Chapter 2 - Forecasts of Aviation Demand

This Chapter contains aviation activity forecasts for the Hector International Airport (FAR) over a 20 year planning horizon. Aviation demand forecasts are an important step in the master planning process. Ultimately, they form the basis for future demand-driven improvements at the Airport, provide data from which to estimate future off-airport impacts such as noise and traffic, and are incorporated by reference into other studies and policy decisions. This Chapter, which presents aviation activity forecasts through 2033, is organized as follows:

The Federal Aviation Administration (FAA) projects future aviation activity through its Terminal Area Forecasts (TAF) which is utilized to compare projections that were prepared for this Master Plan. Forecasts that are developed for airport master plans and/or federal grants must be approved by the FAA. It is the FAA's policy, listed in Advisory Circular (AC) 150/5070-6B, Airport Master Plans, that FAA approval of forecasts should be consistent with the TAF. Master plan forecasts for operations, based aircraft and enplanements, are considered to be consistent with the TAF if they meet the following criteria:

- ✓ Forecasts differ by less than ten percent in the five-year forecast and 15 percent in the ten-year period.

If the forecast is not consistent with the TAF, differences must be resolved if the forecast is to be used in FAA decision-making. This may involve revisions to the airport sponsor's submitted forecasts, adjustments to the TAF, or both. FAA decision-making includes key environmental issues (e.g. purpose and need, air quality, noise, land use), noise compatibility planning (14 CFR Part 150), approval of development on an airport layout plan and initial financial decisions. It should be noted that the TAF presents annual data for a fiscal year (October 1 to September 30), while the forecasts created in this master plan are presented for the calendar year.

This Chapter examines data that pertains to aviation activities and describes the projections of aviation demand. This chapter was originally prepared in 2014 based on data through the year 2013, as this was the most recent calendar year for which a full 12 months of historical data was available. In February of 2015 a number of items in this chapter, including passenger enplanements, aircraft operations, and the FAA's Terminal Area Forecast, were updated to include historical data through the end of 2014. In October of 2015 most of the remainder of the data was updated to include historical data through the end of 2014 and projection methodologies were updated to utilize this newer data in their analysis and methodologies.

2.1 Forecasting Approach

A number of forecasting techniques may be used to project aviation activity that range from subjective judgment to sophisticated mathematical modeling. These forecasts incorporate local and national industry trends in assessing current and future demand. Socioeconomic factors such as local population, retail sales, employment, and per capita income have also been analyzed for the effect they may have had historically and may have on future levels of activity. The comparison of the relationships among these various indicators provided the initial step in the development of realistic forecasts for future aviation demand.

The following sections provide an assessment of historical trends of aviation activity data at the local and national level. Aviation activity statistics on such items as passenger enplanements, aircraft operations and based aircraft are collected, reviewed and analyzed. Since a large number of variables affect a facility plan, it is important that each one be considered in the context of its use in the plan.

Methodologies used to develop forecasts described in this section include:

- ✓ Time-series methodologies
- ✓ Market share methodologies
- ✓ Socioeconomic methodologies

2.1.a Time-Series Methodologies

Historical trend lines and linear extrapolation are widely used methods of forecasting. These techniques utilize time-series types of data and are most useful for a pattern of demand that demonstrates a historical relationship with time. Trend line analyses used in this Chapter are linearly extrapolated, establishing a trend line using the least squares method to known historical data. Growth rate analyses used in this Chapter examined the historical compounded annual growth rates (CAGR) and extrapolated future data values by assuming a similar CAGR for the future.

2.1.b Market Share Methodology

Market share, ratio, or top-down methodologies compare local levels of activity with a larger entity. Such methodologies imply that the proportion of activity that can be assigned to the local level is a regular and predictable quantity. This method has been used extensively in the aviation industry to develop forecasts at the local level. Historical data is most commonly used to determine the share of total national traffic activity that will be captured by a particular region or airport. The FAA develops national forecasts annually in its FAA Aerospace Forecasts document; the latest edition of which is the FAA Aerospace Forecasts Fiscal Year (FY) 2014-2034.

2.1.c Socioeconomic Methodologies

Though trend line extrapolation and market share analyses may provide mathematical and formulaic justification for demand projections, there are many factors beyond historical levels of activity that may identify trends in aviation and its impact on local aviation demand. Socioeconomic or correlation analyses examine the direct relationship between two or more sets of historical data. Local market conditions examined in this Chapter include population, total employment, total retail sales, and per capita income for the Fargo Metropolitan Statistical Area (MSA), which has been defined by the U.S. Census Bureau as Cass County North Dakota and Clay County Minnesota. Historical and forecasted socio-economic statistics for this MSA were obtained from the economic forecasting firm Woods & Poole Economics, Inc. Based upon the observed and projected correlation between historical aviation activity and the socioeconomic data sets, future aviation activity projections were developed. Table 2-1 presents forecasts of socio-economic indicators that are utilized in various locations of this chapter.

Table 2-1: Historical and Projected Socio-Economic Indicators for Fargo MSA

Year	Population	Employment	Total Retail Sales (mil, 2005$)	Per Capita Personal Income (2005$)
Historical				
2000	174,970	126,833	2,947.46	59,780
2001	177,033	127,950	2,904.39	60,545
2002	178,891	128,936	2,861.81	61,479
2003	181,539	130,659	2,944.35	63,203
2004	186,448	134,259	3,104.00	63,276
2005	189,303	138,220	3,215.62	63,660
2006	193,412	142,868	3,322.01	65,327
2007	197,121	146,982	3,373.60	67,188
2008	201,346	150,271	3,267.27	70,143
2009	206,223	149,317	3,066.88	67,943
2010	209,392	149,993	3,226.74	70,001
2011	210,931	149,525	3,400.00	73,903
2012	212,554	152,239	3,458.08	74,786
2013	214,210	155,222	3,517.29	75,499
2014	215,886	158,258	3,577.68	76,473
Projected				
2018	222,752	170,904	3,831.33	81,606
2023	231,591	188,078	4,181.54	89,639
2028	240,431	206,526	4,563.04	98,910
2033	249,182	226,512	4,983.03	109,665
CAGR (2013-2033)	*0.76%*	*1.91%*	*1.76%*	*1.88%*

Note: Fargo Metropolitan Statistical Area (MSA)
CAGR = Compound Annual Growth Rate
Source: Woods & Poole Economic Inc.

2.2 Enplaned Passengers

Enplanements are defined as the activity of passengers boarding commercial service aircraft that depart an airport. Enplanements include passengers on scheduled commercial service aircraft or non-scheduled charter aircraft. Enplanements do not include the airline crew. The total number of passengers using an airport is the sum of the airport's enplanements and deplanements (passengers debarking commercial service aircraft). Though recorded, deplanements are not specifically evaluated in this document as they are roughly equal to the number of enplanements.

As was noted in the Inventory chapter, commercial airline service at the Airport is provided by five airlines: Delta Air Lines, United Airlines, American Airlines, Frontier Airlines, and Allegiant Air. As of April 2014, Delta Air Lines offers daily flights to Minneapolis, Salt Lake City, and weekly flights to Atlanta. United Airlines offers daily flights to Denver and Chicago-O'Hare, and American Airlines offers daily flights to Chicago and Dallas-Fort Worth. Frontier has a daily flight to Denver and Allegiant Air has multiple flights per week to the

destination cities of Las Vegas, Orlando, Los Angeles, Tampa, and Phoenix-Mesa. A route map is included in the Inventory chapter. The peak month in 2013 was April with 152 aircraft departures and 10,514 departing seats per week.

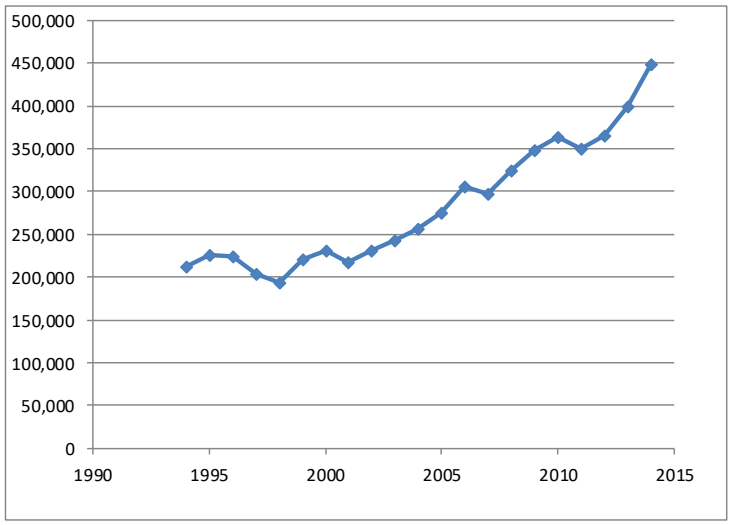
Passenger enplanement data is provided to Airport management by commercial passenger service carriers, who maintain data as they transport people to and from the facility. The FAA has figures in its Terminal Area Forecasts (TAF) based on a fiscal year basis. For projections presented in this chapter, historical data provided by the Airport is generally used based upon the calendar year basis.

2.2.a Enplanement History

Between 1994 and 2014, passenger enplanements at the Hector International Airport have generally increased from a low of 193,826 in 1998 to a high of 448,848 in 2014. From 1994 through 2014, enplanements have increased, at a compound annual growth rate (CAGR) of 3.81 percent. **Table 2-2** presents the historical enplanements at the Airport since 1994.

Table 2-2: Historical Enplanements

Year	FAR Enplanements
1994	212,527
1995	226,498
1996	224,829
1997	203,105
1998	193,826
1999	221,368
2000	230,969
2001	217,979
2002	230,405
2003	243,097
2004	256,004
2005	275,200
2006	305,218
2007	297,964
2008	324,434
2009	348,951
2010	363,138
2011	350,458
2012	364,727
2013	398,677
2014	448,848
CAGR (1994-2014)	*3.81%*
CAGR (2001-2014)	*5.71%*



Notes: CAGR = Compounded Annual Growth Rate
Sources: Historical Enplanements - 1994-1996 FAA TAF; 1997-2014 Airport Management Records

In February of 2015 the historical enplanements were updated to include data through the end of 2014, Table 2-3 included estimates of 2014 enplanements and has been removed from the report.

2.2.b Federal Aviation Administration Forecast

The FAA records passenger enplanements for all commercial service airports and releases an updated version of the TAF every year. As noted earlier, the annual TAF data is based on the federal fiscal year rather than the calendar year, so historical figures differ slightly from the Airport's records. The FAA's historical records and projections of passenger enplanements are shown in **Table 2-3**.

Table 2-3: Enplanement Forecast – FAA Terminal Area Forecast (TAF)

Year	FAA TAF Enplanements
Historical:	
2000	233,863
2001	231,063
2002	230,563
2003	246,951
2004	257,338
2005	280,318
2006	302,024
2007	299,952
2008	320,854
2009	341,898
2010	369,643
2011	344,523
2012	364,646
2013	390,913
2014	436,842
Projected:	
2018	452,718
2023	451,170
2028	477,769
2033	505,510
CAGR (2014-2033)	*0.77%*

Source: FAA Terminal Area Forecast

As illustrated above, the FAA projects a 0.77 percent compound annual growth rate in enplanements for Hector International Airport through 2033.

2.2.c Enplanement Forecast

Six methodologies were evaluated to develop projections for passenger enplanements. These methodologies are described in the following sections and include trend line and growth rate methodologies. The results of these two forecasting methodologies are presented in **Table 2-4**.

Trend Line Methodology – The trend line methodology is based on the assumption that future trends will continue to mimic those of the selected time period and that factors that affect those trends will continue to influence demand levels in a similar fashion. The establishment of a linear trend line using historical data through the least squares method typically serves as a baseline projection to which other methodologies are compared.

Airport records for passenger enplanements from 2000 to 2014 were reviewed as a part of this methodology. Applying the least squares method, results in a regression equation and regression statistics of:

Enplanements = 14,944.696 * (Year) – 29,783,951

Regression Statistics	
Multiple R	0.975625349
R Square	0.951844822
Adjusted R Square	0.948140577
Standard Error	15652.49011
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	62955457876	62955457876	256.9605842	6.0683E-10
Residual	13	3185005806	245000446.6		
Total	14	66140463682			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-29783951.13	1877382.655	-15.86461399	6.90171E-10
Enplanements	14994.69643	935.4151993	16.02999015	6.0683E-10

The trend line methodology projects passenger enplanements will increase to 475,346 in 2018 and continuing to increase linearly through 2033 to 700,267, a compound annual growth rate of 2.37 percent.

Growth Rate Methodology – The growth rate methodology examines the percent change in activity between two points in time, and assumes that future activity will change at this rate throughout the forecasting

period. Between 2000 and 2014, there was a robust 4.86 percent compound annual growth rate in passenger activity. Applying this CAGR, passenger enplanements are forecasted to grow to 542,676 in 2018, 688,007 in 2023, 872,258 in 2028, and 1,105,852 in 2033.

Table 2-4: Enplanement Forecasts – Trend Line & Growth Rate Methodologies

	Trend Line	Growth Rate	
Year	Enplanements	Enplanements	Percent Change
Historical:			
2000	230,969	230,969	
2001	217,979	217,979	-5.62%
2002	230,405	230,405	5.70%
2003	243,097	243,097	5.51%
2004	256,004	256,004	5.31%
2005	275,200	275,200	7.50%
2006	305,218	305,218	10.91%
2007	297,964	297,964	-2.38%
2008	324,434	324,434	8.88%
2009	348,951	348,951	7.56%
2010	363,138	363,138	4.07%
2011	350,458	350,458	-3.49%
2012	364,727	364,727	4.07%
2013	398,677	398,677	9.31%
2014	448,848	448,848	12.58%
		CAGR (2000-2014)	*4.86%*
Projected:			
2018	475,346	542,676	*4.86%*
2023	550,320	688,007	*4.86%*
2028	625,293	872,258	*4.86%*
2033	700,267	1,105,852	*4.86%*
CAGR (2014-2033)	*2.37%*	*4.86%*	

Sources: Historical Enplanements - Airport Management Records
Projections - Mead & Hunt

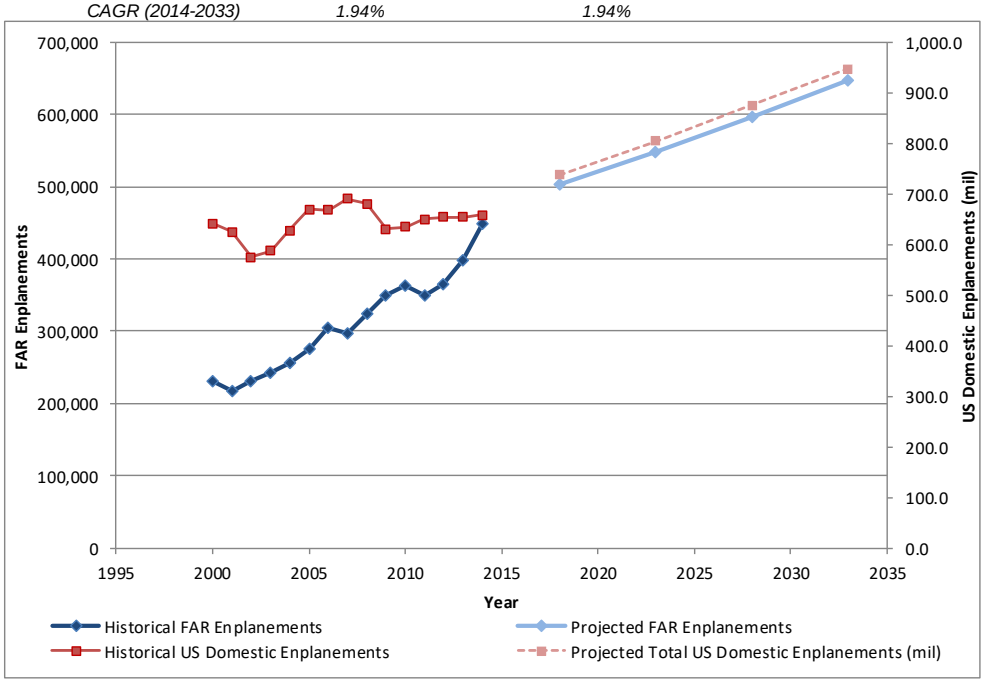
Market Share Methodology – A market share methodology compares activity levels at an airport to a larger geographical region as a whole over a given length of time. For the purposes of this Master Plan, a market share methodology forecast has been developed that compares activity at the Hector International Airport with total U.S. domestic enplanements. Domestic U.S. and Hector International Airport enplanement data dating back to 2000 was examined. The results of these projection methodologies are presented in **Table 2-5**.

This market share methodology utilizes the projections of total U.S. domestic enplanements described in the FAA Aerospace Forecasts FY 2014-2034. The FAA develops their commercial aviation forecasts from econometric models that explain and incorporate emerging trends for the different segments of the industry along with the world and U.S. economies. The FAA has developed its forecasts for the U.S. domestic market with a model based upon real disposable personal income, believing that aviation demand is a derived demand – that is, aviation demand depends upon the level of business and leisure activity in the economy. Hector International has seen significant growth in air service offerings and seats in the market since 2001 resulting in significant passenger enplanement growth. The Airport's market share of total U.S. domestic enplanements has increased from 0.0348% in 2001 to 0.0682% in 2014. This high level of growth is not anticipated to be sustainable long-term as carriers exhibit capacity discipline and limit the amount of additional seats they add in individual markets. Therefore this market share methodology assumes that the Airport's 2014 market share of U.S. domestic enplanements of 0.0682% will remain constant through the year 2033. This assumption is supported by the fact that year-to-date enplanements through October in 2015 are approximately 2.5% below 2014's year-to-date enplanements.

The market share methodology projects 503,530 passenger enplanements in 2018, 548,369 in 2023, 597,459 in 2028 and 646,259 in 2033. This represents a compound annual growth rate of 1.94 percent, the same as the FAA's projected growth rate in total U.S. Domestic Enplanements.

Table 2-5: Enplanement Forecast – Market Share Methodology

	Market Share Methodology		
Year	FAR Enplanements	Total US Domestic Enplanements (mil)	FAR Market Share
Historical:			
2000	230,969	641.2	0.0360%
2001	217,979	625.8	0.0348%
2002	230,405	575.1	0.0401%
2003	243,097	587.8	0.0414%
2004	256,004	628.5	0.0407%
2005	275,200	669.5	0.0411%
2006	305,218	668.4	0.0457%
2007	297,964	690.1	0.0432%
2008	324,434	680.7	0.0477%
2009	348,951	630.8	0.0553%
2010	363,138	635.2	0.0572%
2011	350,458	650.1	0.0539%
2012	364,727	653.8	0.0558%
2013	398,677	654.3	0.0609%
2014	448,848	658.1	0.0682%
CAGR (2000-2014)	*4.86%*	*0.19%*	
Projected:			
2018	503,530	738.2	0.0682%
2023	548,369	804.0	0.0682%
2028	597,459	876.0	0.0682%
2033	646,259	947.5	0.0682%
CAGR (2014-2033)	*1.94%*	*1.94%*	



Notes: CAGR = Compounded Annual Growth Rate
Sources: Historical Enplanements - Airport Management Records
Total US Domestic Enplanements - FAA Aerospace Forecasts FY 2014-2034
Projections - Mead & Hunt

Socioeconomic Methodology – Socioeconomic, or correlation, methodologies examine the direct relationship between two or more sets of historical data. To conduct forecasts using this method, local conditions were examined including population and total employment for The Fargo Metropolitan Statistical Area (MSA). Historical and forecasted socio-economic statistics for this service area were obtained from the economic forecasting firm Woods & Poole Economics, Inc. Based upon the observed and projected correlation between historical aviation activity and the socioeconomic data sets, future aviation activity projections were developed. The results of these methodologies are presented in **Table 2-6**.

Socioeconomic Methodology – Population Variable – Local population can be a strong indicator for the demand of commercial aviation, particularly at small hub and non-hub airports. The socioeconomic population variable methodology compares historical population figures to passenger enplanements. Between 2000 and 2014, the population of the Fargo MSA is anticipated to increase from 174,970 to 215,886, a compound annual growth rate of 1.51 percent. The correlation between population and enplanements as expressed by the coefficient of determination, or R^2, was found to be 0.9324. It is projected that for the Fargo MSA population through 2033 will increase to 249,182, a compound annual growth rate of 0.76%. The number of enplanements per capita has increased from 1.231 in 2001 to 2.079 in 2014. As noted under the market share methodology, this high level of growth is not anticipated to be sustainable long-term, this methodology assumes that the Airport's 2014 ratio of enplanements per capita will remain constant at its 2014 level of enplanements per capita, through the year 2033. This assumption is supported by the fact that year-to-date enplanements through October in 2015 are approximately 2.5% below 2014's year-to-date enplanements. In 2014, the number of annual enplanements per capita was 2.079. This figure was applied to population projections to forecast 463,123 passenger enplanements in 2018, 481,501 in 2023, 499,879 in 2028, and 518,073 in 2033.

Socioeconomic Methodology – Employment Variable – Because local economic conditions can impact levels of passenger activity, another socioeconomic factor that was examined was total employment. Between 2000 and 2014, total employment in the Airport's region is anticipated to increase from 126,833 to 158,258 a compound annual growth rate of 1.59. The correlation between employment and enplanements as expressed by the coefficient of determination, or R^2, was found to be 0.9228. It is projected that for the Fargo MSA, total employment through 2033 will increase to 226,512, a compound annual growth rate of 1.91 percent. The number of enplanements per job has increased from 1.704 in 2001 to 2.836 in 2014. As noted under the market share methodology, this high level of growth is not anticipated to be sustainable long-term, this methodology assumes that the Airport's 2014 ratio of enplanements per job will remain constant at its

2014 level of enplanements per job, through the year 2033. This assumption is supported by the fact that year-to-date enplanements through October in 2015 are approximately 2.5% below 2014's year-to-date enplanements. The number enplanements per regional job was 2.836 in 2014, applying this figure to the total employment projections by Woods and Poole Economics, Inc., forecasts illustrate that 484,714 passengers will be enplaned in 2018, 533,423 in 2023, 585,745 in 2028, and 642,430 in 2033.

Table 2-6: Enplanement Forecasts – Socioeconomic Methodologies

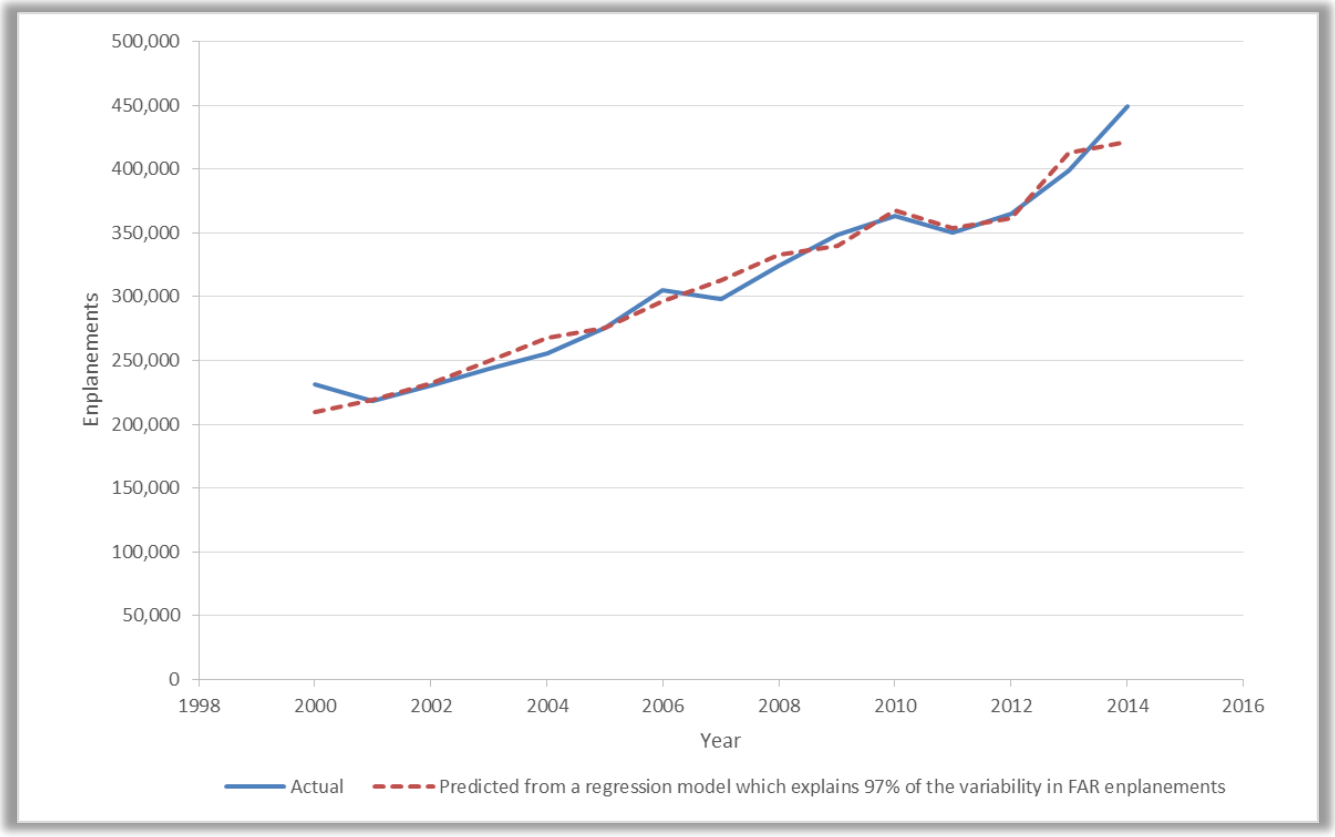
	Socio-Economic Methodology Population Variable			Socio-Economic Methodology Employment Variable		
Year	Enplanements	Fargo MSA Population	Enplanements Per Capita	Enplanements	Fargo MSA Employment	Enplanements Per Job
Historical:						
2000	230,969	174,970	1.320	230,969	126,833	1.821
2001	217,979	177,033	1.231	217,979	127,950	1.704
2002	230,405	178,891	1.288	230,405	128,936	1.787
2003	243,097	181,539	1.339	243,097	130,659	1.861
2004	256,004	186,448	1.373	256,004	134,259	1.907
2005	275,200	189,303	1.454	275,200	138,220	1.991
2006	305,218	193,412	1.578	305,218	142,868	2.136
2007	297,964	197,121	1.512	297,964	146,982	2.027
2008	324,434	201,346	1.611	324,434	150,271	2.159
2009	348,951	206,223	1.692	348,951	149,317	2.337
2010	363,138	209,392	1.734	363,138	149,993	2.421
2011	350,458	210,931	1.661	350,458	149,525	2.344
2012	364,727	212,554	1.716	364,727	152,239	2.396
2013	398,677	214,210	1.861	398,677	155,222	2.568
2014	448,848	215,886	2.079	448,848	158,258	2.836
CAGR (2000-2014)	*4.86%*	*1.51%*		*4.86%*	*1.59%*	
Projected:						
2018	463,123	222,752	2.079	484,714	170,904	2.836
2023	481,501	231,591	2.079	533,423	188,078	2.836
2028	499,879	240,431	2.079	585,745	206,526	2.836
2033	518,073	249,182	2.079	642,430	226,512	2.836
CAGR (2014-2033)	*0.76%*	*0.76%*		*1.91%*	*1.91%*	

Sources: Historical Enplanements - Airport Management Records
Historical & Projected Population & Employment - Woods & Poole

Multi-Variable Regression Analysis – Multi-variable regression analysis examines the causal relationship between a number of independent variables. This analytical tool typically requires independent forecasts of the independent of "causal" variables to produce aviation forecasts. To prepare forecasts for Hector International Airport, regression analyses of passenger enplanements were prepared. The trend in passenger enplanements was predicted based upon the independent variables of local Fargo Metropolitan Statistical Area socio-economic indicators including population, employment, total retail sales, and per capita income as presented in Table 2-1. The regression analysis also included the national variable of total U.S. Domestic

enplanements as presented in Table 2-6, and a dummy variable[1] to represent the drop in enplanements at FAR during 2011 and 2012 due to an economic recession. The dummy variable has a value of 1 in 2011 and 2012, and value of 0 in all other historical and projected years. As shown in **Figure 2-1**, the historical trend in enplanements is strongly predicted by the regression model employed.

Figure 2-1: Annual and Predicted Enplanements



[1] A dummy variable of 0 or 1 is used to indicate the presence or absence of condition or event that affect the outcome but is not explained by other independent variables.

The multivariable regression analysis was found to have a correlation to the number of enplanements as expressed by the coefficient of determination, or R^2, of 0.9709 and this regression analysis was found to have the following statistics:

Regression Statistics	
Multiple R	0.985334282
R Square	0.970883648
Adjusted R Square	0.949046384
Standard Error	15423.31458
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6	63456431379	10576071896	44.45995	1.02844E-05
Residual	8	1903029060	237878632.5		
Total	14	65359460439			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-609711.6474	147663.3715	-4.129064921	0.003303
Population	3.979548948	2.592448103	1.535054431	0.163318
Employment	-1.528151626	3.992862487	-0.382720825	0.711895
Retail Sales	48.20427361	66.5967191	0.72382355	0.489796
Per Capita Income	4.08680145	4.482477352	0.911728299	0.388559
US Dom. Enpl	-107.9701482	345.0070819	-0.312950527	0.762321
Economic Recessio	-43500.42101	20949.88451	-2.076403857	0.071514

This regression model was utilized to project future enplanements based upon the independent projections in the independent variables utilized. **Table 2-7** summarizes the results of this analysis. This methodology projects enplanements will increase to 621,853 by the year 2033, a compound annual growth rate of 1.73%.

Table 2-7: Multi-Variable Regression Analysis Methodology

	Actual FAR Enplanements	Predicted Multi-Variable Regression Analysis
Historical:		
2000	230,969	209,933
2001	217,979	219,144
2002	230,405	232,272
2003	243,097	249,825
2004	256,004	267,463
2005	275,200	275,291
2006	305,218	296,601
2007	297,964	312,830
2008	324,434	332,576
2009	348,951	340,184
2010	363,138	367,401
2011	350,458	353,432
2012	364,727	361,753
2013	398,677	413,001
2014	448,848	421,513
CAGR (2000-2014)	*4.86%*	*5.11%*
Projected:		
2018		454,060
2023		505,606
2028		561,097
2033		621,853
CAGR (2014-2033)		*1.73%*

Sources: Historical Enplanements - Airport Management Records
Predicted - Mead & Hunt, Inc.

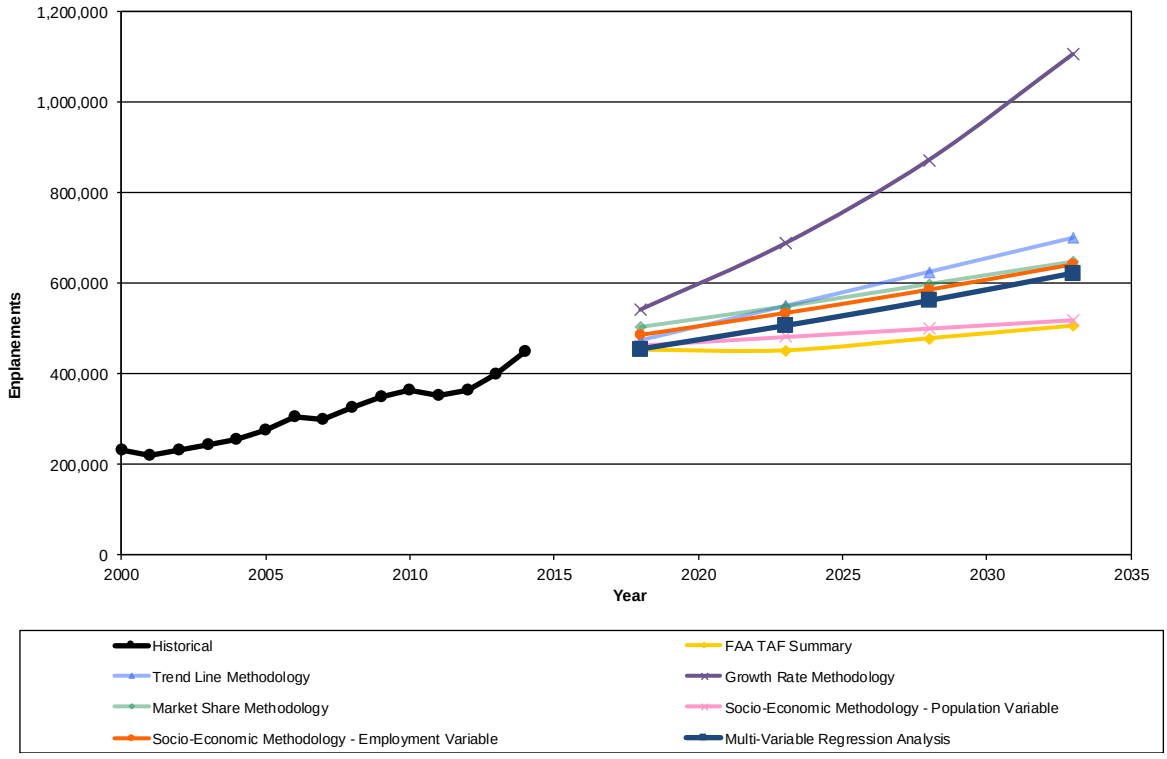
Enplanement Forecasts Comparison and Summary – A comparison of projected enplanements using the methodologies described in this section is presented in **Table 2-8**. All of the methodologies project that there will be an increase in passenger demand over the next 20 years. The 20-year projection of passenger enplanements for the year 2033 ranges from a high of 1,089,383 under the growth rate methodology and a low of 501,849 under the FAA's Terminal Area Forecast.

All of the methodologies utilized for passenger projections indicate strong increases in passenger enplanements through the planning period. Near the middle of this range is the Multivariable Regression Analysis methodology, projecting passenger enplanements of 621,853 for the year 2033. Of all the methodologies examined, the Multivariable Regression Analysis Methodology has the highest R^2 correlation statistic at 0.9709. This methodology takes into account the strong population and economic growth occurring within the Fargo MSA, which has a strong correlation to the number of enplanements. It also includes consideration of the FAA's projections for total U.S. Domestic Enplanements. As this methodology has the highest correlation statistic it has been selected as the preferred methodology and will serve as the baseline projection for this master plan update.

Projecting passenger enplanements to increase to 454,060 in 2018, 505,606 in 2023, and 561,097 in 2028, and 621,853 in 2033, a compound annual growth rate of 1.73 percent.

Table 2-8: Enplanement Forecasts Summary

Year	Historical	FAA TAF Summary	Trend Line Methodology	Growth Rate Methodology	Market Share Methodology	Socio-Economic Methodology - Population Variable	Socio-Economic Methodology - Employment Variable	*Preferred* Multi-Variable Regression Analysis
Historical:								
2000	230,969							
2001	217,979							
2002	230,405							
2003	243,097							
2004	256,004							
2005	275,200							
2006	305,218							
2007	297,964							
2008	324,434							
2009	348,951							
2010	363,138							
2011	350,458							
2012	364,727							
2013	398,677							
2014	448,848							
CAGR (2000-2014)	*4.86%*							
Projected:								
2018		452,718	475,346	542,676	503,530	463,123	484,714	454,060
2023		451,170	550,320	688,007	548,369	481,501	533,423	505,606
2028		477,769	625,293	872,258	597,459	499,879	585,745	561,097
2033		505,510	700,267	1,105,852	646,259	518,073	642,430	621,853
CAGR (2014-2033)		*0.63%*	*2.37%*	*4.86%*	*1.94%*	*0.76%*	*1.91%*	*1.73%*



Sources: Historical Enplanements - 1994-1996 FAA TAF; 1997-2014 Airport Management Records
Projections - Mead & Hunt, Inc., except FAA TAF Summary which are from the FAA Terminal Area Forecast

2.3 Commercial Aircraft Operations

Commercial aircraft operations are either scheduled or unscheduled flights typically operated by a certificated air carrier, or are conducted by a charter or air taxi operator. This section summarizes the forecasts that were prepared for commercial aircraft operations.

2.3.a Scheduled Commercial Passenger Operations Forecasts

National trends in aviation demand have been volatile in recent years. The terrorist attacks that occurred on September 11, 2001 had a significant impact on collective national travel behavior. The economic recession that began in 2008 also impacted travel behavior and the commercial airlines economics. As a result, fewer passengers were enplaned at many airports throughout the U.S. With recent increases in aircraft operating costs, airlines have been forced to maximize fleet efficiency in order to remain profitable.

In many markets, air carriers are reducing or retiring older turboprops and less fuel efficient small regional jet aircraft (typically 50 seats and smaller), and if the market can profitably sustain it, replacing them with larger regional jets (typically 70 to 90 seats) and narrow-body jets that have more seats and lower operational costs per passenger. In many markets, the use of larger aircraft is reducing the frequency of particular routes. Due to increasing fuel and operational costs, air carriers must maintain higher passenger load factors to remain profitable. **Table 2-9** presents the historical and projected seats per departure and load factor at the Hector International Airport and for the U.S. regional and mainline carrier fleets.

Table 2-9: Scheduled Commercial Average Seats/Departure and Load Factor

	Average Seats/Dep			Load Factor % (Domestic)		
Year	FAR	US Regional Carrier Fleet	US Mainline Carrier Fleet	FAR	US Regional Carrier Fleet	US Mainline Carrier Fleet
Historical:						
2010	71.2	56.1	151.9	71.1%	76.2%	82.7%
2011	67.8	56.4	152.3	72.9%	76.2%	83.6%
2012	69.6	56.1	152.7	75.8%	77.6%	84.1%
2013	67.3	56.1	153.9	78.5%	78.4%	84.2%
2014	71.6	57.5	155.2	84.7%	78.1%	84.2%
CAGR (2010-2014)	*0.15%*	*0.62%*	*0.54%*	*4.48%*	*0.62%*	*0.45%*
Projected:						
2018	73.4	59.2	156.4	84.7%	78.2%	84.9%
2023	77.8	61.4	157.9	84.7%	78.3%	85.3%
2028	82.7	63.7	159.5	84.7%	78.4%	85.6%
2033	85.4	66.1	161.0	84.7%	78.5%	85.7%
CAGR (2014-2033)	*0.93%*	*0.74%*	*0.19%*	*0.00%*	*0.03%*	*0.09%*

Sources: FAR Hist Average Seat Data - Airline Schedules, Diio Mio
Hist Load Factor Calculated from Historial Passengers, Historcial Departures, and Historical Avg Seats/Dep
Hist and Projected US Carrier Fleet Avg/Seats & Load Factor - FAA Aerospace Forecasts FY2014-2034
Projections - Mead & Hunt, Inc.

At the Hector International Airport, the average number of seats per departure and aircraft load factor is projected to increase, similar to the FAA's projected increases in these metrics within the U.S. regional and mainline carrier fleets. At the Airport, the average number of seats per departure is anticipated to increase from 71.6 in 2014, to 73.4 in 2018, 77.8 in 2023, 82.7 in 2028, and 85.4 in 2033. Passenger load factor is also anticipated to remain high throughout the projection period at 84.7 percent.

In calculating future scheduled commercial operations, the average number of seats per departure at the Airport is multiplied by the passenger load factor. Projected passenger enplanements are then divided by this figure to obtain scheduled commercial passenger departures; and departures are multiplied by two to calculate projected scheduled commercial operations (operations being arrivals and departures) as shown in **Table 2-10**. Through the next 20 years, passenger enplanements are projected to increase at a compound annual growth rate of 1.73 percent while increases in aircraft size and load factor are anticipated to result in a 0.79 percent CAGR increase in the number of scheduled commercial operations. Scheduled passenger operations are projected to total 14,599 in 2018, 15,337 in 2023, 16,011 in 2028, and 17,184 in 2033.

Table 2-10: Scheduled Commercial Operations Forecasts

Year	Scheduled Passenger Enpl	Scheduled Passenger Dep	Average Seats/Dep	Load Factor	Scheduled Passenger Ops
Historical:					
2010	363,138	7,172	71.2	71.1%	14,344
2011	350,458	7,100	67.8	72.9%	14,200
2012	364,727	6,914	69.6	75.8%	13,828
2013	398,677	7,542	67.3	78.5%	15,084
2014	448,848	7,397	71.6	84.7%	14,794
	5.44%	*0.78%*	*0.15%*	*4.48%*	*0.78%*
Projected:					
2018	454,060	7,299	73.4	84.7%	14,599
2023	505,606	7,668	77.8	84.7%	15,337
2028	561,097	8,006	82.7	84.7%	16,011
2033	621,853	8,592	85.4	84.7%	17,184
CAGR (2014-2033)	*1.73%*	*0.79%*	*0.93%*	*0.00%*	*0.79%*

Sources: Hist Enplanements - Airport Records
Hist Scheduled Air Carrier Dep's and Avg Seat Data - Airline Schedules, Diio Mi
Projections - Mead & Hunt, Inc.

2.3.b Air Carrier Fleet Mix

The FAA Aerospace Forecasts FY 2013-2033 notes the following regarding the U.S. commercial aircraft fleet:

> *After 2013, the mainline air carrier passenger fleet increases an average of 58 aircraft a year over the remaining years of the forecast period, totaling 4,907 aircraft in 2033. The narrow-body fleet (including E-190's at JetBlue and U.S. Airways) is projected to grow by 28 aircraft annually over the period 2012-2033; the wide-body fleet grows by 26 aircraft a year as the Boeing 787 and Airbus A350's enter the fleet.*

> *The regional carrier passenger fleet is forecast to decrease by 63 aircraft in 2013 as increases in larger regional jets are more than offset by reductions in 50 seat and smaller regional jets and turboprops. After 2013, the regional carrier fleet is expected to increase by an average of 5 aircraft (0.2 percent) a year over the remaining years of the forecast period, totaling 2,436 aircraft in 2033. The number of regional jets (90 seats or fewer) at regional carriers is projected to grow from 1,645 in 2012 to 2,082 in 2033, an average annual increase of 1.1 percent. All of the growth in regional jets over the forecast period occurs in the larger 70 to 90-seat aircraft……. Turboprop/piston aircraft are expected to account for just 14.5 percent of the regional carrier passenger fleet in 2033, down from a 31.5 percent share in 2012.*

The number of commercial passenger aircraft in the U.S. is forecast to grow from 6,185 in 2012 to 7,343 in 2033. The U.S. mainline carrier fleet is projected to shrink initially through 2015 as carriers remove older, less fuel efficient narrow-body aircraft and then increase through 2033. The narrow-body fleet is anticipated to grow by approximately 3 aircraft annually, particularly as carriers take deliveries of Embraer 190s, and the coming single aisle replacements from Airbus and Boeing (A320-NEO, B737-MAX). The wide-body fleet is anticipated to grow by 15 aircraft a year, particularly as the Boeing 787 and Airbus A350's enter the fleet.

The regional carrier passenger fleet is forecast to increase by nearly 2 aircraft per year as increases in larger regional jets offset reductions in 50 seat and smaller regional jets. All growth in regional jets over the forecast period is projected to occur in the larger 70 and 90-seat aircraft. The turboprop/piston fleet is expected to shrink from 758 units in 2012 to 354 in 2033, reflecting a decline in the make-up of the regional carrier passenger fleet from 31.5 percent turboprop/piston in 2012 to only 14.5 percent in 2033.

Bombardier Commercial Aircraft prepares market forecasts regarding the world commercial aircraft market. The Bombardier Commercial Market Forecast 2012-2031, projects a significant decline in the less than 60 seat fleet and strong growth in the 60 to 99 seat fleet along with the strong growth in the 100 to 149 seat aircraft fleets (see **Table 2-11**).

Table 2-11: Bombardier Fleet Growth Forecast (20- to 149-seat Aircraft Market)

World Fleet	2011 Fleet	Deliveries	Retirements	2031 Fleet
20- to 59-seat	3,600	300	2,700	1,200
60- to 99-seat	2,500	5,600	1,300	6,800
100- to 149-seat	5,100	6,900	3,000	9,000
Total	11,200	12,800	7,000	17,000

Sources: Bombardier Commerical Aircraft Market Forecast 2012-2031

As previously mentioned, in many US markets, air carriers are reducing or retiring older and less fuel efficient aircraft, particularly 50 seat and smaller regional jets, and replacing them with larger regional (70 to 90 seats) and narrow-bodied jets that have more seats and lower operational costs per passenger. This trend is anticipated to present itself at the Hector International Airport as the turboprop and small regional jets are retired from air carrier fleets and replaced with larger regional jets.

Table 2-12 presents the historical and projected fleet of scheduled commercial airline operators at the Airport. Commercial aircraft equipped with 40- to 60-seats make up the majority of the current scheduled operations fleet mix. As these aircraft are retired by the carriers they are being replaced with larger regional jets, therefore it is projected that operations by aircraft with 40- to 60-seats will be reduced in favor of 70- to 90-seat regional jets and small narrow body aircraft with 100 to 150 seats. Additionally, service by low-cost carriers utilizing narrow-body aircraft with over 151 seats to leisure destinations, is anticipated to continue to grow through the projection period.

Table 2-12: Scheduled Commercial Operations Fleet Mix Forecast

Seat Range	Typical Aircraft	Historical Departures 2010	2011	2012	2013	Projected Departures 2018	2023	2028	2033
Less than 40	Saab340, ERJ135, DHC-8	0	0	0	0	0	0	0	0
	Beech1900, EMB120	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*
40-60	CRJ200, ERJ140, ERJ145,	4,302	4,928	4,722	5,290	3,650	2,684	1,601	1,289
	DHC-8-300	*60.0%*	*69.4%*	*68.3%*	*70.1%*	*50.0%*	*35.0%*	*20.0%*	*15.0%*
61-99	CRJ700, CRJ900,	1,594	1,118	1,120	1,269	2,409	3,834	5,204	5,843
	EMB170, EMB175	*22.2%*	*15.7%*	*16.2%*	*16.8%*	*33.0%*	*50.0%*	*65.0%*	*68.0%*
100-130	B717, DC9, EMB190,	673	420	142	41	146	153	160	215
	EMB195, A318	*9.4%*	*5.9%*	*2.1%*	*0.5%*	*2.0%*	*2.0%*	*2.0%*	*2.5%*
131-150	A319, A320, MD80,	200	189	248	339	365	383	400	516
	B737-4, B737-5	*2.8%*	*2.7%*	*3.6%*	*4.5%*	*5.0%*	*5.0%*	*5.0%*	*6.0%*
151 or more	A319, A320, MD80, B737-8, B	403	445	682	603	584	613	640	730
		5.6%	*6.3%*	*9.9%*	*8.0%*	*8.0%*	*8.0%*	*8.0%*	*8.5%*
Total Scheduled Passenger Aircraft Departures		7,172	7,100	6,914	7,542	7,299	7,668	8,006	8,592
Average Seats Per Departure		71.2	67.8	69.6	67.3	73.4	77.8	82.7	85.4
Total Scheduled Seats		510,523	481,050	481,455	507,947	535,775	596,598	662,075	733,765

Note: Numbers may not add due to rounding
Sources: Historical Scheduled Departures and Average Seat Data - Airline Schedules, Diio Mi
Projections - Mead & Hunt, Inc.

2.3.c Unscheduled Commercial Passenger Operations Forecasts

Unscheduled commercial flights are typically categorized as charters or air taxis. FAR has a significant amount of charter activity due to the presence of North Dakota State University and the number of athletic charters that use the airport, among other charter users of the airport. **Table 2-13** summarizes the number of scheduled commercial operations in comparison to the number of operations conducted by commercial air carrier aircraft over 60 seats and air taxi aircraft 60 seats and under reported by the Airport's Airport Traffic Control Tower (ATCT). The difference between the two totals is the number of unscheduled commercial operations.

Table 2-13: Commercial Operations Forecasts

	Total			Scheduled Operations			Unscheduled / Others[1]	
Year	Air Carrier	Commuter/ Air Taxi	Total Commercial	Scheduled Commercial Departures	Scheduled Commercial Operations	*Percent Scheduled*	Ops	*Percent Unscheduled*
Historical:	***Historical ATCT Reported Operations***			***Scheduled Airline Operations***				
2011	4,545	14,092	18,637	7,100	14,200	*76.2%*	4,437	*23.8%*
2012	4,443	13,839	18,282	6,914	13,828	*75.6%*	4,454	*24.4%*
2013	4,435	18,950	23,385	7,542	15,084	*64.5%*	8,301	*35.5%*
2014	5,612	21,483	27,095	7,397	14,794	*54.6%*	12,301	*45.4%*
			FAA Projected Growth Rate in Total Active General Aviation and Air Taxi Fleet [3]				*0.5%*	
Projected:								
2018	7,007	20,140	27,148	7,299	14,599	*53.8%*	12,549	*46.2%*
2023	9,969	18,234	28,202	7,668	15,337	*54.4%*	12,866	*45.6%*
2028	12,809	16,393	29,202	8,006	16,011	*54.8%*	13,191	*45.2%*
2033	14,607	16,101	30,708	8,592	17,184	*56.0%*	13,524	*44.0%*
CAGR (2014-2033)	*5.16%*	*-1.51%*	*0.66%*	*0.79%*	*0.79%*		*0.50%*	

[1]Others is the difference between the tower reported Commercial Ops and the Scheduled Ops reported by Diio Mi. Others represents the Charter/Air Taxi/Fractional ownership aircraft

[2]FAA Aerospace Forecasts 2014-2034

Sources: Historical Operations - FAA Air Traffic Activity Data System (ATADS) & Mead & Hunt
Historical Scheduled Commercial Operations: Airline Schedules obtained from Diio Mi
Projections - Mead & Hunt, Inc.

The overall proportion of unscheduled operations at the Hector International Airport was 45.4 percent in 2013. According to the FAA Aerospace Forecasts FY 2014-2034, the projected annual growth rate of the national general aviation and air taxi fleet is expected to be 0.5 percent. It is assumed that unscheduled operations at the Hector International Airport will reflect this national trend; therefore, applying this projected CAGR to the level of operations conducted in 2014, an increase to 13,524 unscheduled operations annually can be anticipated by 2033. Total commercial operations included both the projected scheduled carrier operations and the unscheduled commercial operations, they are projected to increase from 27,095 in 2014 to 30,708 in 2033, and CAGR of 0.66 percent.

2.4 Based Aircraft

The FAA defines a based aircraft at an airport, as an aircraft that is "operational & air worthy" and which is typically based at the airport for a majority of the year. Airport management conducted a survey of tenants in June of 2014 to determine current based aircraft totals and found 119 single engine aircraft, 42 multi-engine, 20 jet, 5 helicopter, and 4 military aircraft, for a total of 190. This inventory is considered the current 2013/2014 based aircraft total for the master plan. Historical based aircraft totals have been obtained from airport management records.

There are several factors that affect the number of based aircraft at an airport. Recently, increasing costs to own and operate aircraft has been a primary factor that has contributed to a slight decline in the overall U.S. general aviation fleet since 2007. The Hector International Airport, however, has experienced an increase in the number of aircraft based at the Airport since 2000. Several methodologies were evaluated to develop based aircraft projections.

The growth rate methodology examines the percent change in activity between two points in time, and assumes that future activity will change at this rate throughout the forecasting period. Between 2000 and 2014, there was a 1.10% percent compound annual growth rate in total based aircraft. The correlation between years and FAR based aircraft as expressed by the coefficient of determination, or R^2, was found to only be 0.0754. Applying the historic CAGR of 1.10%, based aircraft are forecasted to grow from 190 in 2014 to 234 in 2033.

The market share methodology compares local based aircraft at the Airport to the total number of general aviation aircraft in the U.S. as reported by the FAA. As illustrated in **Table 2-14**, the Airport's market share has increased since 2000, and in 2014 the number of based aircraft represented 0.09359 percent of total active general aviation aircraft in the United States. The correlation between total U.S. active aircraft and FAR based aircraft as expressed by the coefficient of determination, or R^2, was found to only be 0.0117. Applying a projected CAGR of 0.51 percent as forecasted for the growth of based aircraft in the U.S., the number of aircraft at the Airport is forecasted to grow from 190 in 2014 to 209 in 2033.

Table 2-14: Based Aircraft Forecast – Market Share Methodology

	Growth Rate Methodology	Market Share Methodology		
	Based Aircraft	Based Aircraft	Total U.S. Active Aircraft	Market Share
Historical:				
2000	163	163	217,533	0.07493%
2001	171	171	211,446	0.08087%
2002	184	184	211,244	0.08710%
2003	175	175	209,606	0.08349%
2004	194	194	219,319	0.08846%
2005	188	188	224,257	0.08383%
2006	188	188	221,942	0.08471%
2007	177	177	231,606	0.07642%
2008	177	177	228,664	0.07741%
2009	177	177	223,876	0.07906%
2010	171	171	223,370	0.07655%
2011	180	180	220,453	0.08165%
2012	180	180	209,034	0.08611%
2013	180	180	202,865	0.08873%
2014	190	190	203,020	0.09359%
CAGR (2000-2014)	*1.10%*	*1.10%*	*-0.49%*	
Projected:				
2018	199	204	217,560	0.09359%
2023	210	205	219,400	0.09359%
2028	221	207	221,380	0.09359%
2033	234	209	223,470	0.09359%
CAGR (2014-2033)	*1.10%*	*0.51%*	*0.51%*	

Sources: Historical Based Aircraft - Airport Management Records
Total U.S. Active Aircraft (GA & Air Taxi) - FAA Aerospace Forecasts FY2014-2034
Projected Based Aircraft - Mead & Hunt, Inc.

Socioeconomic (or correlation) forecasting methodologies examine the direct relationship between two or more sets of historical data. Data examined in developing based aircraft forecasts using this methodology included both population and total employment. Total employment was used as an indicator of economic activity occurring within the community with the assumption being that changes in economic activity will impact the number of based aircraft. Population and total employment for the Fargo Metropolitan Statistical Area (MSA) were examined. Historical and forecasted socio-economic statistics for this service area were obtained from the economic forecasting firm Woods & Poole Economics, Inc. Based upon the observed and projected correlation between historical aviation activity and socioeconomic data, based aircraft forecasts

were developed. The correlation, as expressed by the coefficient of determination, or R^2, was found to only be 0.0451 for population and 0.0556 for employment. The forecasts that were prepared utilizing these methodologies are presented in **Table 2-15**. As illustrated in the table, based aircraft at the Airport are projected to increase from 190 aircraft in 2014 to 219 aircraft in 2033 using the population variable socioeconomic methodology. Utilizing the same methodology, but using the number of based per job in the region, based aircraft at the Airport are projected to increase from 190 aircraft in 2014 to 272 aircraft in 2033.

Table 2-15: Based Aircraft Forecasts – Socioeconomic Methodologies

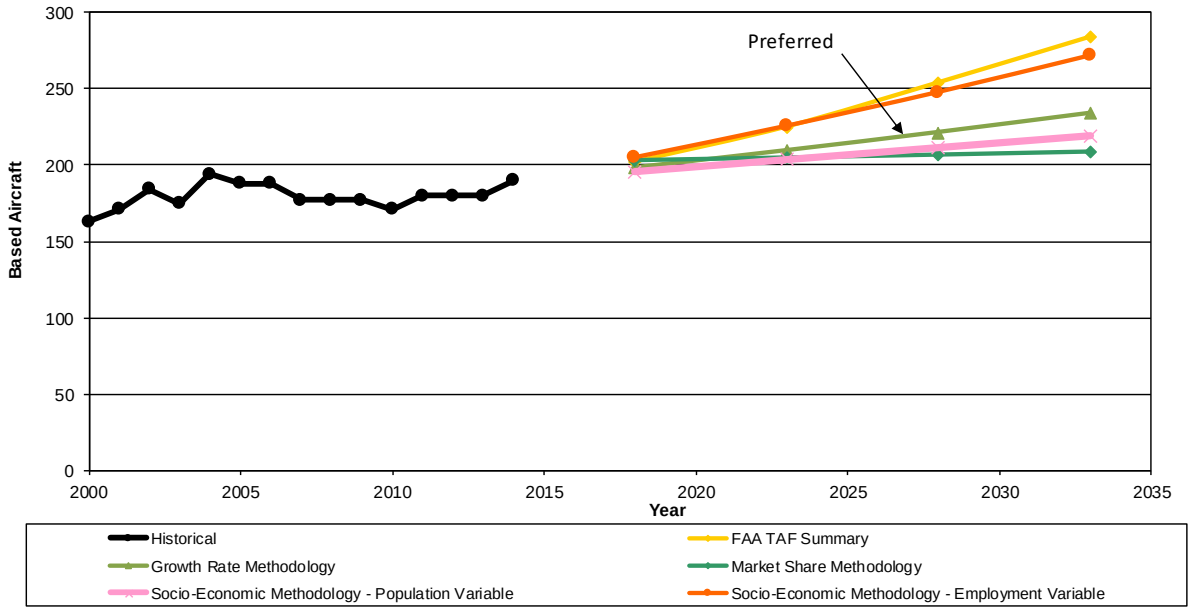
	Socio-Economic Methodology - Population Variable			Socio-Economic Methodology - Total Employment Variable		
Year	Based Aircraft	Fargo MSA Population	Based Aircraft Per Capita	Based Aircraft	Fargo MSA Employment	Based Aircraft Per Job
Historical:						
2000	163	174,970	0.00093	163	126,833	0.00129
2001	171	177,033	0.00097	171	127,950	0.00134
2002	184	178,891	0.00103	184	128,936	0.00143
2003	175	181,539	0.00096	175	130,659	0.00134
2004	194	186,448	0.00104	194	134,259	0.00144
2005	188	189,303	0.00099	188	138,220	0.00136
2006	188	193,412	0.00097	188	142,868	0.00132
2007	177	197,121	0.00090	177	146,982	0.00120
2008	177	201,346	0.00088	177	150,271	0.00118
2009	177	206,223	0.00086	177	149,317	0.00119
2010	171	209,392	0.00082	171	149,993	0.00114
2011	180	210,931	0.00085	180	149,525	0.00120
2012	180	212,554	0.00085	180	152,239	0.00118
2013	180	214,210	0.00084	180	155,222	0.00116
2014	190	215,886	0.00088	190	158,258	0.00120
CAGR (2000-2014)	*1.10%*	*1.51%*		*1.10%*	*1.59%*	
Projected:						
2018	196	222,752	0.00088	205	170,904	0.00120
2023	204	231,591	0.00088	226	188,078	0.00120
2028	212	240,431	0.00088	248	206,526	0.00120
2033	219	249,182	0.00088	272	226,512	0.00120
CAGR (2014-2033)	*0.76%*	*0.76%*		*1.91%*	*1.91%*	

Sources: Historical Based Aircraft - Airport Management Records
Population & Employment - Woods & Poole

A comparison of projected based aircraft at the Airport using the methodologies described in this section and the FAA's Terminal Area Forecast is presented in **Table 2-16**. All of the methodologies indicate an increase in the number of based aircraft at the airport. They range from a compound annual growth rate of 0.51 percent to a high of 2.14 percent under the FAA's TAF. None of methodologies exhibited a strong correlation between the examined independent variable and based aircraft. For the purposes of this Master Plan study, the Growth Rate methodology lies near the middle of various methodologies examined and serves as the preferred projection of based aircraft for the next 20 years. This methodology takes into the historic growth in activity that has been generated based upon the strong local economy, the amount of new pilot training that occurs at Hector International, and the robust FBO that operates at the airport. This methodology projects based aircraft to increase from 190 in 2013 to 234 in 2033, a compound annual growth rate of 1.10 percent.

Table 2-16: Based Aircraft Forecasts Summary

Year	Historical	FAA TAF Summary	Preferred Growth Rate Methodology	Market Share Methodology	Socio-Economic Methodology - Population Variable	Socio-Economic Methodology - Employment Variable
Historical:						
2000	163					
2001	171					
2002	184					
2003	175					
2004	194					
2005	188					
2006	188					
2007	177					
2008	177					
2009	177					
2010	171					
2011	180					
2012	180					
2013	180					
2014	190					
CAGR (2000-2014)	*1.10%*					
Projected:						
2018		202	199	204	196	205
2023		225	210	205	204	226
2028		254	221	207	212	248
2033		284	234	209	219	272
CAGR (2014-2033)		*2.14%*	*1.10%*	*0.51%*	*0.76%*	*1.91%*



Sources: Historical Based Aircraft - Airport Management Records
Projections - Mead & Hunt, Inc., except FAA TAF Summary which are from the FAA Terminal Area Forecast

2.5 Based Aircraft Fleet Mix

Historical based aircraft by type and projected fleet mix at the Hector International Airport is presented in **Table 2-17**. In 2014, 63 percent of the local fleet was comprised of single engine aircraft, 22 percent multi-engine aircraft, 11 percent jet aircraft, 3 percent helicopters, and 2 percent military or other aircraft. The FAA Aerospace Forecast FY 2014-2034 projects that turboprop and jet aircraft will see a higher growth rate than other types of aircraft through 2033. This trend is also anticipated to occur locally as the number of multi-engine and jet aircraft based at the Airport are expected to increase at a higher growth rate than single engine aircraft types.

Table 2-17: Based Aircraft Fleet Mix Forecast

	Single Engine		Multi-Engine		Jet		Helicopter		Military		
Year	#	%	#	%	#	%	#	%	#	%	Total
Historical:											
2000	85	52%	48	29%	6	4%	4	2%	20	12%	163
2001	87	51%	52	30%	6	4%	4	2%	22	13%	171
2002	100	54%	50	27%	8	4%	4	2%	22	12%	184
2003	84	48%	55	31%	9	5%	5	3%	22	13%	175
2004	103	53%	51	26%	12	6%	6	3%	22	11%	194
2005	102	54%	47	25%	11	6%	6	3%	22	12%	188
2006	102	54%	45	24%	14	7%	5	3%	22	12%	188
2007	101	57%	48	27%	14	8%	5	3%	9	5%	177
2008	101	57%	48	27%	14	8%	5	3%	9	5%	177
2009	101	57%	48	27%	14	8%	5	3%	9	5%	177
2010	105	61%	37	22%	14	8%	6	4%	9	5%	171
2011	101	56%	44	24%	18	10%	5	3%	12	7%	180
2012	101	56%	44	24%	18	10%	5	3%	12	7%	180
2013	101	56%	44	24%	18	10%	5	3%	12	7%	180
2014	119	63%	42	22%	20	11%	5	3%	4	2%	190
Projected:											
2018	119	60%	46	23%	25	13%	5	2%	4	2%	199
2023	126	60%	48	23%	26	13%	5	2%	4	2%	210
2028	133	60%	51	23%	28	13%	5	2%	4	2%	221
2033	140	60%	54	23%	29	13%	6	2%	5	2%	234
CAGR (2014-2033)	*0.87%*		*1.31%*		*2.06%*		*0.61%*		*0.83%*		*1.10%*

Notes: Numbers may not add due to rounding
Sources: Historical Based Aircraft Airport Management Records
Projections - Mead & Hunt, Inc.

2.6 General Aviation Operations

General aviation operations are those aircraft operations which are not categorized as commercial or military. The FAA Air Traffic Activity Data System (ATADS) contains the FAA's official air traffic operations data and includes general aviation operations. Hector International Airport has significant amount of general aviation activity due to the number of personal and business aircraft based at the airport, and also due to the fact that they have a robust full-service Fixed Based Operator (FBO) with international arrivals capability, fuel service, and maintenance facilities.

Overall, general aviation operations across the nation over the past ten years have significantly decreased, with the greatest loss of activity experienced in recreational flying due to higher fuel and operating costs. This has also been experienced at Hector International Airport when general aviation operations have declined from over 70,000 in 2000 to a low of approximately 43,000 in 2006, fluctuating since 2006 to 46,916 in 2014.

Table 2-18 presents the general aviation operations forecasts that were prepared using the Operations per Based Aircraft Methodology, the Market Share Methodology, and summary of the FAA TAF forecast.

Table 2-18: GA Operations Forecasts

		FAA TAF Summary	Operations Per Based Aircraft Methodology			Market Share Methodology		
Year	Historical	Total GA Ops	Based Acft	Ops per Based Acft	Total GA Ops	Total GA Ops	Total U.S. GA Ops	Market Share
Historical:								
2000	70,363	72,479	163	432	70,363	70,363	36,833,300	0.1910%
2001	65,875	63,961	171	385	65,875	65,875	38,046,600	0.1731%
2002	60,770	63,497	184	330	60,770	60,770	39,999,600	0.1519%
2003	56,167	56,243	175	321	56,167	56,167	39,878,500	0.1408%
2004	46,858	49,527	194	242	46,858	46,858	37,626,472	0.1245%
2005	47,805	48,996	188	254	47,805	47,805	37,652,701	0.1270%
2006	43,083	41,829	188	229	43,083	43,083	35,524,020	0.1213%
2007	45,908	45,470	177	259	45,908	45,908	34,967,730	0.1313%
2008	46,473	47,447	177	263	46,473	46,473	34,146,800	0.1361%
2009	48,055	46,360	177	271	48,055	48,055	33,072,516	0.1453%
2010	45,968	45,890	171	269	45,968	45,968	33,131,959	0.1387%
2011	52,733	49,362	180	293	52,733	52,733	31,573,810	0.1670%
2012	54,801	57,481	180	304	54,801	54,801	28,019,023	0.1956%
2013	53,282	54,101	180	296	53,282	53,282	26,580,130	0.2005%
2014	46,916	47,436	190	247	46,916	46,916	25,964,931	0.1807%
			Average	*293*				
Projected:								
2018		47,481	199	247	49,016	50,876	28,156,592	0.1807%
2023		47,777	210	247	51,774	51,118	28,290,480	0.1807%
2028		48,079	221	247	54,687	51,362	28,425,623	0.1807%
2033		48,387	234	247	57,764	51,609	28,562,046	0.1807%
	CAGR (2014-2033)	*0.10%*	*1.10%*		*1.10%*	*0.50%*	*0.50%*	

Sources: Historical Operations - Air Traffic Activity Data System (ATADS)
Total U.S. GA Operations - FAA Aerospace Forecasts FY 2014-2034
Projections - Mead & Hunt, Inc., except FAA TAF Summary which are from the FAA Terminal Area Forecast

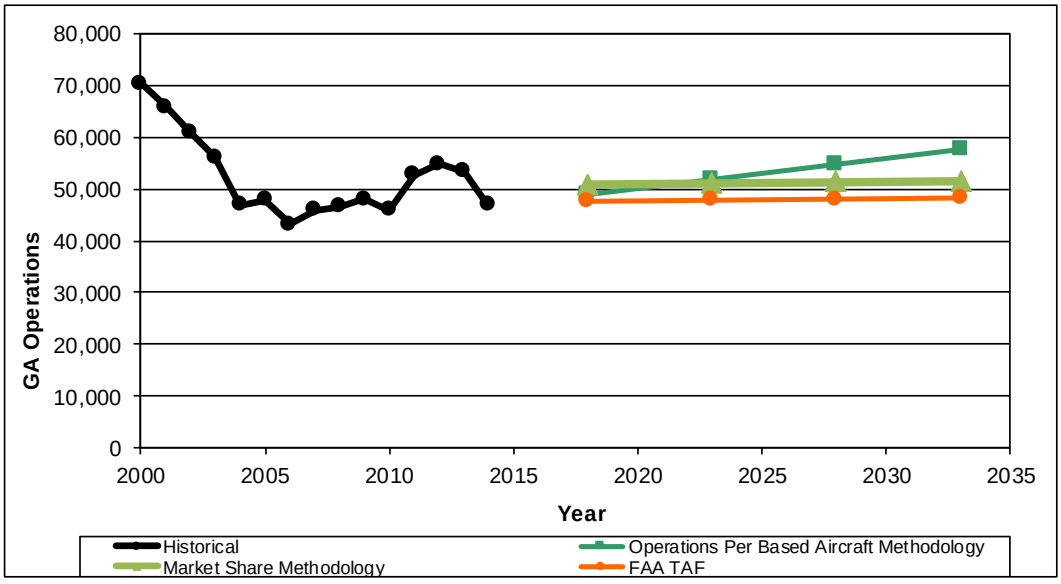
The Operations per Based Aircraft Methodology examines the number of general aviation operations that occurred in 2014 per based aircraft. In 2014, the number of general aviation operations per based aircraft was 247. Using the projected number of based aircraft for FAR and assuming this level of operations per based aircraft remains constant throughout the forecasting period, general aviation operations will increase from 46,916 in 2014 to 57,764 in 2033.

The market share methodology compares local activity with a larger entity. In 2014 the Airport's 46,916 general aviation operations represented 0.1807 percent of the total U.S. general aviation operations. Using the FAA's forecasts of total U.S. general aviation operations, and assuming the 2014 market share of 0.1807 percent remains constant throughout the forecasting period, the market share methodology projects general aviation operations will increase from 46,916 in 2013 to 51,608 in 2033.

General aviation activity can be affected by many variables including the costs to own and operate an aircraft, available hangar space for lease, and the status of local, state, national and world economies. A comparison of projected general aviation operations using the methodologies described in this section is presented in **Table 2-19**. It is anticipated that the Airport's number of general aviation operations will increase proportionally with the number of based aircraft for the airport, and therefore the Operations per Based Aircraft Methodology is the preferred projection. Based aircraft are projected to increase at a compound annual growth rate of 1.10 percent and therefore the general aviation operations are also anticipated to increase at 1.10 percent with this methodology.

Table 2-19: GA Operations Forecasts Summary

Year	Historical	*Preferred* Operations Per Based Aircraft Methodology	Market Share Methodology	FAA TAF
Historical:				
2000	70,363			
2001	65,875			
2002	60,770			
2003	56,167			
2004	46,858			
2005	47,805			
2006	43,083			
2007	45,908			
2008	46,473			
2009	48,055			
2010	45,968			
2011	52,733			
2012	54,801			
2013	53,282			
2014	46,916			
Projected:				
2018		49,016	50,876	47,481
2023		51,774	51,118	47,777
2028		54,687	51,362	48,079
2033		57,764	51,609	48,387
CAGR (2014-2033)		*1.10%*	*0.50%*	*0.16%*



Sources: Historical Operations - Air Traffic Activity Data System (ATADS)
Projections - Mead & Hunt, Inc., except FAA Terminal Area Forecast Summary

As a part of the projections developed for general aviation operations, a breakdown of the operations that can be anticipated by local and itinerant aircraft movements was also prepared. As defined by the FAA Air Traffic Activity Data System, local operations are those operations performed by aircraft that remain in the local traffic pattern, execute simulated instrument approaches or low passes at an airport and the operations to or from an airport and a designated practice area within a 20−mile radius of the tower. Itinerant operations are operations performed by an aircraft, either IFR, SVFR (special VFR), or VFR that lands at an airport arriving from outside the airport area or departs an airport and leaves the airport area.

In 2014, itinerant general aviation operations represented 50 percent of the total general aviation operations, while local operations represented 50 percent. These percentages have been fairly consistent since 2000 and it is anticipated that the split in local/itinerant operations experienced in 2014 will remain constant throughout the forecasting period. A summary of the projected local and itinerant general aviation operations is presented in **Table 2-20**.

Table 2-20: Local/Itinerant General Aviation Operations Forecast

	Total GA	Itinerant GA		Local GA	
Year	Operations	Operations	Percent	Operations	Percent
Historical:					
2000	70,363	37,017	53%	33,346	47%
2001	65,875	34,822	53%	31,053	47%
2002	60,770	34,497	57%	26,273	43%
2003	56,167	32,414	58%	23,753	42%
2004	46,858	26,596	57%	20,262	43%
2005	47,805	26,003	54%	21,802	46%
2006	43,083	23,374	54%	19,709	46%
2007	45,908	21,300	46%	24,608	54%
2008	46,473	20,444	44%	26,029	56%
2009	48,055	20,061	42%	27,994	58%
2010	45,968	22,359	49%	23,609	51%
2011	52,733	26,231	50%	26,502	50%
2012	54,801	29,101	53%	25,700	47%
2013	53,282	27,710	52%	25,572	48%
2014	46,916	23,356	50%	23,560	50%
Projected:					
2018	49,016	24,402	50%	24,615	50%
2023	51,774	25,775	50%	26,000	50%
2028	54,687	27,225	50%	27,463	50%
2033	57,764	28,757	50%	29,008	50%
CAGR (2013-2033)	*1.10%*	*1.10%*		*1.10%*	

Sources: Historical Operations - Air Traffic Activity Data System (ATADS) and Mead & Hunt
Projections - Mead & Hunt, Inc.

2.7 Military Operations

In 2014 the number of annual military operations conducted at Hector International Airport was 2,189. Military operations are driven more by national security policy decisions than by economic factors, therefore barring any change in mission for the military at Hector International Airport or at a surrounding facility, it is logical to project military operations will remain consistent with the number conducted in 2014. **Table 2-21** presents the military operations projections.

Table 2-21: Military Operations Forecast

Year	Itinerant Operations	Itinerant %	Local Operations	Local %	Total
Historical:					
2000	4,345	59%	2,962	41%	7,307
2001	3,822	64%	2,107	36%	5,929
2002	3,329	63%	1,959	37%	5,288
2003	2,829	65%	1,499	35%	4,328
2004	2,677	71%	1,098	29%	3,775
2005	3,876	56%	3,053	44%	6,929
2006	3,579	53%	3,131	47%	6,710
2007	2,887	61%	1,823	39%	4,710
2008	3,130	58%	2,262	42%	5,392
2009	5,234	61%	3,281	39%	8,515
2010	3,855	59%	2,654	41%	6,509
2011	3,551	63%	2,090	37%	5,641
2012	3,124	61%	1,979	39%	5,103
2013	2,150	57%	1,621	43%	3,771
2014	1,138	52%	1,060	48%	2,198
Projected:					
2018	1,138	52%	1,060	48%	2,198
2023	1,138	52%	1,060	48%	2,198
2028	1,138	52%	1,060	48%	2,198
2033	1,138	52%	1,060	48%	2,198

Sources: Historical Military Operations - FAA Air Traffic Activity Data System (ATADS)
Projections - Mead & Hunt, Inc.

2.8 Instrument Operations

Instrument operations are those conducted by properly equipped aircraft that can utilize radio and global positioning system (GPS) signals emitted by navigational equipment for a pilot to conduct a landing with limited visual cues. Most instrument operations are conducted by commercial aircraft, general aviation aircraft filing instrument flight plans, and essentially all aircraft operations conducted in IFR weather. In 2014, 49 percent of all aircraft operations conducted at the Hector International Airport were instrument operations (**Table 2-22**). Assuming this percentage remains constant throughout the forecasting period, instrument operations are projected to increase from 37,498 in 2014 to 44,614 in 2033.

Table 2-22: Instrument Operations Forecast

Year	Total Operations	Instrument Operations		Visual Operations	
		Operations	Percent	Operations	Percent
Historical:					
2000	97,173	37,014	38%	60,159	62%
2001	89,206	34,771	39%	54,435	61%
2002	83,254	34,978	42%	48,276	58%
2003	78,582	34,372	44%	44,210	56%
2004	70,189	31,780	45%	38,409	55%
2005	77,899	35,002	45%	42,897	55%
2006	72,836	34,015	47%	38,821	53%
2007	73,093	33,597	46%	39,496	54%
2008	76,024	32,898	43%	43,126	57%
2009	84,774	34,793	41%	49,981	59%
2010	75,489	34,656	46%	40,833	54%
2011	77,011	34,326	45%	42,685	55%
2012	78,186	35,826	46%	42,360	54%
2013	80,438	38,905	48%	41,533	52%
2014	76,209	37,498	49%	38,711	51%
Projected:					
2018	78,362	38,557	49%	39,805	51%
2023	82,175	40,433	49%	41,741	51%
2028	86,087	42,359	49%	43,729	51%
2033	90,670	44,614	49%	46,057	51%
CAGR (2014-2033)	*0.92%*	*0.92%*		*0.92%*	

Sources: Historical Operations - FAA Air Traffic Activity Data System (ATADS)
Projections - Mead & Hunt, Inc.

2.9 Cargo Activity

Air cargo at Hector International Airport consists of charter activity and small package delivery since DHL ceased operations nationwide and left the market in 2008. As shown in **Table 2-23**, the amount of landed weight at the Airport since 2008 has ranged from a low of 7,261 tons in 2009 to a high of 11,749 tons in 2011. In 2013, the Airport had 8,142 tons of landed cargo aircraft weight, indicating that the Airport's market share compared to total U.S. revenue ton miles in 2013 was 0.00007 percent. Barring any change in the nature of the air cargo activity occurring at the airport, such as a new cargo operator, the air cargo projection assumes that the Airport's current market share of the domestic air cargo market will remain steady through the forecasting period. Analyzing U.S. air cargo projections obtained from the FAA Aerospace Forecast FY 2014-2034, a CAGR of 1.36 percent is projected through 2033. Applying this CAGR, total air cargo enplaned at the Airport is projected to increase from 8,142 tons in 2013 to 10,667 tons in 2033.

Table 2-23: Air Cargo Projections

Year	Cargo Aircraft Landings	Total FAR Landed Weight (tons)	Weight per Landing (tons)	Total U.S. Air Cargo (mil-rev ton mi)	FAR Market Share
Historical:					
2000	4,401	54,740	12.4	14,698.73	0.00037%
2001	3,454	44,243	12.8	13,937.89	0.00032%
2002	3,490	30,086	8.6	12,967.38	0.00023%
2003	3,546	30,272	8.5	14,972.44	0.00020%
2004	3,153	31,505	10.0	16,340.95	0.00019%
2005	3,165	39,079	12.3	16,089.58	0.00024%
2006	2,883	39,552	13.7	15,380.90	0.00026%
2007	2,235	34,272	15.3	15,219.14	0.00023%
2008	1,894	23,362	12.3	14,407.63	0.00016%
2009	1,491	7,261	4.9	11,898.56	0.00006%
2010	1,323	10,726	8.1	12,823.07	0.00008%
2011	1,082	11,749	10.9	12,046.88	0.00010%
2012	1,432	9,367	6.5	12,294.75	0.00008%
2013	1,395	8,142	5.8	12,375.18	0.00007%
Projected:					
2018	1,534	8,954	5.8	13,608.36	0.00007%
2023	1,633	9,530	5.8	14,484.38	0.00007%
2028	1,726	10,075	5.8	15,313.18	0.00007%
2033	1,828	10,667	5.8	16,212.92	0.00007%
CAGR (2013-2033)	*1.36%*	*1.36%*		*1.36%*	

Sources: Historical Airport Cargo Data - Airport Management Records
Total U.S. Air Cargo (Revenue Ton Miles) - FAA Aerospace Forecasts FY2014-2034

Since the writing of this document, cargo operations have exploded at Hector International Airport. Fed Ex began ramping-up in 2016 to begin daily cargo service with 2 Airbus A-300 aircraft. This required a significant investment in ground handling facilities, aircraft storage hangars, and additional apron space. A fleet of more than 10 feeder aircraft are housed at the Airport, and support the role of the wide-body aircraft. The annual landed weight for calendar year 2017 is anticipated to reach nearly 125,000 tons. This is a major departure from projections prior to Fed Ex, and the situation of FAR's cargo operations is considered fluid. Current expectiations are that annual landed weight will continue to increase over time, and the potential additions of other operations could cause numbers to spike in the future. These increases in volume are also steering the usage of larger aircraft, such as the Boeing 767.

2.10 Peak Passenger Activity and Operations

Airfield infrastructure planning is often based on peak periods of aircraft activity. In an effort to measure how well existing facilities can accommodate high levels of demand, this section presents the monthly, daily and hourly peak activity levels for passengers and aircraft operations that can be anticipated at the Airport for the next 20 years.

2.10.a Peak Month Passenger Activity Forecasts

Monthly passenger enplanement data obtained from the Airport illustrates that between 2011 and 2014, the average percentage of passenger enplanements that occurred in the peak month accounted for 10.1 percent of the total annual enplanements **(Table 2-24**). It is assumed that the peak monthly enplanements will continue to account for 10.1 percent of the total enplaned passengers at the Airport throughout the forecasting period. Applying this methodology, peak month enplanements are anticipated to increase from 44,222 in 2014 to 62,793 in 2033.

Table 2-24: Peak Month Enplanements Projections

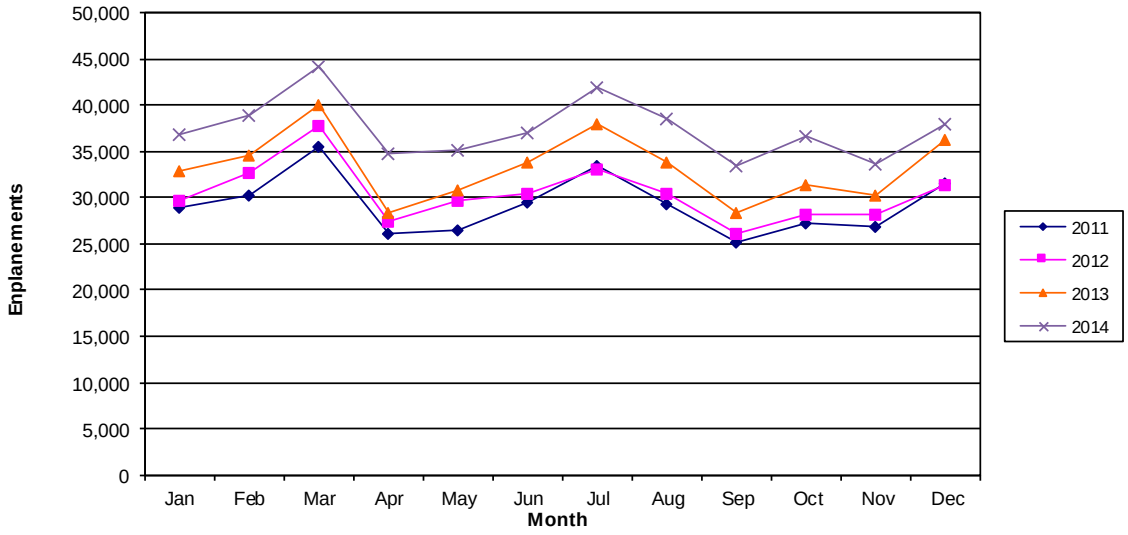
Historical Monthly Enplanements

Month	2011		2012		2013		2014	
Jan	29,008	8.3%	29,608	8.1%	32,937	8.3%	36,898	8.2%
Feb	30,266	8.6%	32,597	8.9%	34,581	8.7%	38,869	8.7%
Mar	35,588	10.2%	37,700	10.3%	40,054	10.0%	44,222	9.9%
Apr	26,148	7.5%	27,373	7.5%	28,279	7.1%	34,690	7.7%
May	26,450	7.5%	29,727	8.2%	30,786	7.7%	35,077	7.8%
Jun	29,496	8.4%	30,452	8.3%	33,891	8.5%	37,019	8.2%
Jul	33,510	9.6%	33,142	9.1%	37,895	9.5%	41,980	9.4%
Aug	29,243	8.3%	30,378	8.3%	33,851	8.5%	38,447	8.6%
Sep	25,186	7.2%	26,038	7.1%	28,425	7.1%	33,487	7.5%
Oct	27,216	7.8%	28,217	7.7%	31,445	7.9%	36,633	8.2%
Nov	26,824	7.7%	28,214	7.7%	30,199	7.6%	33,583	7.5%
Dec	31,505	9.0%	31,281	8.6%	36,334	9.1%	37,943	8.5%
Total	350,440	Mar	364,727	Mar	398,677	Mar	448,848	Mar
Peak Month	35,588	10.2%	37,700	10.3%	40,054	10.0%	44,222	9.9%

Average Percent of Enplanements in Peak Month = 10.1%

Projected Peak Month Enplanements (Scheduled Carriers)

	Projected Annual Enpl	Peak Month %	Peak Month Enplanements
2018	454,060	10.1%	45,850
2023	505,606	10.1%	51,055
2028	561,097	10.1%	56,658
2033	621,853	10.1%	62,793



Source: Airport Management Records
Mead & Hunt, Inc.

2.10.b Peak Month Average Day Passenger Activity Forecasts

It should be noted that airport infrastructure planning is based on the probable demand for facilities that may occur over a period of time. If planning is contingent with the busiest periods of activity, it can lead to overestimation, overspending, and inefficiencies. Daily peak activity figures are based on a regularly occurring activity level day during the peak month. A review of airline activity schedules for the peak month of March 2013 indicates that activity regularly peaks on Saturdays. On average, Saturday typically has 28 departures and 27 arrivals and accounts for approximately 19.1 percent and 17.7 percent of weekly departing and arriving seats, respectively (**Table 2-25**). Considering the average peak month is 31 days long (4.4 weeks), the average number of weekly passengers in the peak month is calculated by dividing the number of total monthly passengers with the average number of weeks in the peak month. This figure is then divided by the percent of weekly activity that occurs on a typical Saturday to determine the average daily number of total passengers that are enplaned and deplaned in the peak month.

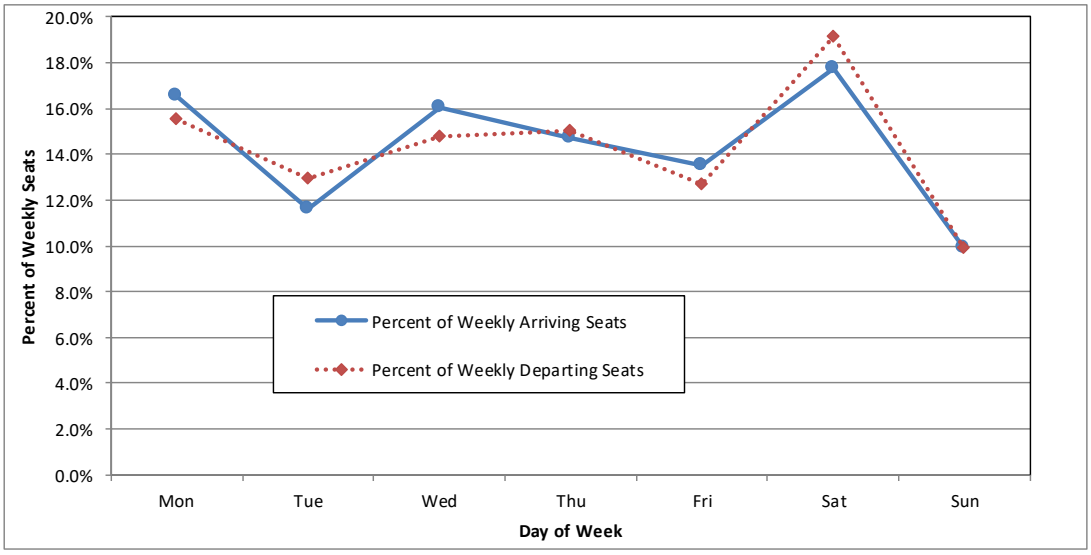
Table 2-25: Peak Month Average Day (PMAD) Passenger Projections

Seats per Day (Scheduled Carriers)

Day of the Week	Departures	Departing Seats	Percentage of Weekly Dep Seats	Arrivals	Arriving Seats	Percentage of Weekly Arr Seats
Mon	24	1,632	15.5%	25	1,744	16.5%
Tue	22	1,362	13.0%	21	1,224	11.6%
Wed	23	1,556	14.8%	24	1,694	16.1%
Thu	24	1,578	15.0%	23	1,550	14.7%
Fri	17	1,334	12.7%	17	1,422	13.5%
Sat	28	2,010	19.1%	27	1,872	17.7%
Sun	14	1,042	9.9%	14	1,042	9.9%
Total	152	10,514		151	10,548	

Average Day Passengers -Saturday (Scheduled Carriers)

Year	Peak Month Enpl/Depl	Weeks in Peak Month	Avg Week Enpl/Depl	Percent of Weekly Activity on a Typical Saturday: Enplaning	Percent of Weekly Activity on a Typical Saturday: Deplaning	Average Day Passengers: Enpl	Average Day Passengers: Depl	Average Day Passengers: Total Pass.
2014	44,222	4.4	10,050	19.1%	17.7%	1,921	1,784	3,705
2018	45,850	4.4	10,420	19.1%	17.7%	1,992	1,849	3,841
2023	51,055	4.4	11,528	19.1%	17.7%	2,204	2,046	4,250
2028	56,658	4.4	12,794	19.1%	17.7%	2,446	2,271	4,716
2033	62,793	4.4	14,179	19.1%	17.7%	2,711	2,516	5,227



Source: Airline Schedules from Diio Mi, Mar 2013 Schedule

2.10.c Peak Hourly Passenger Activity Forecasts

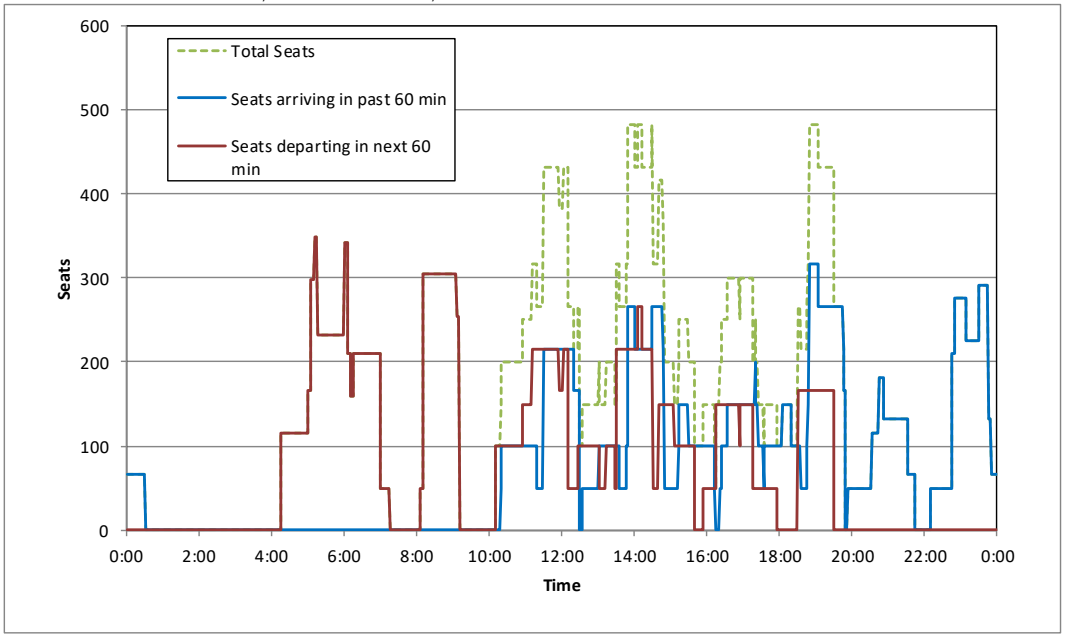
The number of hourly arriving and departing seats during a typical Saturday in the peak month is shown in **Table 2-26**. Peak hour departing seats occur between 05:15 and 06:14 while peak hour arriving seats occur between 18:01 and 19:00 (6:01 p.m. and 7:00 p.m.). The peak total arriving and departing seats occurs between 13:50 and 14:01.

Table 2-26: Peak Hour Passenger Projections

Time of Day	Number of Seats	Total Daily Seats	Percent of Day in Peak Hour (PH)
Peak Hour Departing Seats (Enplanements)			
05:15 to 06:14	348	2,010	17.3%
Peak Hour Arriving Seats (Deplanements)			
18:01 to 19:00	316	1,872	16.9%
Peak Total Passengers			
13:50 to 14:01	482	3,882	12.4%

Projected Peak Hour (Scheduled Carriers)

	Peak Month Average Day Passengers		Peak Hour Passengers		
			Enplanements	Deplanements	Total Pass.
Year	Enplanements	Deplanements	*17.3%*	*16.9%*	*12.4%*
2014	1,921	1,784	333	301	460
2018	1,992	1,849	345	312	477
2023	2,204	2,046	382	345	528
2028	2,446	2,271	423	383	586
2033	2,711	2,516	469	425	649



Source: Airline Schedules from Diio Mi, Sat, Mar 2013 Schedule
Mead & Hunt, Inc.

2.10.d Passenger Activity Peaking Characteristics Summary

A summary of the peak month, peak month average day, and peak hour passenger forecasts presented in this section is illustrated in **Table 2-27**.

Table 2-27: Peak Month, Average Day, and Peak Hour Passenger Summary

Year	Peak Factor	Enplanements	Deplanements	Total Passengers
2014	**Actual**			
	Annual	448,848	445,578	894,426
	Peak Month	44,222	44,222	88,444
	Peak Month Average Day (PMAD)	1,921	1,784	3,705
	Peak Hour - PMAD	333	301	460
2018	**Projected**			
	Annual	454,060	454,060	908,120
	Peak Month	45,850	45,850	91,699
	Peak Month Average Day (PMAD)	1,992	1,849	3,841
	Peak Hour - PMAD	345	312	477
2023	**Projected**			
	Annual	505,606	505,606	1,011,212
	Peak Month	51,055	51,055	102,109
	Peak Month Average Day (PMAD)	2,204	2,046	4,250
	Peak Hour - PMAD	382	345	528
2028	**Projected**			
	Annual	561,097	561,097	1,122,194
	Peak Month	56,658	56,658	113,316
	Peak Month Average Day (PMAD)	2,446	2,271	4,716
	Peak Hour - PMAD	423	383	586
2033	**Projected**			
	Annual	621,853	621,853	1,243,705
	Peak Month	62,793	62,793	125,586
	Peak Month Average Day (PMAD)	2,711	2,516	5,227
	Peak Hour - PMAD	469	425	649

Source: Airline Schedules, Diio Mi
Airport Management Records
Mead & Hunt, Inc.

2.10.e Peak Operations Forecasts

To forecast peak month operations, the average percent of operations accounted for in the peak month is multiplied by the projected number of annual operations, and then divided by the number of days in the peak month. Assuming this percentage remains constant throughout the forecasting period, the peak number of operations in a month is anticipated to increase from 7,150 in 2014 to 8,656 in 2033.

The number of aircraft operations in the peak hour for each day was estimated at 12.0 percent based upon a typical industry average. Assuming this percentage remains constant throughout the forecasting period, the number of peak hour operations in the peak month is anticipated to increase from 28 in 2014 to 34 in 2033 (**Table 2-28**).

Table 2-28: Peak Month, Average Day, and Peak Hour Operations Projections

	Monthly Operations							
Historical	**2011**		**2012**		**2013**		**2014**	
Jan	4,127	5.4%	5,814	7.4%	5,908	7.3%	5,394	7.1%
Feb	6,180	8.0%	5,413	6.9%	5,262	6.5%	6,264	8.2%
Mar	7,160	9.3%	6,707	8.6%	7,048	8.8%	6,512	8.5%
Apr	6,316	8.2%	7,007	9.0%	7,355	9.1%	7,002	9.2%
May	5,347	6.9%	6,991	8.9%	7,719	9.6%	6,876	9.0%
Jun	6,083	7.9%	6,643	8.5%	7,601	9.4%	5,760	7.6%
Jul	6,479	8.4%	7,531	9.6%	6,946	8.6%	7,150	9.4%
Aug	7,375	9.6%	7,120	9.1%	6,791	8.4%	6,099	8.0%
Sep	7,281	9.5%	6,988	8.9%	7,029	8.7%	6,883	9.0%
Oct	7,232	9.4%	6,059	7.7%	6,759	8.4%	6,865	9.0%
Nov	7,129	9.3%	6,511	8.3%	6,886	8.6%	6,115	8.0%
Dec	6,302	8.2%	5,402	6.9%	5,134	6.4%	5,289	6.9%
Total	77,011	9.6%	78,186	9.6%	80,438	9.6%	76,209	9.4%
Peak Month	7,375	Aug	7,531	Jul	7,719	May	7,150	Jul
			Average Percent in Peak Month			***9.5%***		
			PMAD Operations			***1/31***		
PMAD Operations	238		243		249		231	
			Estimted PMAD Peak Hour Ops[1]			**12.0%**		
PMAD Peak Hour Operations	29		29		30		28	

Projected:	**Annual Ops**	**Peak Mnth %**	**PM Ops**	**PMAD Ops**	**Peak Hr[1] %**	**PH Ops**
2018	78,362	9.55%	7,481	241	12.00%	29
2023	82,175	9.55%	7,845	253	12.00%	30
2028	86,087	9.55%	8,219	265	12.00%	32
2033	90,670	9.55%	8,656	279	12.00%	34
CAGR (2014-2033)	*0.92%*		*1.01%*	*1.01%*		*1.01%*

Notes: PM = Peak Month; PMAD = Peak Month Avg Day
[1]Estimated based upon typical industry averages

Sources: Historical Monthly Operations - FAA Air Traffic Activity Data System (ATADS)
Projections - Mead & Hunt, Inc.

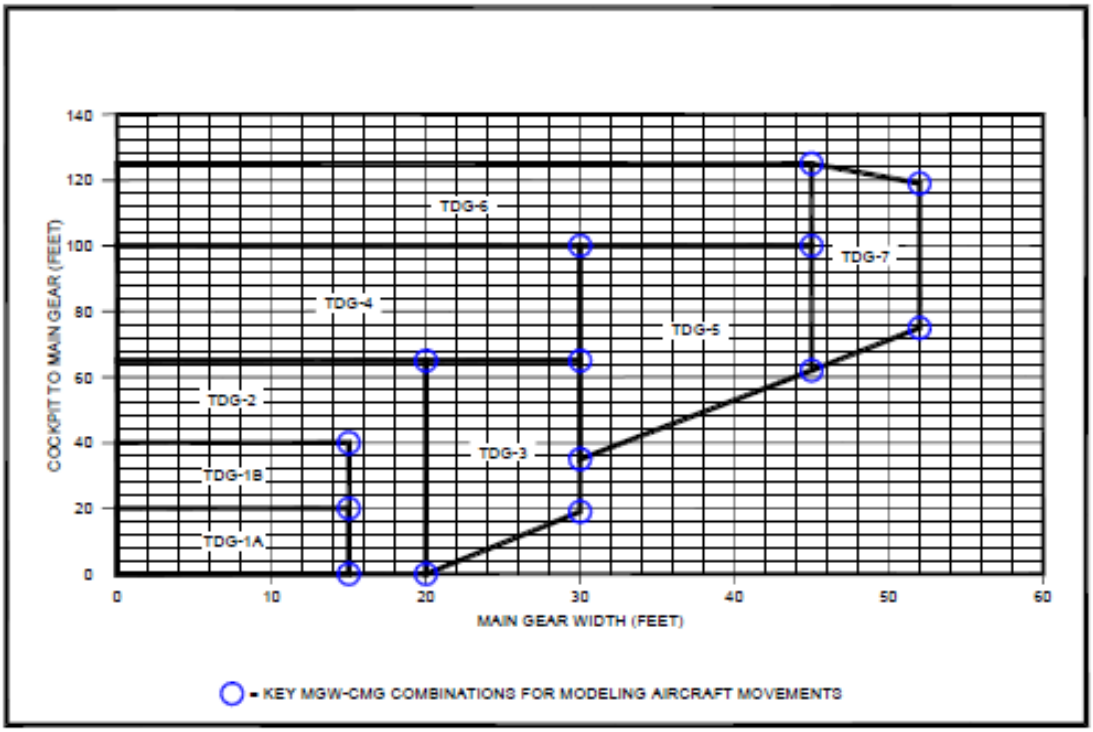
2.11 Design Aircraft

It is important to determine the most demanding aircraft operating at an airport, or "design aircraft", as these aircraft have a direct influence on airfield geometric design standards and safety criteria. The de-sign aircraft is composite aircraft representing a collection of aircraft classified by three parameters: Aircraft Approach Category (AAC), Airplane Design Group (ADG), and Taxiway Design Group (TDG). The AAC, ADG, and approach visibility minimums are combined to form the Runway Design Code (RDC). The RDC provides the information needed to determine certain standards that apply. The first component, depicted by a letter is the AAC and relates to aircraft approach speed (operational characteristics). The second component depicted by a Roman numeral, is the ADG and relates to either the aircraft wingspan or tail height (physical characteristics). The TDG signifies the standards to which taxiways are to be built based upon undercarriage dimensions. FAA standard definitions for aircraft approach categories and design groups are noted in **Table 2-29**.

Table 2-29: Aircraft Approach Category and Design Group Definitions

Aircraft Approach Category (AAC)	Approach Speed (knots)	
A	Less than 91 knots	
B	91 or greater, but less than 121	
C	121 or greater, but less than 141	
D	141 or greater, but less than 166	
E	166 or greater	
Airplane Design Group (ADG)	Wingspan (feet)	Tail Height (feet)
I	<49	<20
II	49 - <79	20 - <30
III	79 - <118	30 - <45
IV	118 - <171	45 - <60
V	171 - <214	60 - <66
VI	214 - <262	66 - <80

Taxiway Design Groups (TDG)



Source: FAA Advisory Circular 150/5300-13A, Airport Design

Hector International Airport currently accommodates a wide variety of civilian and military aircraft use. Aircraft using the airport include small single engine and multi-engine aircraft (which fall within the approach categories A and B and airplane design group I) and business turboprop and jet aircraft (which fall within approach categories B, C, and D and airplane design groups I and II). The airport is also used by transport jet aircraft for transporting passengers and cargo. The passenger aircraft are regional jets and narrow body single aisle aircraft (which generally fall in approach category C and airplane design groups II and III). Cargo aircraft run a wide range of aircraft types from small turboprops to B767 and B747 freighters. Large transports such as the B747-400 freighter, KC135, B757, B767, and MD11 regularly operate at the airport, the largest of which fall in approach category D and airplane design groups IV and V. **Table 2-30** summarizes the number of IFR jet operations recorded in 2010, 2011, 2012, and 2013 by weight class and descending prevalence; also noted is the Runway Design Code for each type.

Table 2-30: Historical IFR Jet Operations by Aircraft Type

Weight Class	Aircraft Type(s)	Runway Design Code	IFR Jet Operations 2010	2011	2012	2013
Heavy	K35R - Boeing KC-135 Stratotanker	C - IV	25	16	10	16
Heavy	B744 - Boeing 747-400	D - V	-	32	10	4
Heavy	MD11 - Boeing (Douglas) MD 11	D - IV	-	-	-	2
Heavy	B742 - Boeing 747-200	D - V	24	-	-	-
Heavy	Various (B777, B767, A340, others)	- -	14	15	-	-
	Subtotal Heavy (over 255,000 lb)		**63**	**63**	**20**	**22**
Large	CRJ2 - Bombardier CRJ-200	C - II	5,763	4,086	4,466	5,073
Large	E145 - Embraer ERJ-145	C - II	2,109	3,359	3,890	4,185
Large	CRJ9 - Bombardier CRJ-900	C - III	590	644	485	1,267
Large	E45X - Embraer ERJ 145 EX	C - II	308	2,034	949	836
Large	A319 - Airbus A319	C - III	312	152	265	693
Large	MD83 - Boeing (Douglas) MD 83	C - III	891	895	979	674
Large	E170 - Embraer 170	C - III	1,067	706	1,130	627
Large	CRJ7 - Bombardier CRJ-700	C - II	1,169	881	575	611
Large	A320 - Airbus A320 All Series	C - III	130	143	460	325
Large	MD90 - Boeing (Douglas) MD 90	C - III	6	108	207	282
Large	E135 - Embraer ERJ 135/140/Legacy	C - II	310	175	69	246
Large	MD88 - Boeing (Douglas) MD 88	C - III	174	163	188	77
Large	B738 - Boeing 737-800	D - III	56	95	83	68
Large	B737 - Boeing 737-700	C - III	32	30	34	47
Large	Various (E190, B757, DC9, B737, others)	- -	1,182	758	176	71
	Subtotal Large (more than 41,000 and up to 255,000 lbs)		**14,099**	**14,229**	**13,956**	**15,082**
Medium	LJ35 - Bombardier Learjet 35/36	D - I	278	528	1,158	772
Medium	C550 - Cessna Citation II/Bravo	B - II	642	504	485	536
Medium	C56X - Cessna Excel/XLS	C - II	326	322	331	363
Medium	C560 - Cessna Citation V/Ultra/Encore	B - II	500	488	449	329
Medium	BE40 - Raytheon/Beech Beechjet 400/T-1	C - I	276	241	272	294
Medium	CL30 - Bombardier (Canadair) Challenger 300	C - II	36	26	90	167
Medium	LJ60 - Bombardier Learjet 60	D - I	123	130	154	133
Medium	C650 - Cessna III/VI/VII	B - II	59	49	56	123
Medium	C525 - Cessna CitationJet/CJ1	B - I	107	69	107	122
Medium	CL60 - Bombardier Challenger 600/601/604	C - II	118	103	82	106
Medium	Various (Hawker, Gulfstreams, Falcons, others)	- -	1,871	1,356	1,259	1,038
	Subtotal Medium (more than 12,500 up to 41,000 lbs)		**4,336**	**3,816**	**4,443**	**3,983**
Small/Unknown	C25C - Cessna Citation CJ4	B - II	2	4	52	172
Small/Unknown	C25A - Cessna Citation CJ2	B - II	33	25	29	100
Small/Unknown	Various (Learjets, Phenom, others)	- -	160	65	159	287
	Subtotal Small & Unknown (12,500 lb or less)		**195**	**94**	**240**	**559**
	Grand Total		**18,693**	**18,202**	**18,659**	**19,646**

Source: FAA Traffic Flow Management System Counts (TFMSC) and Mead & Hunt

It should also be noted that in addition to the IFR jet operations identified in the table above, there are a number of VFR and local operations that are also occurring. Of particular interest for the design aircraft determination are the number of heavy aircraft VFR operations occurring. Conversations with the ATCT indicate that there are approximately 10 to 20 additional local touch and go operations occurring annually by heavy aircraft, most predominantly being the KC-135 from Red River. These operations are in addition to the IFR operations noted in the above table.

Table 2-31 summarizes the number of IFR jet operations by Approach Category and Design Group for historical operations 2010 through 2013. Projections for operations by approach category and design group were made from the scheduled carrier fleet mix previously presented in this chapter for scheduled carrier aircraft, and general aviation operations by types which were assumed to increase at the same rate as total general aviation operations, as previously presented in this chapter. As shown below, the projected fleet mix is anticipated to remain relatively consistent with the current fleet, with the exception of some growth in the ADG III narrow body aircraft and regional jets as additional low cost carrier service is added and as ADG II 50-seat regional jets are phased out in favor of ADG III 70 to 90-seat regional jets.

Table 2-31: 2013 Historical and Projected IFR Jet Operations by AAC and ADG

Approach	IFR Jet Operations				Projected IFR Jet Operations			
Category	2010	2011	2012	2013	2018	2023	2028	2033
A	10		2	3	3	3	3	4
B	1,986	1,818	1,891	1,981	2,037	2,136	2,238	2,357
C	15,310	15,217	14,963	16,305	16,766	17,581	18,419	19,399
D	1,299	1,158	1,799	1,325	1,362	1,429	1,497	1,576
Unknown	88	9	4	32	33	35	36	38
Total	18,693	18,202	18,659	19,646	20,201	21,184	22,193	23,374

Design	IFR Jet Operations				Projected IFR Jet Operations			
Group	2010	2011	2012	2013	2018	2023	2028	2033
I	1,737	1,529	2,218	1,768	1,818	1,906	1,997	2,103
II	12,264	12,767	12,287	13,576	10,679	9,427	7,958	8,150
III	4,534	3,821	4,122	4,242	7,642	9,786	12,170	13,049
IV	38	39	18	24	25	26	27	29
V	32	37	10	4	4	4	5	5
Unknown	88	9	4	32	33	35	36	38
Total	18,693	18,202	18,659	19,646	20,201	21,184	22,193	23,374

Note: IFR Jet Ops = 50.4% of total IFR operations
Source: FAA Traffic Flow Management System Counts (TFMSC)
Mead & Hunt

The Taxiway Design Group (TDG) of the aircraft currently operating at and projected to operate at FAR was also examined. The majority of the aircraft operating at FAR are TDG's 1, 2 (seat RJ's), 3 (70 to 90 seats RJ's, A320, and B737), and 4 (B757 and MD80), however there are also TDG-5 (B767 and B747) and 6 (MD11) aircraft occasionally operating at the airport as well.

FAA Advisory Circular (AC) 150/5300-13A, *Airport Design*, states the following regarding selection of a design aircraft:

> *The design aircraft enables airport planners and engineers to design the airport in such a way as to satisfy the operational requirements of such aircraft and meet national standards for separation and geometric design (safety issues). The "design" aircraft may be a single aircraft or a composite of several different aircraft composed of the most demanding characteristics of each.*

This FAA guidance document also states the following regarding selection of a design aircraft for federally funded projects:

> *The FAA administers a grant program (Order 5100.38) which provides financial assistance for developing public-use airports. Persons interested in the program can obtain information from the FAA Airports Regional Office or Airports District Office (ADO) that serves their geographic area. Consult these offices for assistance with selection of the design aircraft for federally funded projects, which depends on demand factors that are beyond the scope of this AC.*

FAA Order 5090.3C, Field Formulation of the National Plan of Integrated Airport Systems (NPIAS) defines "substantial use" as 500 or more annual itinerant operations, or scheduled commercial service, by the design or critical aircraft to be eligible for federal funding participation. However FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*, also notes that:

> *Under unusual circumstances, adjustments may be made to the 500 total annual itinerant operations threshold after considering the circumstances of a particular airport. Two examples are airports with demonstrated seasonal traffic variations, or airports situated in isolated or remote areas that have special needs.*

The current ALP designates the airport's reference code a D-V with a critical aircraft of the B-747. As was shown in Table 2-32, the current and projected traffic at the airport that meets the 500 operations threshold for designation as the design or critical aircraft is a Runway Design Code of D-III and a Taxiway Design Group of TDG-4. However, the airport regularly sees operations by aircraft up to RDC D-V and TDG-5 for a variety of operations including:

- ✓ Cargo operations for large domestic and international shipping,
- ✓ Passenger charter operations,
- ✓ Military operations, and
- ✓ Passenger airline diversions, primarily from MSP and ORD. The airport is a designated diversion site for Delta Air Lines B747's and B777's, and United and American Airlines B777's and B787's.

Large heavy aircraft traffic is regularly occurring at the airport and Hector International is 255 miles from the nearest hub airport in Minneapolis-St Paul (MSP), it is also the closest commercial service airport northwest of MSP capable of handling large heavy aircraft. The airport generally has 30 to 70 annual IFR operations and 10 to 20 VFR operations by RDC D-IV and D-V aircraft, therefore it is recommended that the airport maintain its current D-V designation for the airport and at least portions of the airfield so that these aircraft can continue to safely operate at the airport. The airport needs to have at least portions of the airfield capable of handling these aircraft so they can safely use the airport and are not in danger of deviating from paved surfaces.

The current and future design aircraft are summarized in **Table 2-32**. According to the current ALP, the current design aircraft is a D-V and TDG-5 aircraft. For the reasons noted in the prior paragraph it is recommended that the future design aircraft maintain this D-V and TDG-5 designation for at least portions of the airfield so that these types of aircraft can continue to safely operate at the airport. Because the Airport is utilized regularly by all sizes and types of aircraft, the facility requirements and alternatives analyses will need to consider the needs of all user groups and not just the design aircraft identified above, and particular areas of the airport should be designed to the critical types using that portion of the airfield, which may be less the D-V designation. The runway design code for particular runways and areas of the airfield will be evaluated and discussed in the facility needs chapter of this master plan.

Table 2-32: Current and Future Design Aircraft

Design Category	Current Design Aircraft	Future Design Aircraft
Runway Design Code (RDC)	D-V	D-V
Aircraft Approach Category (AAC)	D	D
Approach Speed (knots)	141 or greater, but less than 166	141 or greater, but less than 166
Design Aircraft	B-747-400	B-747-400
Airplane Design Group (ADG)	V	V
Wingspan (feet)	171 - <214	171 - <214
Design Aircraft	B-747-400	B-747-400
Taxiway Design Group (TDG)	TDG-5	TDG-5
Design Aircraft	B-747-400	B-747-400

Source: Airport Layout Plan, 2002 Master Plan, Mead & Hunt

2.12 Forecast Summary and FAA TAF Comparison

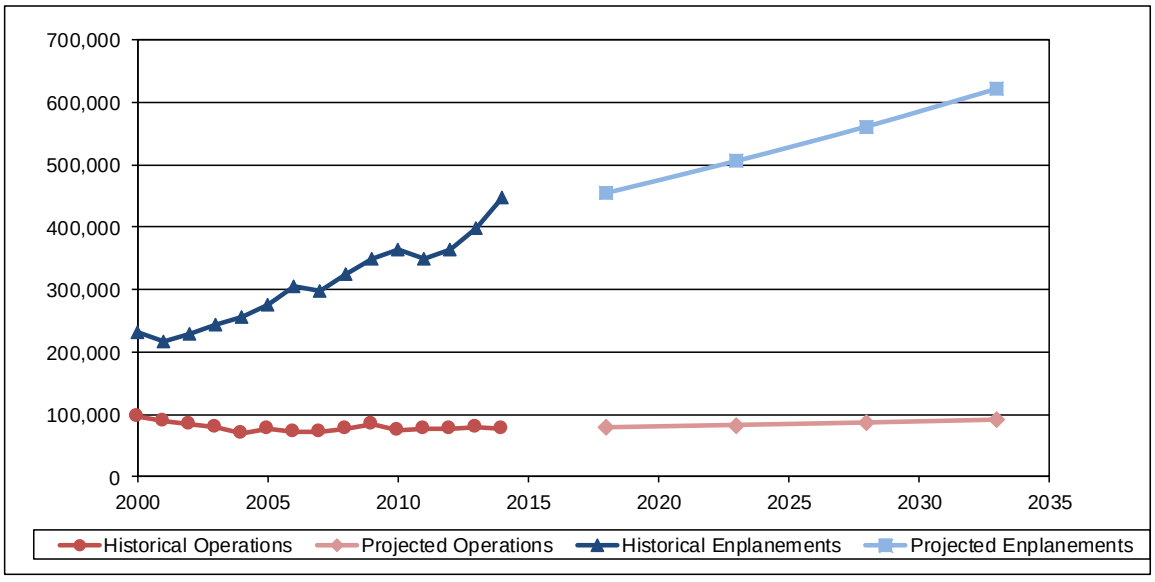
Passenger activity at the Hector International Airport has been increasing in recent history despite increases in fuel cost, airline bankruptcies, system-wide route restructuring and aircraft fleet overhauls that are impacting passenger enplanements at other small hub airports. This is reflective of the strong economy in North Dakota and the Fargo region along with the air service additions at Hector International. The airport is well situated to maintain and enhance both hub airline service as well as low-cost carrier service to leisure destinations. Both of these segments of the commercial air service market have done well at Hector International Airport and are anticipated to remain strong through the future.

The forecasts developed for this Master Plan Update suggest passenger enplanements, based aircraft and total aircraft operations will grow at the Airport over the next 20 years. A summary of these projections is presented in **Table 2-33**. A summary of these forecasts is also presented in specific FAA required tabular formats in **Table 2-34** and **Table 2-35**.

As was noted earlier, forecasts that differ from the FAA TAF projections by more than 10 percent in 5 years and 15 percent in 10 years are considered inconsistent with the TAF and require FAA HQ review. As these forecasts were updated for the addition of 2014 historical data, the 5-year projection is now a 4-year project and the 10-year projection is now a 9-year projection. As shown in Table 2-34 the enplanement, commercial operations, and total operations projections prepared as part of the master plan are within the FAA TAF tolerances recommended and will not require FAA Headquarters review.

Table 2-33: Projections Summary

Year	Enplanements	Operations: Total Commercial	Operations: General Aviation	Operations: Military	Operations: Total	Total Air Cargo (Landed Wt tons)	Based Aircraft
Historical							
2000	230,969	19,503	70,363	7,307	97,173	54,740	163
2001	217,979	17,402	65,875	5,929	89,206	44,243	171
2002	230,405	17,196	60,770	5,288	83,254	30,086	184
2003	243,097	18,087	56,167	4,328	78,582	30,272	175
2004	256,004	19,556	46,858	3,775	70,189	31,505	194
2005	275,200	23,165	47,805	6,929	77,899	39,079	188
2006	305,218	23,043	43,083	6,710	72,836	39,552	188
2007	297,964	22,475	45,908	4,710	73,093	34,272	177
2008	324,434	24,159	46,473	5,392	76,024	23,362	177
2009	348,951	28,204	48,055	8,515	84,774	7,261	177
2010	363,138	23,012	45,968	6,509	75,489	10,726	171
2011	350,458	18,637	52,733	5,641	77,011	11,749	180
2012	364,727	18,282	54,801	5,103	78,186	9,367	180
2013	398,677	23,385	53,282	3,771	80,438	8,142	180
2014	448,848	27,095	46,916	2,198	76,209	NA	190
Projected							
2018	454,060	27,148	49,016	2,198	78,362	8,954	199
2023	505,606	28,202	51,774	2,198	82,175	9,530	210
2028	561,097	29,202	54,687	2,198	86,087	10,075	221
2033	621,853	30,708	57,764	2,198	90,670	10,667	234
CAGR (2014-2033)	*1.73%*	*0.66%*	*1.10%*	*0.00%*	*0.92%*	*1.36%*	*1.10%*



Source: Historical Enplanements - 1994-1996 FAA TAF; 1997-2014 Airport Management Records
Historical Operations - Air Traffic Activity Data System (ATADS)
Historical Air Cargo - Airport Records
Historical Based Aircraft -Airport Management Records
Projections - Mead & Hunt, Inc.

Table 2-34: FAA Template – Forecast Levels and Growth Rates

A. Forecast Levels and Growth Rates

	Specify base year: 2014					Average CAGR			
	2014	**2018**	**2023**	**2028**	**2033**				
	Base Yr. Level	**Base Yr. + 4yr.**	**Base Yr. + 9yrs.**	**Base Yr. + 14yrs.**	**Base Yr. + 19yrs.**	**Base Yr. + 4yr.**	**Base Yr. + 9yrs.**	**Base Yr. + 14yrs.**	**Base Yr. + 19yrs.**
Passenger Enplanements									
TOTAL Air Carrier & Commuter	448,848	454,060	505,606	561,097	621,853	0.3%	1.3%	1.6%	1.7%
Operations									
Itinerant									
Air carrier	5,612	7,007	9,969	12,809	14,607	5.7%	6.6%	6.1%	5.2%
Commuter/air taxi	21,483	20,140	18,234	16,393	16,101	-1.6%	-1.8%	-1.9%	-1.5%
Total Commercial Operations	27,095	27,148	28,202	29,202	30,708	0.0%	0.4%	0.5%	0.7%
General aviation	23,356	24,402	25,775	27,225	28,757	1.1%	1.1%	1.1%	1.1%
Military	1,138	1,138	1,138	1,138	1,138	0.0%	0.0%	0.0%	0.0%
Local									
General aviation	23,560	24,615	26,000	27,463	29,008	1.1%	1.1%	1.1%	1.1%
Military	1,060	1,060	1,060	1,060	1,060	0.0%	0.0%	0.0%	0.0%
TOTAL OPERATIONS	76,209	78,362	82,175	86,087	90,670	0.7%	0.8%	0.9%	0.9%
Instrument Operations	37,498	38,557	40,433	42,359	44,614	0.7%	0.8%	0.9%	0.9%
Peak Hour Operations	30	29	30	32	34	-0.8%	0.2%	0.4%	0.6%
Cargo/mail (landed wt lbs)	8,142	8,954	9,530	10,075	10,667	2.4%	1.8%	1.5%	1.4%
Based Aircraft									
Single Engine (Nonjet)	119	119	126	133	140	0.0%	0.6%	0.8%	0.9%
Multi Engine (Nonjet)	42	46	48	51	54	2.1%	1.5%	1.4%	1.3%
Jet Engine	20	25	26	28	29	5.7%	3.1%	2.4%	2.1%
Helicopter	5	5	5	5	6	-1.2%	0.1%	0.4%	0.6%
Other	4	4	4	4	5	-0.2%	0.5%	0.7%	0.8%
TOTAL	190	199	210	221	234	1.1%	1.1%	1.1%	1.1%

B. Operational Factors

	Base Yr. Level	**Base Yr. + 5yr.**	**Base Yr. + 10yrs.**	**Base Yr. + 15yrs.**	**Base Yr. + 20yrs.**
Average aircraft size (seats)					
Air carrier & Commuter	71.6	73.4	77.8	82.7	85.4
Average enplaning load factor					
Air carrier & Commuter	84.7%	84.7%	84.7%	84.7%	84.7%
GA operations per based aircraft	247	247	247	247	247

CAGR = Compound Annual Growth Rate

Table 2-35: FAA Template – Comparing Airport Forecasts and TAF

	Year	Airport Forecast	TAF	AF/TAF (% Difference)
Passenger Enplanements				
Base Yr. Level	2014	448,848	436,842	2.7%
Base Yr. + 4yr.	2018	454,060	452,718	0.3%
Base Yr. + 9yrs.	2023	505,606	451,170	12.1%
Base Yr. + 14yrs.	2028	561,097	477,769	17.4%
Base Yr. + 19yrs.	2033	621,853	505,510	23.0%
Commercial Operations				
Base Yr. Level	2014	27,095	27,263	-0.6%
Base Yr. + 4yr.	2018	27,148	27,376	-0.8%
Base Yr. + 9yrs.	2023	28,202	26,648	5.8%
Base Yr. + 14yrs.	2028	29,202	27,987	4.3%
Base Yr. + 19yrs.	2033	30,708	29,437	4.3%
Total Operations				
Base Yr. Level	2014	76,209	76,719	-0.7%
Base Yr. + 4yr.	2018	78,362	76,877	1.9%
Base Yr. + 9yrs.	2023	82,175	76,445	7.5%
Base Yr. + 14yrs.	2028	86,087	78,086	10.2%
Base Yr. + 19yrs.	2033	90,670	79,844	13.6%

NOTES: TAF data is on a U.S. Government fiscal year basis (October through September).
Airport Forecast is on a calendar year basis.