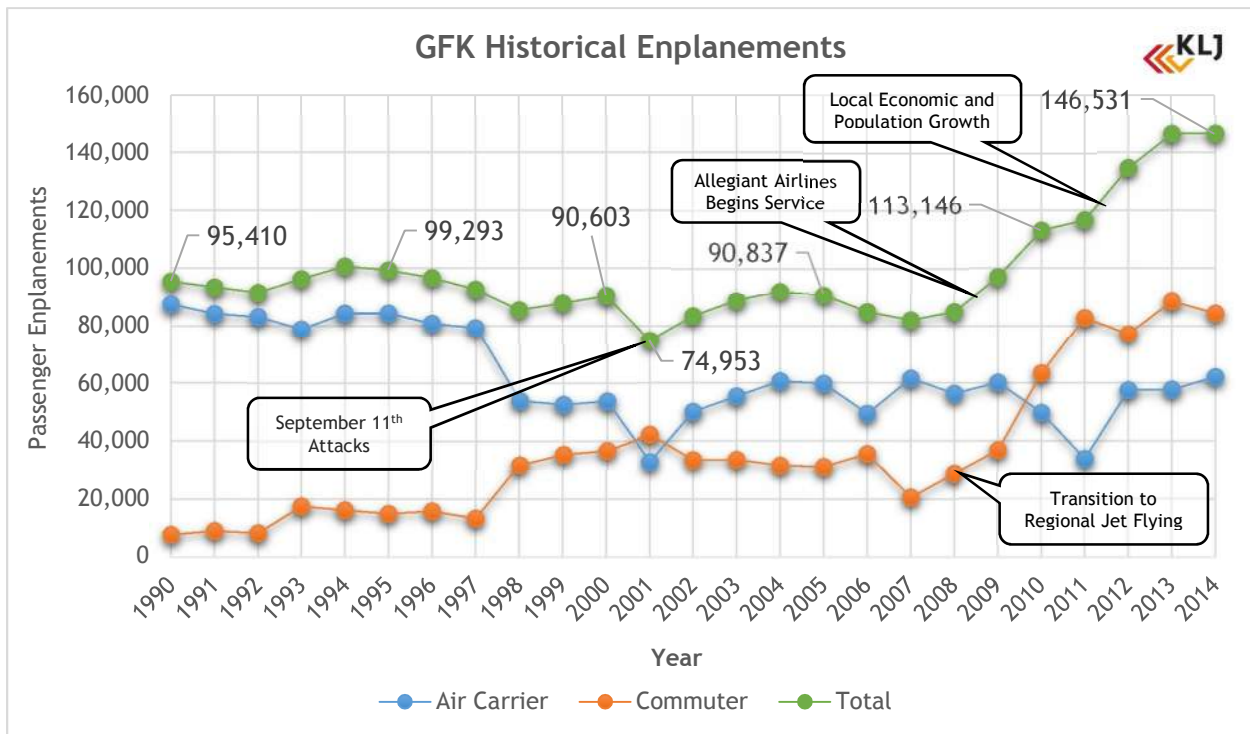
In September 2008 Allegiant Airlines began service from GFK, providing direct flights from GFK to leisure destinations. Service to Las Vegas (LAS) began in 2008, with service to Phoenix-Mesa (AZA) and Orlando-Sanford (SFB) added since then. Nearly 60,000 passengers boarded Allegiant Airlines flights 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. This has boosted the local economy in Grand Forks as well.

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
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 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. Strong demand for scheduled air service exists at GFK.



Forecasts

An updated forecast of enplaned passengers has been prepared using available data, several methodologies, and professional judgment from industry trends. The forecasts prepared are unconstrained to represent actual demand at GFK. These forecasts superseded 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.
- 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 be replaced 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.
- Allegiant Airlines will continue to 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. Additional frequency may also be added on existing routes to meet passenger demand.
- 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 fairly independent of socioeconomic trends in the catchment area as passengers flying Allegiant are captured from those not traveling or residing in other airport catchment areas (i.e. Winnipeg). A long-term destination includes Los Angeles (LAX).
- Delta Air Lines will continue to serve GFK via its Minneapolis-St. Paul (MSP) hub, a mature route from GFK. The CRJ-200 aircraft will be replaced with CRJ-700/-900 aircraft on this route. Currently, Delta's CRJ-900 aircraft make 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.
- 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



CRJ-900 Regional Jet (Airliners.net)



replace 50-seat jets to maintain capacity-neutral, meaning frequency would be reduced. These aircraft may be seen at GFK on an occasional basis and should be evaluated for contingency planning.

- 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 market is not yet capable of sustaining service to DEN.
- 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. 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 one additional Allegiant route to Florida along with additional capacity in the short-term, and another new route in the long-term. Delta would transition its fleet to 65-seat CRJ-700 aircraft and provide service six times daily.

Air Service Scenario #3 considers a high growth scenario. The scenario includes rapid 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 adding capacity with six daily flights, one of which would be upgraded to a 110-seat Boeing 717.

Air Service Scenario #2, based on data from the PDA, is the recommended forecast for passenger enplanement growth at GFK. This scenario is described below:

- Air Service Scenario #2 (Medium Growth):
 - Short-term: Delta replaces one additional 50-seat CRJ-200 with a third daily 76-seat CRJ-900. Allegiant adds a new Florida destination with twice-weekly service on an Airbus A320. Average growth rate is 2.69% annually for the short-term.



- Mid-term: Delta transitions to all CRJ-900 aircraft for five daily flights to MSP, and Allegiant adds a new twice-weekly service to Los Angeles on an Airbus A320. Average growth rate is 1.86% 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 12 times per week to Denver or Chicago-O’Hare in a CRJ-700. Average growth rate is 2.50% annually for the mid-term.

The proposed airport enplanement forecast along with comparisons to the local and national FAA enplanement forecast is shown in the table below.

Table 3-8 – GFK Passenger Enplanement Forecasts

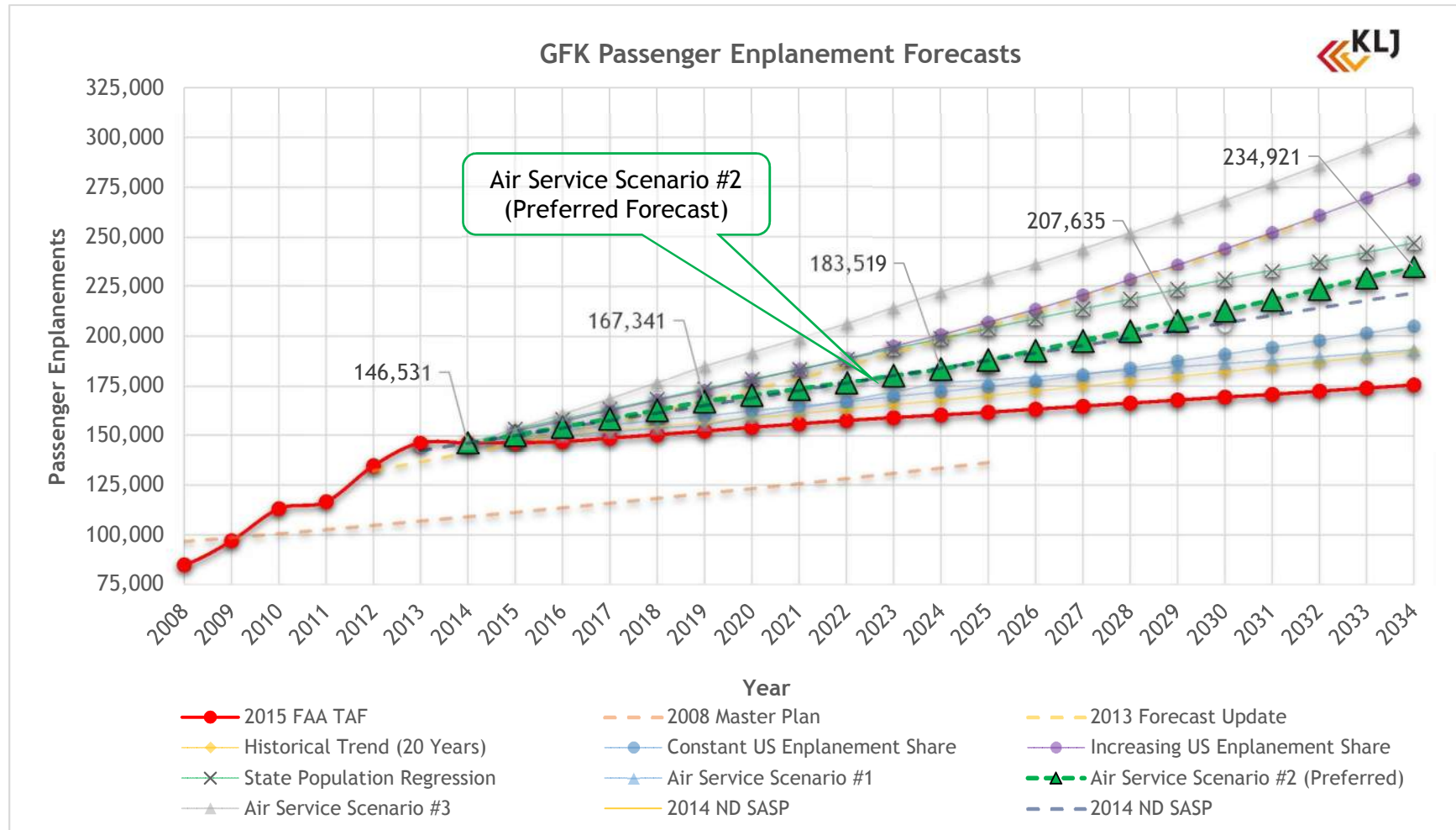
Metric	2014	2019	2024	2034	CAGR
GFK Airport Forecast	146,531	167,341	183,519	234,921	2.39%
U.S. Domestic Enplanements (in millions)	668.3	729.5	784.9	935.3	1.69%
GFK Market Share	0.022%	0.023%	0.023%	0.025%	0.68%

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

The preferred forecast yields an average annual growth rate of 2.56 percent for a total of 234,921 enplanements at the end of the 20-year planning period. GFK’s market share of national enplanements is forecast to increase by 0.68 percent annually. Growth is anticipated as a result of additional capacity to existing destinations and new service to leisure destination through the mid-term, and to a hub airport in the long-term. This service is supported by existing true market passengers and GFK’s proximity to Canada supporting service to additional leisure destinations. This scenario assumes GFK retains a higher percentage of passengers within the catchment area to support new air service.



Exhibit 3-9 – 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 Air taxi operations totaled 101,288, which counts other unscheduled charter aircraft and University of North Dakota flight training aircraft.

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 3-10 – 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 Operations					
Operations	4,662	5,158	5,152	5,988	4,716

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 85.61 percent in 2014.



Table 3-11 – 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](#)

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 regional. For this analysis, a true split using a 60-seat cutoff has been used.

Forecasts

The commercial operations forecasts 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 to 20 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 3-12 – 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%	45.7%	13.3%	0.0%
Total Air Taxi/Commuter	74.8%	45.7%	13.3%	0.0%
Air Carrier (>60 seats)				
61-99 Seats	6.8%	33.2%	64.4%	79.9%
100-120 Seats	0.0%	0.2%	0.2%	0.2%
121-150 Seats	0.6%	0.7%	0.8%	0.8%
151-199 Seats	16.6%	18.7%	19.9%	19.2%
200+ Seats	1.3%	1.5%	1.5%	0.0%
Total Air Carrier	25.2%	54.3%	86.7%	100.0%

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

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. GFK's future load factor is expected to grow at a similar rate to the national average.

Table 3-13 – Passenger Airline Flight Analysis Forecast

Metric	2014	2019	2024	2034	CAGR
Air Taxi/Commuter (<60 seats)					
Total Enplanements	74,479	45,784	13,066	0	-100.0%
Total Departures	1,745	1,068	304	0	-100.0%
Total Operations	3,490	2,137	607	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	121,557	170,453	234,921	6.09%
Total Departures	633	1,298	2,031	2,419	8.00%
Total Operations	1,267	2,596	4,062	5,904	8.00%
Average Seats Per Departure	136.2	111.7	99.7	93.8	-1.85%
Total					
Total Seats (est.)	173,458	197,337	215,589	273,872	2.31%
Total Enplanements	146,531	167,341	183,519	234,921	2.39%
Passenger Load Factor	84.48%	84.80%	85.12%	85.78%	0.08%
Total Departures	2,380	2,366	2,335	2,952	1.09%
Total Operations	4,760	4,733	4,670	5,904	1.09%
Average Seats Per Departure	73.6	83.5	91.1	93.8	1.22%

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

The preferred forecast yields total commercial passenger operations growing at a 1.09 percent annual growth rate, as compared to enplanements growing at 2.39 percent annually. Air carrier enplanements are forecast to become indicating all scheduled passenger commercial aircraft will be greater than 60



seats in size. The average size of the each scheduled passenger commercial departure will increase from 73.6 seats to 93.8 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 announced in February 2016 that it will move its air operations from GFK to Fargo’s Hector International Airport as soon as October 2016. This would 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 change.

Historical Activity

GFK currently serves as the regional air cargo hub for FedEx. The airport is also and a regular destination for UPS and other contract cargo carriers. FedEx shipping operations are based on the southwest portion of the terminal area. 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.



FedEx Airbus A300 (Airliners.net)

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.

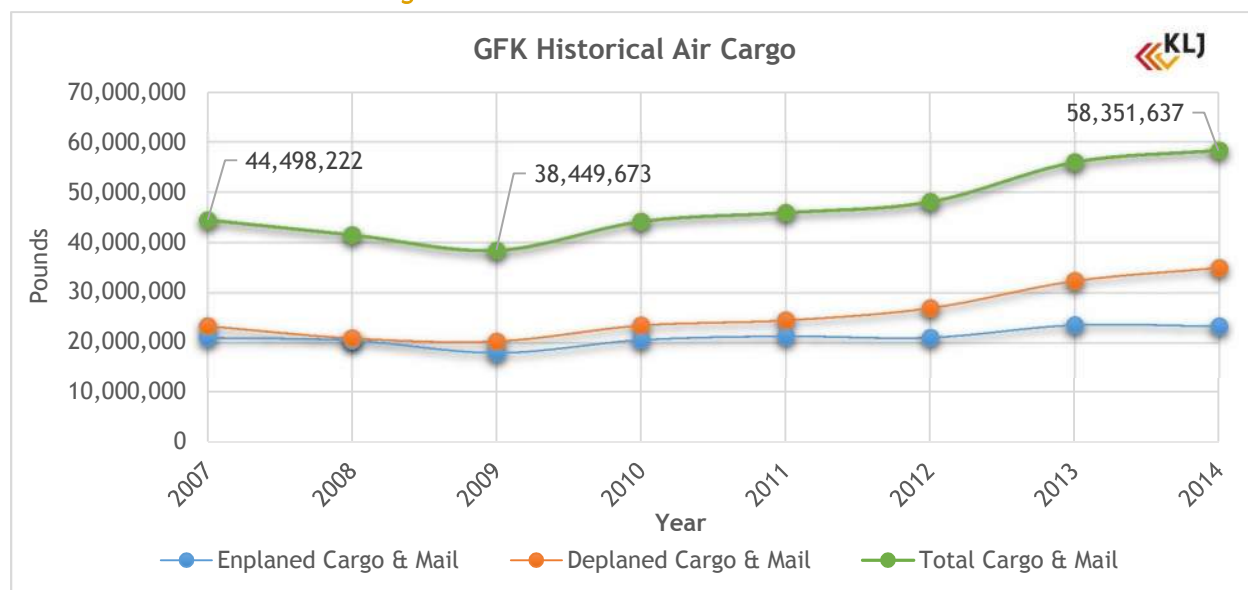
Table 3-14 – Historical Air Cargo Freight & Mail

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 3-15 – 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 3-16 – 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.

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.

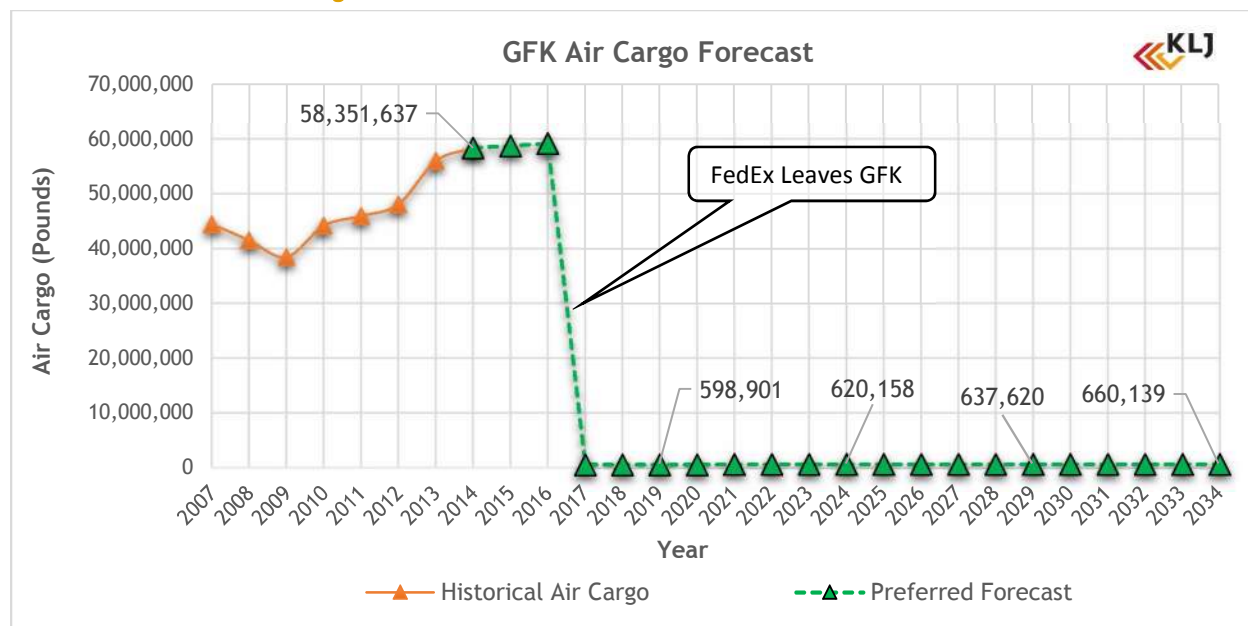
Forecast

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 3-17 – GFK Air Cargo Forecast



Source: Form 41 Traffic Data: T-100 Domestic Segment - Bureau of Transportation Statistics, KLJ Analysis

Table 3-18 – 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 is 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 3-19 – 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

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



Valley Med Flight Fixed-Wing Airplanes



General Aviation. For purposes of consistency with FAA guidance only itinerant (point-to-point) operations are evaluated.

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 the University of North Dakota (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 around the country to accommodate the demand. Since 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 corresponds 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 3-20 – 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 total flight hours activity metric correlates to airport operations.

Much of the preferred forecast at GFK will be driven by the University of North Dakota 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.



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

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 e 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 3-21 – Other Commercial Operations Forecast

Metric	2014	2015	2019	2024	2034	CAGR
UND Itinerant	89,966*	85,136*	89,721	95,801	99,004	0.48%
Other Air Charter	1,053	1,067*	1,124	1,200	1,369	1.32%
TOTAL	91,019	86,203	90,845	97,001	100,373	0.49%
UND Local**	199,992*	191,475*	197,751	211,152	218,212	0.44%

Source: University of North Dakota, KLJ Analysis

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

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 3-22 – Other Commercial Operations Forecast (High Scenario)

Metric	2014	2015	2019	2024	2034	CAGR
UND Itinerant	89,966*	85,136*	89,721	95,801	109,225	0.97%
Other Air Charter	1,053	1,067*	1,124	1,200	1,369	1.32%
TOTAL	91,031	86,203	90,845	97,001	110,593	0.98%
UND Local**	199,992*	191,475*	197,751	211,152	240,739	0.93%

Source: University of North Dakota, KLJ Analysis

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

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 3-23 – Other Commercial Itinerant Fleet Mix & Operations Forecast

Metric	2014	2019	2024	2034	CAGR
Other Commercial Itinerant					
Single-Engine Piston	72,057	71,866	76,737	79,313	0.48%
Multi-Engine Piston	13,642	13,616	14,538	15,042	0.49%
Turboprop	527	562	600	684	1.32%
Turbojet	242	259	276	315	1.32%
Helicopter	4,551	4,542	4,850	5,019	0.49%
Total Operations	91,019	90,845	97,001	100,373	0.49%

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

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 up-tick of 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.

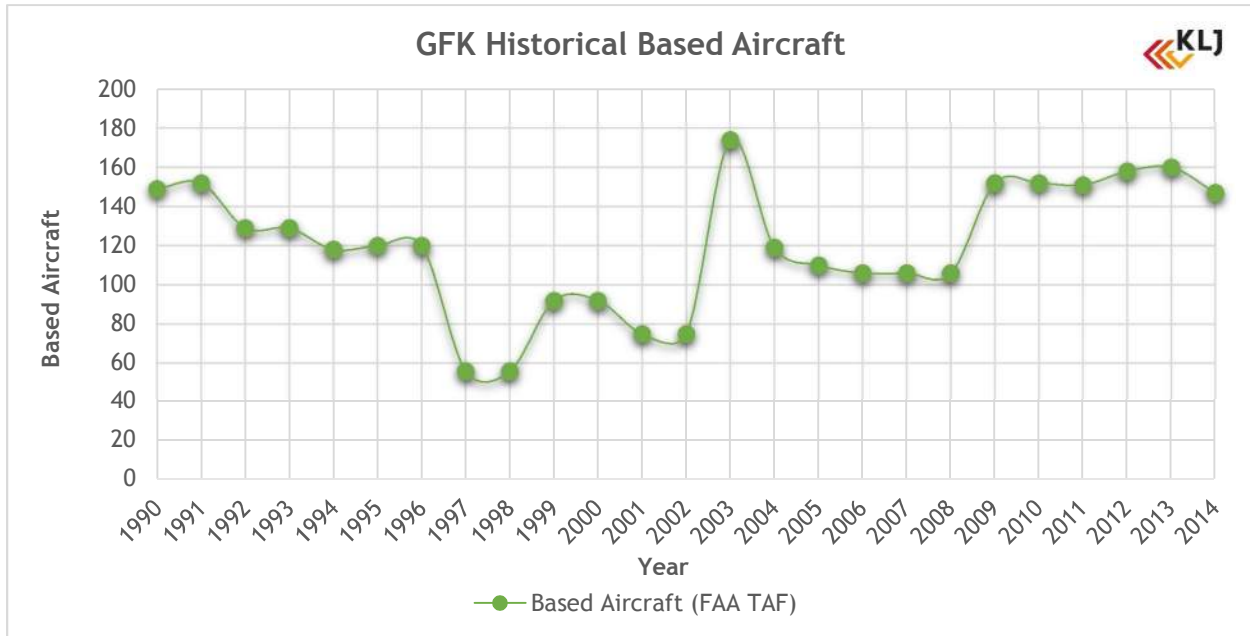
Statewide, based aircraft in North Dakota have increased nearly by over 66 percent since 1990 according to the FAA TAF, equating to an average annual growth rate 2.14 percent.

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 reflecting this historical data is displayed on the following page showing 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](#) dated December 2015, 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 3-24 – Historical FAA TAF Based Aircraft



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

Table 3-25 – 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 estimated 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 update concluded that based aircraft in the 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 State Aviation System Plan excerpt for GFK forecasts a 1.21 percent annual based aircraft growth rate.

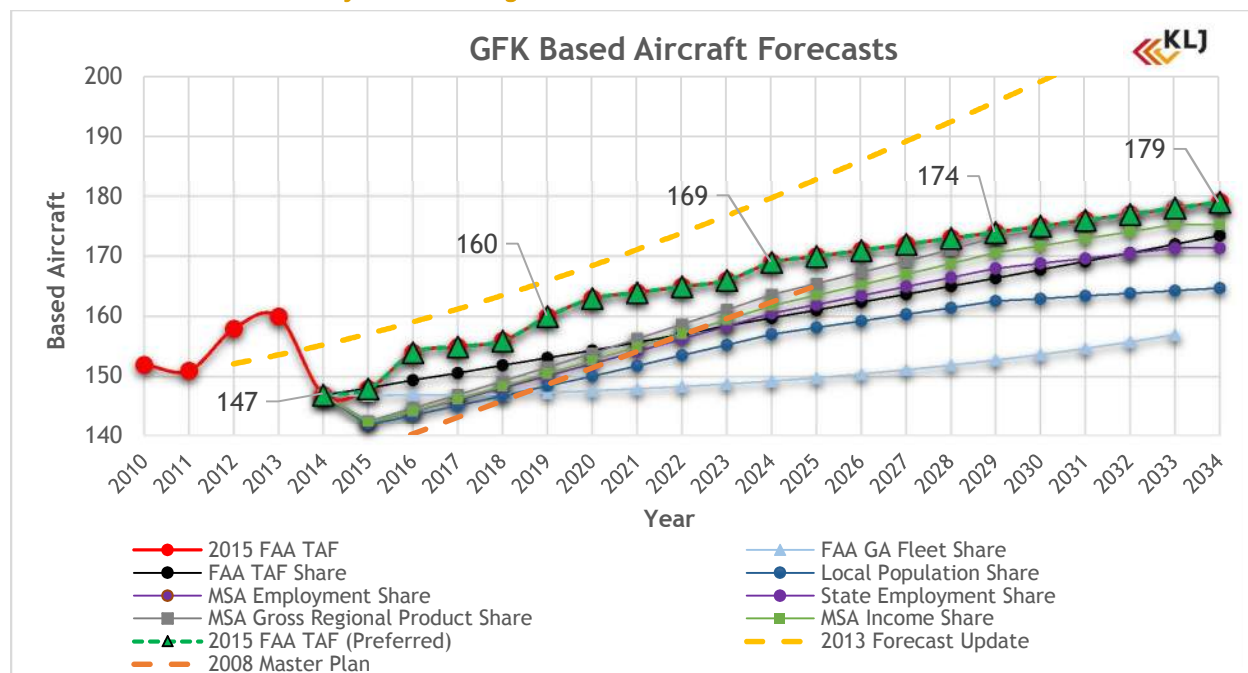
One forecasting method is to look individually at UND Aerospace and other based aircraft. In September 2014 UND based 99 aircraft at GFK, or 67 percent of the total GFK based aircraft. It is



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. This equates to a decline in 2015 but 10 new aircraft within the next 15 years. The remaining number of based aircraft would then be forecasted by reviewing on 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 preferred forecast method is to accept the FAA TAF from January 2016. 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 3-26 – 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 3-27 – 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 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 3-28 – 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 Airport Traffic Control Tower (ATCT) airports 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.

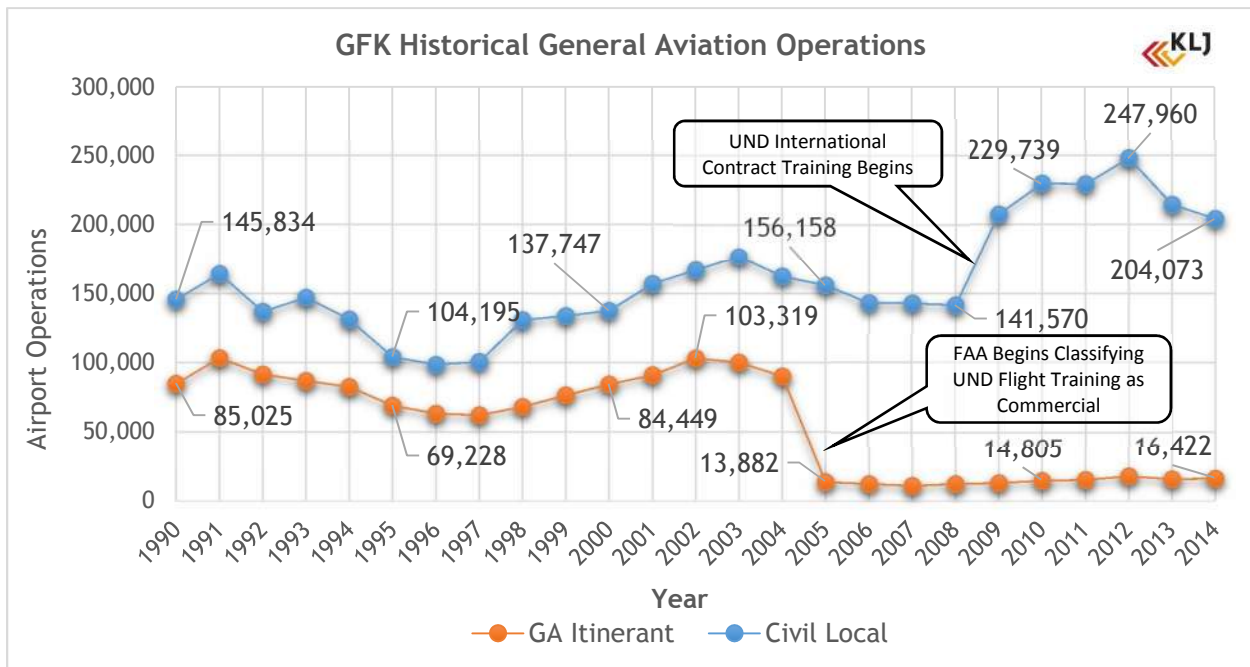
Historical Data

The 2015 FAA Aerospace Forecasts reported total aviation 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 are 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 3-29 – 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.

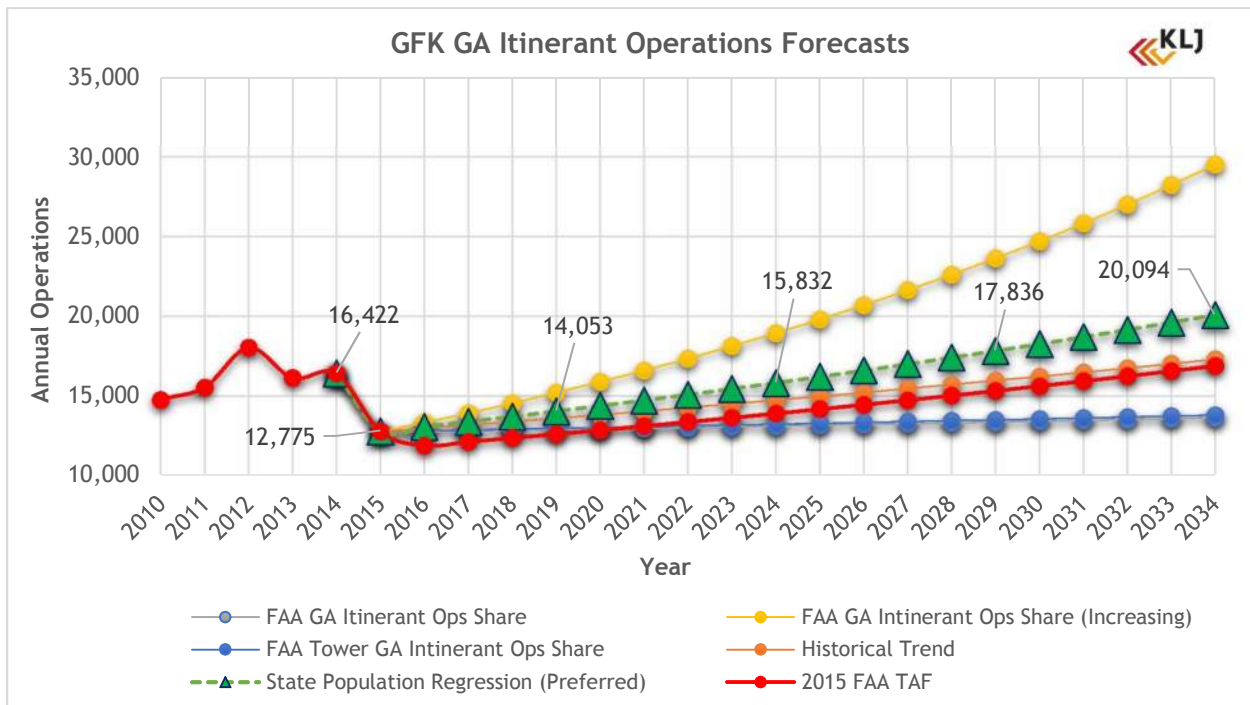
GA itinerant operations are non-UND traffic, thus this figure is expected to be reflective of local and regional socioeconomic elements including population, employment, gross regional product and income trends. A regression evaluation showed that State Population provides the highest correlation of 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 the State population regression model growth rate beyond 2015. This model averages 2.41 percent annual growth for the planning period beyond 2015. The 20-year growth average growth rate is 1.01 percent from year 2014.



Exhibit 3-30 – GA Itinerant Forecasting Methods



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

Table 3-31 – 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 227,000 annually in year 2034 for an average annual growth rate of 0.53 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 itinerant 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 3-32 – 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

With no capacity constraints, 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 3-33 – 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

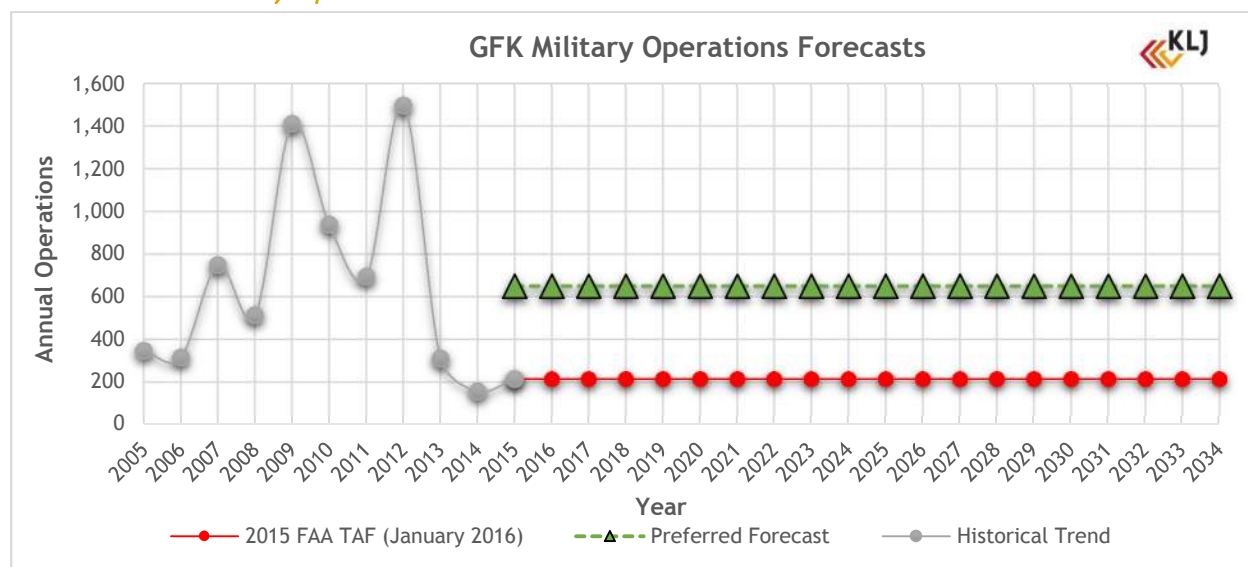
*Estimated based on 98% of total civil local traffic

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. Operations are estimated to be 56.9 percent itinerant and 43.1 percent local.



Exhibit 3-34 – 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.

Table 3-35 – 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 3-36 – Total Operations Forecast Summary

Metric	2014	2019	2024	2029	2034	CAGR
Commercial Operations	103,543	95,770	101,874	105,713	106,490	0.14%
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	312,261	333,818	347,013	350,360	0.39%
UND Aerospace	289,958	287,472	306,952	317,216	317,216	0.45%
Other Operations	34,238	24,676	26,745	29,672	33,019	-0.18%

Source: KLJ Analysis, CAGR = Compounded Annual Growth Rate



Table 3-37 – Total Operations Forecast Summary (High Scenario)

Metric	2014	2019	2024	2029	2034	CAGR
Commercial Operations	103,543	95,770	101,874	109,005	116,723	0.60%
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	312,261	333,818	357,554	383,120	0.84%
UND Aerospace	289,958	287,472	306,952	327,753	349,964	0.95%
Other Operations	34,238	24,676	26,745	29,672	33,019	-0.18%

Source: KLJ Analysis, CAGR = Compounded Annual Growth Rate

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 of up 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 3-38 – 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 3-39 – 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-900 aircraft.
- 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 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 3-40 – Future Critical Aircraft Operations Breakdown

Representative Aircraft	Design	2014	2019	2024	2029	2034
Boeing MD-83 (Allegiant)	ARC D-III, TDG-4	456	468	273	0	0
CRJ-200 (Delta)	ARC D-II, TDG-3	3,526	2,288	728	416	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	73	83	42	0
Boeing 757-200 (FedEx)	ARC C-IV, TDG-4	324	10	10	10	10
CRJ-900 (Delta)	ARC C-III, TDG-3	320	1,664	3,536	3,952	5,200
Airbus A319/A320 (Allegiant)	ARC C-III, TDG-3	326	468	819	1,144	1,248

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 3-41 – 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. For purposes of this definition, an approach initiated when the observed visibility is less than 3 miles or the cloud ceiling is less than the final approach fix. At GFK an altitude is 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 determined. Based on data



from the FAA, 44.9 percent³ 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. A total of 12.58 percent⁴ of the hourly weather observations are in conditions that require an instrument approach to be performed.

Table 3-42 – Annual Instrument Approach Forecast

Metric	2014	2019	2024	2029	2034	CAGR
Annual Operations	324,196	312,261	333,818	347,013	350,360	0.39%
Itinerant Operations	120,119	110,194	118,077	123,919	126,954	0.28%
% IFR Itinerant Operations	44.9%	46.4%	47.9%	49.4%	50.9%	0.63%
IFR Itinerant Operations	53,933	51,130	56,559	61,216	64,620	0.91%
IFR Approaches	26,967	25,565	28,279	30,608	32,310	0.91%
Instrument Approach Weather	12.58%					-
Annual Instrument Approaches	3,392	3,216	3,558	3,850	4,065	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)

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.

³ 53,993 IFR Itinerant Operations divided by 120,119 total operations in Federal Fiscal Year 2014.

⁴ 11,034 weather hours divided by 87,690 total weather hours from 2005-2014.



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 weekday 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. The average peak weekday 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 weekday 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 3-43 – Peak Month, Design Day Passenger Airline Activity Forecast

Metric	2014	2019	2024	2029	2034
Passenger Airline Enplanements					
Annual	146,531	167,341	183,519	207,635	234,921
Peak Month (11.31%)	16,558	18,910	20,738	23,463	26,546
Avg. Week Peak Month	3,820	4,362	4,784	5,413	6,124
Design Day (16.45%)	628	718	787	890	1,007
Passenger Airline Operations					
Annual	4,756	4,733	4,670	5,217	5,904
Peak Month (9.87%)	469	467	461	515	583
Avg. Week Peak Month	108	108	105	119	134
Design Day (15.38%)	17	17	17	18	21

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



DESIGN HOUR

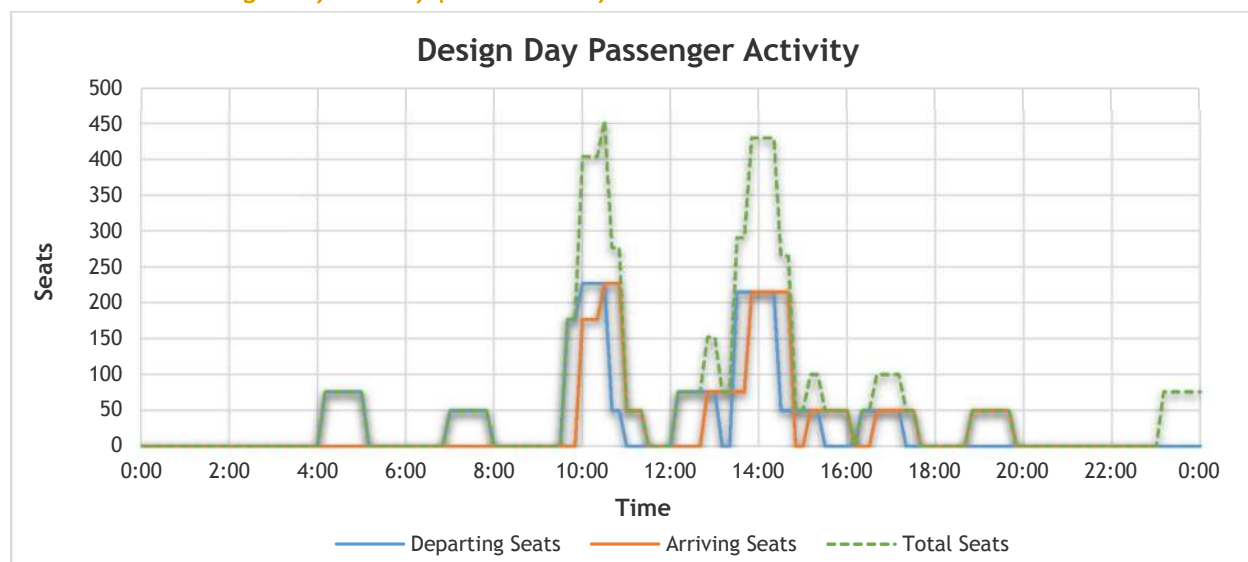
The design hour is based on the flight schedules during a design day. Using the terminal planning guidance from [ACRP Report 25](#), peak hour assumes passengers arrive to the airport 60 minutes prior to departure and remain at the airport up to 60 minutes after arrival. An average week from the peak 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.

The sample flight schedule to determine design day activity has been modified to reflect twice-daily service from Delta on a 76-seat CRJ-900 aircraft.

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 A320 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, out of 1,488 total daily 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 3-44 – Design Day Activity (March 2014)



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

The peak hour operations occurs at two points in the day with four (4) out of 16 daily operations within one hour, occurring at two points daily 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 3-45 – Design Day Passenger Airline Activity Forecast

Metric	2014	2019	2024	2029	2034
Passenger Airline Passengers					
Design Day Enplanements	628	718	787	890	1,007
Design Hour Enplanements (30.5%)	192	219	240	272	307
Design Hour Deplanements (30.5%)	192	219	240	272	307
Design Hour Passengers (28.9%)	364	414	454	514	582
Passenger Airline Operations					
Design Day	17	17	17	18	21
Design Hour (25.0%)	4.2	4.1	4.1	4.6	5.2

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

Airport Operations

Peaking tendencies for total airport operations reviewed the recommended 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.

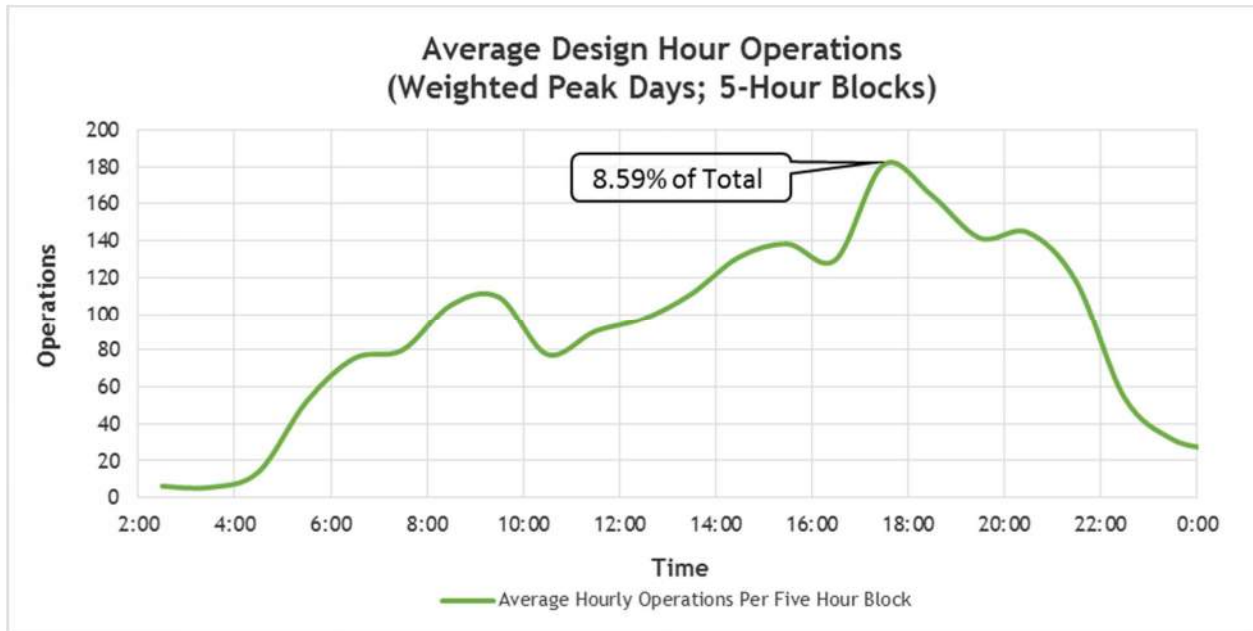
Table 3-46 – Airport Operations Peak Forecast

Metric	2014	2019	2024	2029	2034	High
Annual Operations	324,196	312,261	333,818	347,013	350,360	383,942
Peak Month (11.01%)	35,694	34,380	36,753	38,206	38,575	42,272
Design Day (4.91%)	1,753	1,688	1,805	1,876	1,894	2,076
Design Hour (8.59%)	151	145	155	161	163	178

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



Table 3-47 – Average Hourly Operations



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



Forecast Summary

Exhibit 3-48 – GFK Aviation Activity Forecast Summary

A. Forecast Levels	Activity Levels					Average Annual Compound Growth Rates			
	2014	2019	2024	2029	2034	2019	2024	2029	2034
Passenger Enplanements									
Air Carrier	72,052	121,557	170,453	199,451	234,921	11.03%	8.99%	7.02%	6.09%
Commuter	74,479	45,784	13,066	8,184	0	-9.27%	-22.18%	-8.93%	-100.00%
TOTAL ENPLANEMENTS	146,531	167,341	183,519	207,635	234,921	2.69%	2.28%	2.35%	2.39%
Operations									
Itinerant									
Air Carrier	2,255	2,606	4,073	4,849	5,916	2.94%	9.34%	3.55%	4.06%
Commuter/Air Taxi	101,288	93,164	97,801	100,864	100,574	-1.66%	-0.35%	-0.03%	-0.04%
Total Commercial	103,543	95,770	101,874	105,713	106,490	-1.55%	1.24%	0.74%	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%	0.00%	0.00%	0.00%
Total Itinerant Operations	120,119	110,194	118,077	123,919	126,954	-1.71%	1.39%	0.97%	0.49%
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	312,261	333,818	347,013	350,360	-0.75%	0.29%	0.45%	0.39%
Annual Instrument Approaches	3,392	3,216	3,558	3,850	4,065	-1.06%	0.48%	0.85%	0.91%
Peak Hour Operations	151	145	155	161	163	-0.75%	0.29%	0.45%	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	111.7	99.7	97.6	93.8	-3.89%	-3.07%	-2.20%	-1.85%
Commuter	50.0	50.0	50.0	50.0	0.0	0.00%	0.00%	0.00%	-100.00%
Average Enplaning Load Factor									
Air Carrier	83.53%	83.85%	84.17%	84.49%	84.82%	0.08%	0.08%	0.08%	0.08%
Commuter	85.39%	85.72%	86.05%	86.37%	86.71%	0.08%	0.08%	0.08%	0.08%

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 FAA TAF for the 10-year forecast horizon.

Table 3-49 – Passenger Enplanements vs. FAA TAF

Metric	2014	2019	2024	2029	2034	CAGR
GFK Enplanement Forecast	146,531	167,341	183,519	207,635	234,921	2.39%
2015 FAA TAF	146,531	152,472	160,559	167,963	175,567	0.91%
Difference	0.0%	9.8%	14.3%	23.6%	33.8%	-
Allowable Difference	-	10.0%	15.0%	-	-	-
Consistent with FAA TAF?	-	YES	YES	-	-	-

Source: KLJ Analysis, CAGR = Compounded Annual Growth Rate

BASED AIRCRAFT

The airport's proposed forecast of constrained based aircraft is considered to be **consistent** with the 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 FAA TAF at the end of the planning period.

Table 3-50 – Based Aircraft vs. FAA TAF

Metric	2014	2019	2024	2029	2034	CAGR
GFK Based Aircraft Forecast	147	160	169	174	179	0.99%
2015 FAA TAF	147	160	169	174	179	0.99%
Difference	0.0%	0.0%	0.0%	0.0%	0.0%	-
Allowable Difference	-	10.0%	15.0%	-	-	-
Consistent with FAA TAF?	-	YES	YES	-	-	-

Source: KLJ Analysis, CAGR = Compounded Annual Growth Rate

TOTAL OPERATIONS

The airport's proposed forecast of constrained total operations is considered to be **consistent** with the FAA TAF for the 10-year forecast horizon. The unconstrained forecast for facility planning purposes yields 383,120 operations, 4.8 percent greater than the FAA TAF at the end of the planning period.

Table 3-51 – Total Operations vs. FAA TAF

Metric	2014	2019	2024	2029	2034	CAGR
GFK Operations Forecast	324,196	312,261	333,818	347,013	350,360	0.39%
2015 FAA TAF	324,196	303,421	323,272	343,669	365,390	0.60%
Difference	0.0%	2.9%	3.3%	1.0%	-4.1%	-
Allowable Difference	-	10.0%	15.0%	-	-	-
Consistent with FAA TAF?	-	YES	YES	-	-	-

Source: KLJ Analysis, CAGR = Compounded Annual Growth Rate