MASTER PLAN UPDATE

Bismarck AIRPORT

2 Aviation Activity Forecasts

2 Aviation Activity Forecasts

2.0 AVIATION ACTIVITY FORECASTS

Forecasts of aviation demand are used to guide identification of future facility needs. In planning for the future growth of any airport, it is important to understand the context within which potential increases in aviation activity are likely to occur. Aviation forecasting is not an "exact science," so experienced aviation judgment and practical considerations will influence the level of detail and effort required to establish reasonable forecasts and subsequent airport development decisions.

This chapter includes forecasts of the following aviation activities: scheduled passenger enplanements, peak passenger activity, aircraft operations and fleet mix, based aircraft, and air cargo volumes. In addition to the development of forecasts, this chapter includes the identification of a critical aircraft. The forecast covers a 20-year period from 2015 (base year) to 2035, and the forecast elements include data at five-year intervals (2020, 2025, 2030, and 2035).

Emerging technologies should also be considered when developing an aviation forecast. For example, unmanned aerial vehicles (UAVs), sometimes called unmanned aerial systems, have begun operating at designated locations within the US. Although the Federal Aviation Administration (FAA) has begun developing regulations to govern where and how UAVs may be flown, they are not yet routinely considered in airport development planning. The FAA does not require that UAVs be included in airport forecasts. Indeed, civilian UAVs weigh too little to be counted as "aircraft" under current FAA guidance. UAV-related facilities are not currently eligible for FAA grant funds. Undoubtedly there will be changes to how UAVs are addressed in airport planning, but it is too early in the evolution of the technology to anticipate what the changes will be.

Bismarck Airport has the potential to be used in the future by both civilian and military UAVs. While the majority of the airport is devoted to civilian uses, the existence of the Army National Guard base opens the potential that military UAVs could be stationed on the airport. However, there are currently no indications that Bismarck Airport will be used by either civilian or military UAVs. Given this uncertainty and the previously mentioned lack of any FAA requirements, no forecast of UAVs is included in this chapter. This topic should be revisited when this Master Plan is updated.

Several indicators of aviation activity including regional and local trends for both commercial and general aviation were used to develop an aviation activity forecast for Bismarck Airport. These trends provide a basis for the projections of aviation activity developed for the Airport. One of the key trends examined for the development of this forecast was the effect a new oil exploration boom within North Dakota would have on aviation activity levels. Section 2.4 includes a detailed discussion on the anticipated timing of an oil boom return.

The aviation forecasts must be approved by the FAA to justify future FAA funding participation in eligible airport improvement projects. The FAA initially reviews forecasts to determine if the forecast is consistent with the 2015 Terminal Area Forecast (TAF). Forecasts of total passenger enplanements, based aircraft, and total operations are considered consistent with the TAF if they are within the following tolerances:

- Forecasts differ by less than 10 percent in the five-year forecast period.
- Forecasts differ by less than 15 percent in the 10-year forecast period.

If the forecast is not consistent with the TAF, then the document will undergo more detailed FAA review at the regional and national level. The FAA may request additional information prior to approval of the forecasts. The approved Master Plan forecasts will be used to update the TAF in the coming years.

This chapter is organized into the following sections.

2.1 AIRPORT ROLE

An airport's role is defined by the mix of aviation uses that exist, or are anticipated to exist, at the facility. Each use is defined by the type of aircraft involved and its mission. Aircraft can be used for multiple missions, such as a medium-sized turboprop that may be used by a commuter airline for scheduled passenger service, an air charter operator for on-demand air taxi service, an air cargo airline for transporting express packages, and the military for transport. It is critical to know both the aircraft type and mission in order to identify the necessary airport support facilities. A key part of the forecasting effort is to identify how the current mix of aircraft types and missions will evolve over the 20-year forecast period. This information will be used to identify needed modifications to the airfield and airport facilities.

2.1.1 Current Role

Bismarck Airport is classified as a primary, non-hub commercial airport that provides scheduled passenger service to the Bismarck metropolitan area and central North

Dakota. As of January 2016, the Airport is served by five airlines with non-stop service to seven destinations. Currently, the Airport supports the following activities:

- Passenger service
- Recreational aviation
- Business aviation
- Air cargo
- Air ambulance service
- Flight training
- Aircraft maintenance
- Military aviation
- Army National Guard air operations

The Airport is home to two fixed-base operators (FBOs) that provide a wide variety of general aviation services, including:

- Aircraft storage facilities for the full range of general aviation aircraft, including: single- and multi-engine, piston-powered aircraft; turboprops; small- to medium-sized corporate jets; and helicopters.
- Aircraft fueling, aircraft maintenance, flight training, aircraft charter, avionics repair, crew and passenger support facilities, and aircraft interiors.

The Airport hosts both scheduled and on-demand air cargo services. Key airport tenants include the North Dakota Army National Guard, Basin Electric and the Montana-Dakota Utilities (MDU) Company, North Dakota Department of Transportation, and the North Dakota Aeronautics Commission.

These mission-related roles can also be sorted into three operational groups identifying Airport roles:

- Commercial service – scheduled passenger service
- General aviation – aviation activities other than scheduled service and military
- Military – Air Guard and transient military aircraft

Data used in these forecasts come from some sources that report data based upon the Federal Fiscal Year and some that report data based upon the calendar year. **Table 2-1** presents historical activity data for the years 2005-2014 from the FAA's 2015 Terminal Area Forecast (TAF). TAF data is reported for the Federal Fiscal Year (which runs October – September), so FAA's totals will differ from those based on a calendar year. Due to the difference in reporting periods, an evaluation may result in contrary trends when making year-to-year comparisons. For example, the TAF reported that passenger enplanements decreased from 2013 to 2014 (241,451 to 237,273). If calendar year data were used, it would show an increase in passengers from 2013 to 2014 (237,683 to 245,205). This difference was caused by a growth trend that occurred from October through December 2013. Although this difference in reporting period may affect some year-to-year comparisons, it does not significantly affect long-term forecasts.

2.1.2 Future Role

The Airport is anticipated to maintain existing roles throughout the 20-year planning period. As discussed in the sections that follow, the ways in which these roles are fulfilled may evolve over time. This evolution is based on the following assumptions.

- **Scheduled and on-demand passenger service –** Replacement of 50-seat passenger regional jets used in scheduled passenger service with those having 70-76 seats or larger. Volume of on-demand service will vary with the economy.
- **Air cargo shipping –** Potential introduction of larger turboprops; most scheduled cargo will remain with smaller turboprops.
- **Business aviation –** Increase in frequency of operations and size of aircraft during periods of rapid economic growth associated with another oil exploration boom.
- **Recreational aviation –** Static or slow decline.
- **Flight training –** Static or slow decline.
- **Aircraft maintenance –** Slow growth linked to increased business use of Airport.
- **Military aviation –** Continuation in role and mix of aircraft types.
- **Disaster response –** Continuation in role.

This page is intentionally blank.

Table 2-1 Historical Aviation Activity														
Fiscal Year	Enplanements			Itinerant Operations					Local Operations			Total Operations	Based Aircraft
	Air Carrier	Commuter	Total	Air Carrier	Air Taxi & Commuter	GA	Military	Total	Civil	Military	Total		
2005	109,856	62,635	172,491	2,982	10,621	22,605	2,569	38,777	12,413	1,416	13,829	52,606	111
2006	111,688	68,595	180,283	2,805	9,112	21,494	2,696	36,107	12,291	1,863	14,154	50,261	89
2007	102,195	79,064	181,259	3,018	8,942	19,896	2,930	34,786	12,430	1,837	14,267	49,053	89
2008	79,012	98,820	177,832	2,745	9,418	20,495	2,961	35,619	10,365	1,791	12,156	47,775	86
2009	81,124	102,356	183,480	2,852	9,104	17,383	2,770	32,109	10,450	1,733	12,183	44,292	95
2010	79,287	115,814	195,101	2,525	9,247	16,936	2,129	30,837	13,261	966	14,227	45,064	78
2011	60,171	131,783	191,954	1,524	10,151	18,958	3,087	33,720	12,489	1,642	14,131	47,851	87
2012	69,889	159,534	229,423	1,774	10,169	22,114	2,361	36,418	13,352	1,240	14,592	51,010	87
2013	85,503	155,948	241,451	2,406	10,279	21,045	2,196	35,926	10,944	1,483	12,427	48,353	93
2014	83,934	153,339	237,273	2,339	10,102	24,326	1,795	38,562	14,969	825	15,794	54,356	117
CAGR '05-'14	**-3%**	**10%**	**4%**	**-3%**	**-1%**	**1%**	**-4%**	**0%**	**2%**	**-6%**	**1%**	**0%**	**1%**
CAGR '09-'14	**1%**	**8%**	**5%**	**-4%**	**2%**	**7%**	**-8%**	**4%**	**7%**	**-14%**	**5%**	**4%**	**4%**

Source: FAA 2015 Terminal Area Forecast

Note: Actual historic activity differs from calendar year verses FAA fiscal year (October – September)

Enplanements: "Air Carrier" = Legacy Carriers, "Commuter" = Regional Airlines

CAGR = Compound Average Annual Growth Rate

This page is intentionally blank.

2.2 INDUSTRY TRENDS

Industry trends are based upon data available through January 2016. Separate sections will discuss national trends for passenger enplanements, the general aviation fleet, aircraft operations, and air cargo. This information will provide a context for review of historical activity levels at Bismarck Airport and development of forecasts. Most forecast material is extracted from the FAA's Aerospace Forecast Fiscal Years 2015-2035 (hereafter Aerospace Forecast). The Aerospace Forecast presents FAA expectations for the aviation industry at a national level for the next 10 years and is updated annually.

2.2.1 Passenger Enplanements

The TAF divides the passenger airline industry into two categories of airlines: air carrier and air taxi/commuter (also called "regional" airlines). The primary difference between the two is the role that the airline plays relative to the other. Regional airlines carry passengers to the hub cities of the air carrier airlines and may feed passengers onto air carrier service at the hub cities. Regional airlines may operate aircraft painted like air carrier airlines and may have their tickets sold by the air carrier operator. Air carrier airlines typically fly aircraft with more passenger seats than regional airlines and serve larger markets. However, the difference between air carrier and regional airlines is generally indistinguishable to a passenger with the exception of aircraft size.

The foremost challenges facing the airline industry today with regard to passenger enplanements are the volatility of fuel prices and uncertainty over the strength of the global economy. Nationally, passenger enplanements have returned to levels achieved prior to the recession that began in 2008. Economic recovery, airline consolidation, and capacity constraints have restored airline profitability. Airlines have increased load factors, the percentage of occupied seats occupied, by reducing flight frequencies. This practice has reduced consumer choice, effectively consolidating a growing number of passengers on to fewer flights. Airlines are also adding aircraft with more seats, which has further necessitated the need to cut frequencies in order to operate the flight profitably.

The Aerospace Forecast projects that national passenger enplanements (domestic plus international) will increase an average of 1.9 percent per year through 2035. Air carrier airlines, called “mainline carriers” in the Aerospace Forecast, are expected to grow at 2 percent a year. This is higher than regional airlines, which are projected to grow at 1.6 percent a year. This section of the Aerospace Forecast is summarized in **Table 2-2**.

As a result, commercial carrier capacity is expected to grow at a slightly slower rate than enplanements, airliners will remain crowded. Domestic commercial carrier capacity (i.e., total number of passenger seats) is expected to grow slowly at an average of 1.8 percent per year, with mainline carriers growing slower than regional carriers, 1.8 percent versus 2.0 percent.

Table 2-2 Comparison of Forecast Passenger Enplanement Growth Rates

Carriers	Domestic + International Flights 2016-2035	Domestic Flights		
		2016-2025	2026-2035	2016-2035
Mainline Carriers	2.0%	1.5%	1.8%	1.7%
Regional Carriers	1.6%	1.5%	1.8%	1.7%
All Carriers	1.9%	1.5%	1.8%	1.7%

Source: FAA Aerospace Forecast Fiscal Years 2015-2035

2.2.2 General Aviation Aircraft Fleet

The total number of aircraft in a given area or organization is referred to as a fleet. The Aerospace Forecast indicates that the national general aviation fleet decreased by 10.5 percent from 2010 to 2013. This decline is partially due to aging aircraft requiring expensive repairs to remain airworthy. Other contributing factors are the aging pilot community struggling to meet medical requirements, the rising cost associated with aircraft ownership, and fewer new pilots overall. Fewer pilots results in reduced demand for new aircraft, particularly those purchased by individuals who would fly for recreation. The Aerospace Forecast expects the number of private pilots in the U.S. to decrease at 0.35 percent per year through 2035.

The Aerospace Forecast projects that the number of piston fixed wing aircraft will continue to decline through 2035. Multi-engine piston aircraft are projected to decline by 0.4 percent per year and single-engine aircraft are forecast to decline at a rate of 0.6 percent per year. However, within the single-engine group, the light sport aircraft segment is forecast to experience 4.3 percent annual growth, although this user class makes up less than 2 percent of the national fleet.

Although the general trend has been one of decline, there are areas of growth for certain segments of the national fleet. Continued concerns about safety, security, and flight delays keep business aviation attractive relative to commercial air travel. For these reasons, the turbine aircraft fleet (jets, turboprops and turbine-powered helicopters) is forecast to grow from 14.3 percent of the general aviation fleet to 21.5 percent by 2035. **Table 2-3** shows that it is the growth of turbine aircraft that supports the projection that the total general aviation fleet will grow at an average annual rate of 0.4 percent through 2035.

Table 2-3 Comparison of Forecast Growth Rates by Aircraft Type									
Year	Total Fleet	Rotorcraft	Fixed Wing						
			Turbine	Multi-Engine Piston	Single-Engine Piston	Light Sport	Experimental	Other
2015*	198,780	10,440	21,305	13,175	122,435	2,355	24,880	4,190
2035	214,260	17,110	33,785	12,135	108,810	5,360	33.040	4,020
CAGR	0.4%	2.5%	2.2%	-0.4%	-0.6%	4.3%	1.4%	-0.2%

Source: FAA Aerospace Forecast Fiscal Years 2015-2035
*Estimate from Aerospace Forecast
CAGR = Compound Annual Growth Rate

2.2.3 Aircraft Operations

The number of annual aircraft operations at towered airports in the United States has declined steadily from 2001-2015 (from 66.2 million to 49.6 million). The sharpest drop in all segments of the aviation industry occurred in 2009, the year following the beginning of the recession. From 2013 to 2014, the number of operations by commercial aircraft (air carrier and regional) grew, reflecting improvement in the national economy. Unlike passenger enplanements, which are categorized as air carrier or regional based on the airline's role, operations are categorized based on aircraft seating capacity. Aircraft with 60 or more seats are air carrier, and aircraft with fewer than 60 seats that are operated by airlines are air taxi/commuter.

Nationally, general aviation operations overall grew from 2011 to 2012, before declining again in subsequent years. Segments of the general aviation market, namely aircraft used for business purposes, are operating more frequently, while flight training and leisure and hobby flying are contracting. Business general aviation is growing in response to airline consolidation – it is simply less convenient to fly commercially than it used to be. Flight training is growing among students interested in the airline career track, but fewer are learning to fly as a hobby. This has led to the decline in leisure pilots. Reasons for this decline includes the increased cost of aircraft ownership, the expense associated with learning to fly, and competing financial needs. Younger generations are saving for a home and repaying student loans, which limits discretionary income.

The Aerospace Forecast projects total operations by all segments of the aviation industry to increase at an average rate of 0.9 percent per year through 2035 at towered airports. Most of the growth is expected to be from increased commercial aircraft activity (up 1.5 percent annually). The air carrier component is projected to increase an average of 2.7 percent per year. Nationally, the increase in air carrier activity is expected to occur due to a combination of air carrier airlines increasing frequencies on select routes, and a switch by regional airlines from 50 seat aircraft to 70-90 seat aircraft. In some instances, regional airlines are replacing 50-seat aircraft with larger regional jets having more than 100-seats without increasing frequency. Air taxi/commuter operations are forecast to fall 4.9 percent in 2015 and decrease 1 percent per year through 2035. This reduction in the air taxi/commuter component will be driven by the retirement of passenger jets with fewer than 50 seats. At small- and non-hub airports such as Bismarck Airport, the FAA's FY 2015-2035 Aerospace Forecast projects total operations to increase at an average annual rate of 0.5 percent a year. The Aerospace Forecast projects that general aviation activity at towered airports will increase an average of 0.3 percent annually through 2035.

2.2.4 Air Cargo Volumes

The Aerospace Forecast concludes that the national volume of air cargo follows trends in the gross domestic product, with secondary influences of airline fuel costs and the need for just-in-time logistics chains. Air cargo volumes have grown since the post-recession low point in 2009, although there has been some year-to-year variability. The significant structural changes in the air cargo industry that have occurred over the last decade have affected air cargo volumes, including: FAA and TSA air cargo screening requirements, maturation of the domestic express package market, a shift from air to other transportation modes (especially truck), use of all-cargo carriers by the U.S. Postal Service, and the increased use of internet-based mail substitutes. The shift from air to other modes may be a temporary cost-cutting measure linked to the recession. If so, improvements in the economy will result in a shift back to air cargo. However, commenters with the Air Cargo News also suggest factors that work against a return to use of air cargo. These include: companies better managing their supply chains are able to reduce their use of expedited shipping; electronic devices have become smaller and lighter; and shifts from use of freight haulers to cargo integrators (such as FedEx and UPS). Another key change is the continuing reduction in the amount of air cargo carried on passenger airliners.

The Aerospace Forecast projects that air cargo volumes will increase at an average annual rate of 0.5 percent. The all-cargo carriers' share of the air cargo market is forecast to grow from 89.2 percent to 90.2 percent by 2035 as passenger airlines take less and less cargo.

2.3 FORECASTING METHODOLOGIES

A number of forecasting techniques may be used to project aviation activity. They range from subjective judgment to sophisticated mathematical modeling. These forecasts utilize 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.

Sixty-four local and national aviation and socioeconomic factors were evaluated for correlations with the airport performance measures being forecast in this Chapter. **Table 2-4** presents those factors with the highest correlations with six airport performance measures. This information will be used to select the most appropriate methodologies for forecasting the airport performance measures. **Table 2-5** lists the data sources used to produce the correlations in Table 2-4.

In the tables and text that follow the statistical measure r is used to measure the strength of the relationship between two factors. An r can range from -1.00 (one variable increases, the other decreases proportionally) to +1.00 (both variables grow or decline proportionally at the same time). A score close to +/-1.00 suggests a stronger correlation, and a score closer to zero suggests that the two variables are not correlated. Typically, an r of at least +/-0.70 is needed to conclude that there is a substantial correlation between the two factors. It is important to understand that correlation does not necessarily imply causality. It could be possible that the two factors are jointly being influenced by another factor.

Those factors with the highest correlations for each activity are shown below. Some factors for which one would logically expect high correlations did not prove to have them. For example, local civil operations and based aircraft turned out to have low correlations with local population (r = 0.56 and 0.56) and personal income (r= 0.65 and 0.62).

Methodologies used to develop forecasts described in this section include time-series methodologies and socioeconomic methodologies. Another common methodology, market-share projection, has not been used in forecasting. The market share methodology compares local levels of activity with those of a larger market (e.g. state, nation, or world). Such methodologies imply that the proportion of activity that can be assigned to the local level is a fixed percentage of the larger entity.

Table 2-4 Bismarck Airport Activity Correlation Analysis						
Rank	Enplanements		Air Carrier Ops.		Air Taxi Ops.	
	Factor	*r*	Factor	*r*	Factor	*r*
1	Personal Income	0.97	AC Enplanements	0.77	Total Retail Sales	0.93
2	GRP	0.97	National AC Ops.	0.53	Total Personal Income	0.93
3	Population	0.97	Nat'l Mainline Enplanements	0.43	Total Earnings	0.92
4	Total Earnings	0.96	Nat'l Mainline + Reg'l Enplanements	0.36	Population	0.91
5	Mining Earnings	0.96	National ATP Pilots	0.07	National ATP Pilots	0.69
Rank	Itinerant GA Ops.		Local GA Ops.		Based Aircraft	
	Factor	*r*	Factor	*r*	Factor	*r*
1	Based Aircraft	0.79	National Student Pilots	0.64	National ATP Pilots	0.86
2	National ATP Pilots	0.79	Total Retail Sales	0.61	Total Retail Sales	0.72
3	Total Retail Sales	0.69	Mining Earnings	0.60	Total Employment	0.72
4	Total Employment	0.64	Total Earnings	0.59	Total Earnings	0.66
5	Mining Earnings	0.61	Total Personal Income	0.56	Population	0.65

GA = General Aviation; GDP = Gross Domestic Product; GRP = Gross Regional Product; Ops = Operations; Nat'l = National AC = Air Carrier; Reg'l = Regional; Data sources are shown in Table 2-5.

The market share 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. This share is then applied to forecasts of activity for the larger entity. However, as shown in Table 2-4, activity metrics at Bismarck Airport do not correlate well with national aviation trends. Therefore, the market share methodology was not used to prepare forecasts.

Table 2-5 Bismarck Airport Activity Correlation Analysis Data Sources		
Factor	**Type(Scale)**	**Source**
Population	Socioeconomic (Local)	Woods & Poole
Gross Regional Product		
Mining Earnings		
Personal Income		
Total Earnings		
Total Employment		
Total Personal Income		
Total Retail Sales		
National Air Carrier Operations	Aviation (National)	FAA Aerospace Forecast
National Airline Transport Pilots		
National Student Pilots		
National Mainline + Regional Enplanements		
National Mainline Enplanements		
Air Carrier Enplanements	Aviation (Local)	FAA TAF
Based Aircraft		

Source: Mead & Hunt, 2016

2.3.1 Socioeconomic Methodologies

Though trend line extrapolation and regression 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 and 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 Bismarck Metropolitan Statistical Area (MSA).

The Bismarck MSA includes Burleigh, Morton, Oliver, and Sioux counties. Historical and forecasted socioeconomic statistics for this MSA were obtained from the economic forecasting firm Woods & Poole Economics. Based upon the observed and projected correlation between historical aviation activity and the socioeconomic data sets, future aviation activity projections were developed. **Table 2-6** presents forecasts of socioeconomic indicators that are utilized in various locations of this chapter.

2.3.2 Time-Series Methodologies

Historical trend lines and regression analyses 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. Regression analyses used in this chapter were linear and used a single variable.

2.4 GENERAL APPROACH TO FORECASTING

The key challenge in this forecasting effort is how to incorporate the potential for a return of an economic boom associated with oil exploration. In considering this issue it is important to distinguish between ongoing oil production in North Dakota and an oil exploration boom. North Dakota is the second largest oil producing state after Texas. The various oil fields in North Dakota will continue to produce oil as long as the market price does not drop lower than their costs to produce the oil. In September 2015, the North Dakota Department of Mineral Resources (Mineral Resources) calculated the price at which the cost of producing oil from existing wells exceeds production costs in the oil producing counties in North Dakota. This break-even price in the three counties with the lowest production costs ranged from $24 to $27 per barrel. At the high end of the production cost range, other counties in North Dakota had break-even costs calculated at $85 per barrel.

Table 2-6 Historical and Projected Socioeconomic Indicators for Bismarck Airport										
Year	**Total Population**	**Total Employment**	**Total Earnings**	**Mining Earnings (includes oil)**	**State and Local Government Earnings**	**Health Care and Social Assistance Earnings**	**Farm Earnings**	**Total Personal Income**	**Gross Regional Product**	**Total Retail Sales**
Historical										
2000	101,020	70,185	2,408,846,000	10,855,000	419,092,000	354,530,000	63,484,000	3,107,766,000	3,590,442,000	1,607,992,000
2001	101,289	70,601	2,570,217,000	10,451,000	439,893,000	382,696,000	52,365,000	3,271,105,000	3,792,554,000	1,608,492,000
2002	102,340	71,229	2,642,454,000	14,472,000	461,316,000	440,434,000	11,086,000	3,324,641,000	4,022,472,000	1,619,463,000
2003	103,201	72,298	2,807,689,000	14,329,000	480,072,000	453,657,000	56,237,000	3,476,443,000	4,277,572,000	1,671,545,000
2004	104,211	74,380	2,925,802,000	12,780,000	493,847,000	478,360,000	55,471,000	3,650,836,000	4,389,184,000	1,748,046,000
2005	105,942	76,398	2,998,770,000	19,646,000	496,055,000	484,001,000	83,892,000	3,762,114,000	4,504,745,000	1,831,664,000
2006	107,861	78,899	3,046,752,000	18,843,000	495,307,000	497,431,000	32,674,000	3,880,277,000	4,643,086,000	1,900,796,000
2007	109,742	80,587	3,139,701,000	19,993,000	507,317,000	501,761,000	64,096,000	4,078,073,000	4,870,828,000	1,947,029,000
2008	111,282	82,181	3,181,434,000	22,466,000	531,445,000	517,362,000	51,339,000	4,189,889,000	5,041,890,000	1,877,674,000
2009	113,143	83,078	3,295,240,000	18,812,000	582,540,000	549,710,000	83,613,000	4,254,014,000	5,211,998,000	1,752,300,000
2010	115,233	83,391	3,421,615,000	32,046,000	636,926,000	581,152,000	83,029,000	4,554,092,000	5,501,272,000	1,835,839,000
2011	117,208	85,653	3,603,018,000	48,909,000	652,595,000	615,464,000	78,885,000	4,896,715,000	5,761,786,000	1,942,594,000
2012	120,085	89,299	3,965,613,000	64,323,000	658,766,000	658,673,000	163,253,000	5,341,362,000	6,438,899,000	2,041,269,000
2013	123,751	91,845	4,071,080,000	68,075,000	702,908,000	686,402,000	37,576,000	5,405,598,000	6,801,109,000	2,143,587,000
2014	125,605	93,900	4,339,490,000	66,922,000	720,172,000	738,164,000	56,525,000	5,678,155,000	7,217,614,000	2,213,501,000
2015	127,540	95,988	4,479,512,000	68,471,000	735,616,000	769,915,000	57,155,000	5,858,156,000	7,453,953,000	2,267,142,000
Projected										
2020	137,931	106,384	5,217,644,000	76,758,000	811,472,000	949,447,000	60,198,000	6,833,226,000	8,702,389,000	2,540,339,000
2025	148,947	117,276	6,048,762,000	86,017,000	884,135,000	1,168,770,000	63,052,000	7,957,122,000	10,109,448,000	2,813,233,000
2030	160,452	128,458	6,966,025,000	96,355,000	952,273,000	1,432,616,000	65,699,000	9,171,087,000	11,663,769,000	3,093,284,000
2035	172,063	139,828	7,975,968,000	107,898,000	1,015,152,000	1,741,031,000	68,126,000	10,434,018,000	13,375,100,000	3,386,664,000
CAGR(2015 -2035)	*1.51%*	*1.90%*	*2.93%*	*2.30%*	*1.62%*	*4.16%*	*0.88%*	*2.93%*	*2.97%*	*2.03%*

Note: Bismarck Metropolitan Statistical Area (MSA)
CAGR = Compound Annual Growth Rate
Dollar values are in 2009 dollars
Source: Woods & Poole Economic Inc.

This page is intentionally blank.

As a point of reference, the price for North Dakota sweet crude oil was $36.25 a barrel on July 15, 2016, according to the July *Director's Cut* newsletter published by Mineral Resources. Mineral Resources indicated that the number of producing oil wells in North Dakota declined for the first time in nearly 12 years, and the state saw a drop in the production of oil and natural gas. However, in spite of the low price of oil in early 2016, the production segment of the oil industry has been less affected than the exploration segment of the industry.

Mineral Resources states that the number of active oil drilling rigs has dropped from 171 in January 2015 to 58 in January 2016, suggesting that the oil exploration boom has ended. The oil exploration boom will return when the industry believes that the price of oil will remain high enough during the time it takes to put an exploratory well into production. Timing of the next oil exploration boom depends on the market price of oil.

A review of published estimates from industry sources yielded estimates of when oil prices would rise from six months to five years and beyond.

- Mineral Resources indicated an expectation that supply and demand for oil would reach a balance in late 2016, followed by an increase in oil prices in 2017.
- The PRICE Futures Group expects oil prices to rise after two years.
- The International Energy Agency Medium-Term Oil Market Report 2015 predicts that prices will stabilize at levels higher than recent lows but substantially below the highs of the last three years (2012-2015).
- Vitol Group BV, the largest oil-trading house, expects the oil price to "bounce around a band width of $50 a barrel for the next decade."

It seems plausible that oil prices could again rise to levels that would restart the recent oil exploration boom. However, the uncertainty of a new oil boom and the greater uncertainty of when it would begin are judged to be too high to be used in forecasting at the Airport. Therefore, the general approach to activity forecasts for Bismarck Airport is not to use methodologies that would emphasize the high growth rates experienced over the last five years (2011-2015). Instead, the chosen methodologies will utilize factors tied to the longer-term growth rates experienced at Bismarck Airport.

It remains appropriate for the Airport staff to monitor changes to the oil industry in North Dakota. Comparing oil-related employment estimates prepared by the Department of Mineral Resources to changes in passenger enplanement volumes suggests that there is a two- to three-year lag between when oil jobs begin rapid increases and when passenger enplanements begin showing rapid year-over-year changes. This gives the Airport staff the lead time to begin implementation of operational and facility changes to accommodate high growth rates.

2.5 PASSENGER ENPLANEMENTS

Passenger enplanement forecasts are used to anticipate facility needs, such as expansion of the passenger terminal or modification of gates to accommodate different classes of aircraft. A passenger enplanement is defined as the act of one passenger boarding a commercial service aircraft that departs an airport. Passenger enplanements include scheduled and non-scheduled flights of more than nine passenger seats, and do not include airline crew. Total passengers is equal to enplanements and deplanements (passengers getting off an aircraft). For the purpose of the aviation forecast, deplanements are equal to enplanements. Passenger enplanement data is provided by the airport management and commercial passenger service carriers. The following sections include a description of enplanement trends and enplanement forecasts.

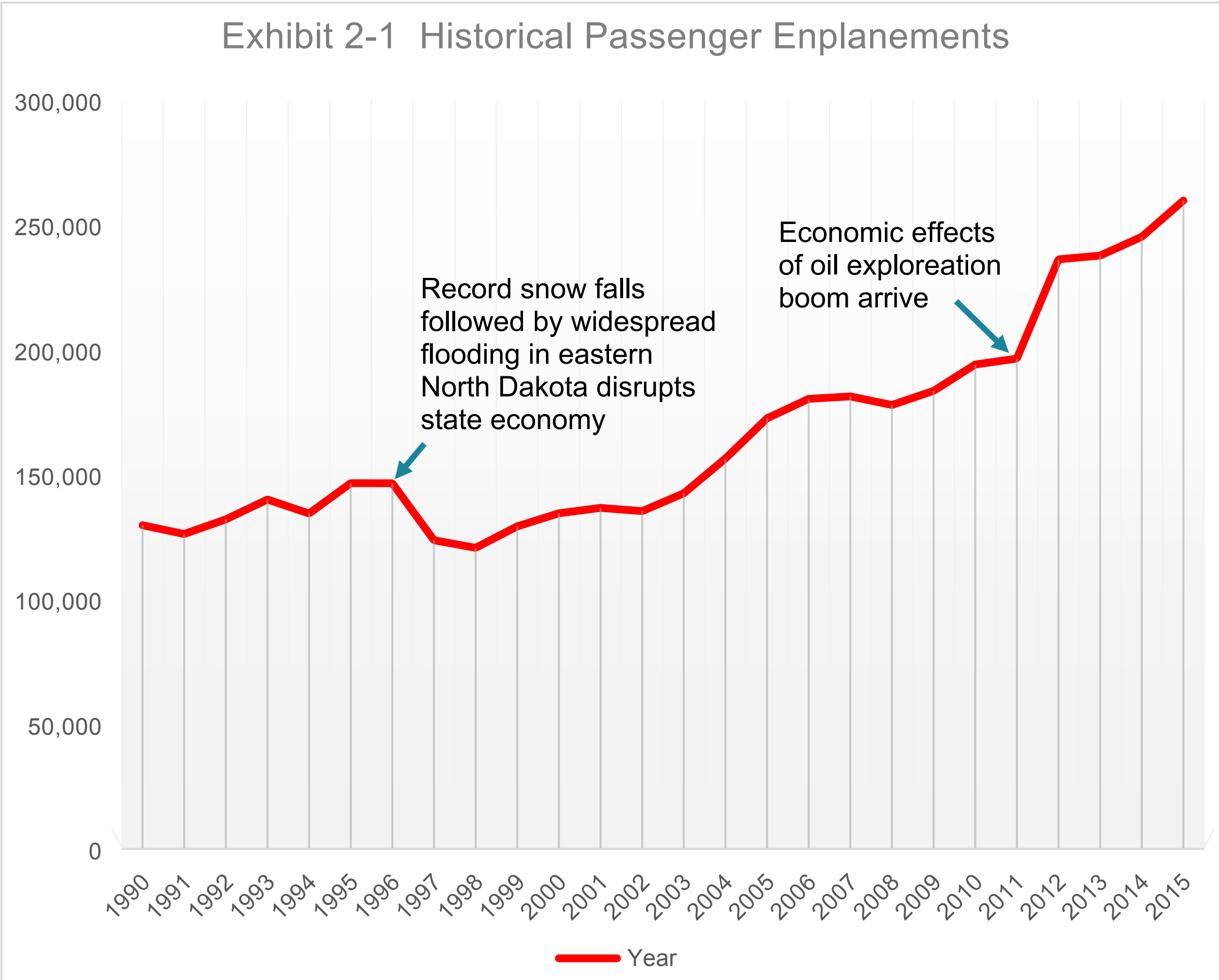
2.5.1 Historical Patterns

As shown in **Exhibit 2-1**, passenger enplanements at Bismarck Airport have grown from 120,589 in 1998 to 259,734 in 2015. Average annual growth rates were higher than 4 percent during the oil exploration boom years (2011-2015), compared to 1.6 percent in the pre-oil boom years. Although enplanements in 2015 were 5.9 percent higher than

2014, growth slowed during the last quarter of 2015. Enplanements were 17.3 percent higher in September 2015 than 2014, 2.5 percent higher in October, 1.5 percent lower in November, and 1.8 percent lower in December. The decline continued in 2016 with January being 0.7 percent lower than January 2015 and February being 0.2 percent lower than February 2015. The trend then reversed with 9.2 percent year-over-year growth in March 2016. The next three months (April-June) showed year-over-year growth of 4.6 percent, 4.8 percent, and 4.1 percent respectively. Passenger enplanements through the first six months of 2016 total 4.0 percent higher than for the comparable period in 2015.

In 2014-2015 North Dakota lost 7,000 oil-related jobs. Communities with less diversified economies, such as Dickinson near the Bakken Oil Fields, lost airline service. Although the economic decline related to the oil industry may slow the growth of passenger enplanements at Bismarck Airport in 2016 and beyond, it is clear that other economic sectors such as tourism and state government profoundly affect the economics of the Bismarck metropolitan area.

This page is intentionally blank.



Year	Enplanements
1990	129,649
1991	126,126
1992	132,001
1993	139,955
1994	134,346
1995	146,501
1996	146,466
1997	123,639
1998	120,589
1999	129,206
2000	134,437
2001	136,597
2002	135,303
2003	142,434
2004	156,384
2005	172,491
2006	180,283
2007	181,259
2008	177,832
2009	183,480
2010	194,043
2011	196,414
2012	236,172
2013	237,683
2014	245,205
2015	259,734
CAGR (1990-2015)	**2.8%**
CAGR (2000-2015)	**4.5%**

This page is intentionally blank.

2.5.2 Forecasts

Passenger Demand Analysis

In order to understand the travel habits of Bismarck Airport passengers, the forecast effort includes a Passenger Demand Analysis. The results of this analysis are summarized in this section. The report provides an understanding of the Bismarck Airport air travel market and includes the following sections.

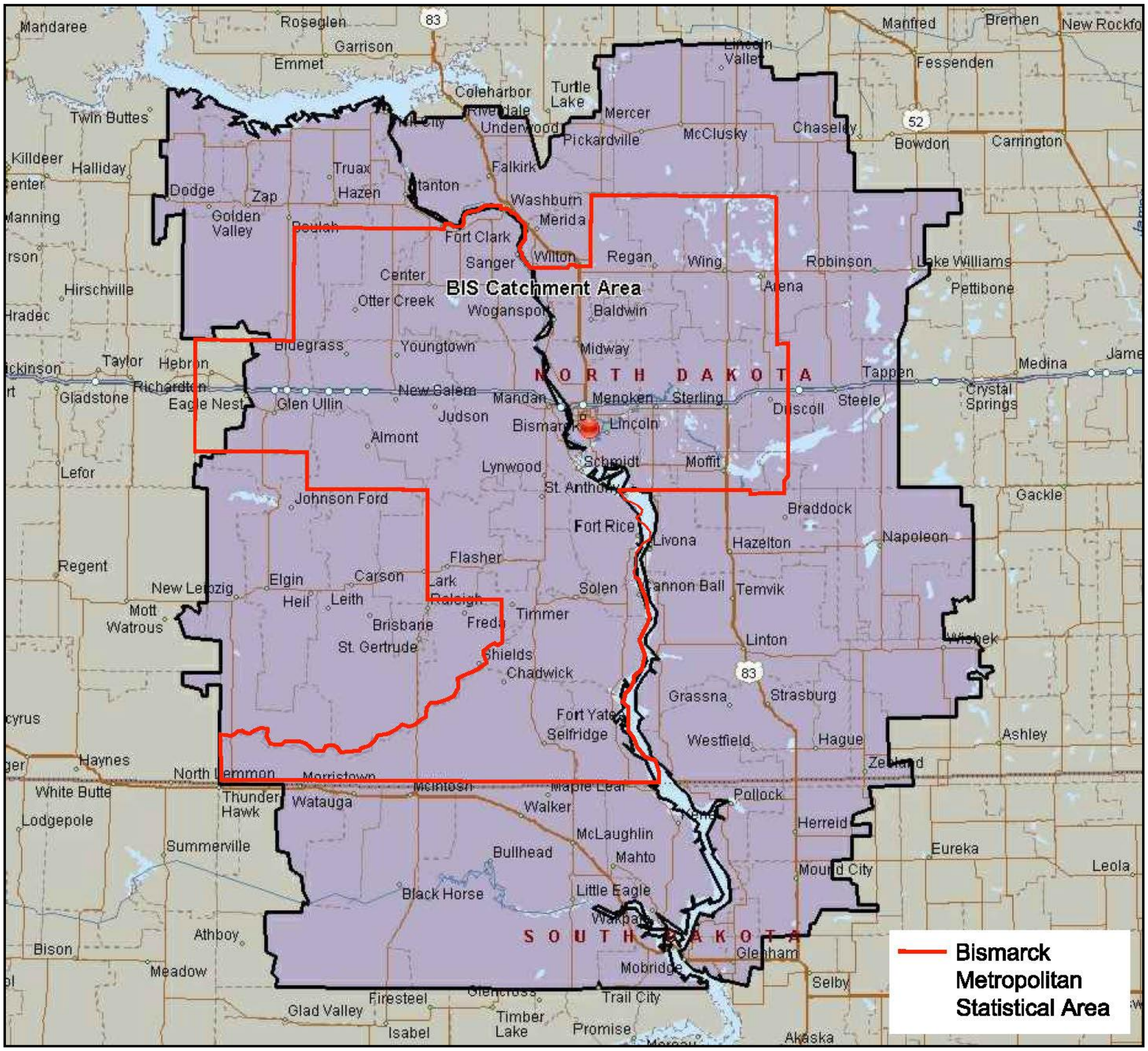
- The originating airports used by air travelers in the airport's catchment area
- Diversion of airline passenger traffic to competing airports
- An estimate of total airline passengers in the catchment area and destinations
- Airlines used by local air travelers
- Average airfares by origin and destination airport
- Service levels at Bismarck Airport and competing airports

The Passenger Demand Analysis utilizes Airline Reporting Corporation (ARC) ticketed data and US Department of Transportation (DOT) airline data to provide a comprehensive overview of the air travel market. A total of 14,090 ARC tickets for the year ended June 30, 2015, were used in this analysis.

The analysis began by defining an airport catchment area for Bismarck Airport. An airport catchment area, or service area, is a geographic area surrounding an airport where it can reasonably expect to draw passenger traffic and is representative of the local market. The catchment area contains the population of travelers who should use Bismarck Airport considering the drive time from the catchment area to competing airports. This population of travelers is Bismarck Airport's focus market for air service improvements and represents the majority of travelers using the local airport. **Exhibit 2-2** shows the catchment area defined for Bismarck Airport. Some of the socioeconomic data used in this analysis is taken from sources that use the Bismarck MSA. As can be seen in Exhibit

2-2, the Bismarck MSA encompasses a smaller geographic area than the Catchment Area. Both the MSA and catchment area include the core cities of Bismarck and Mandan.

Exhibit 2-2 Bismarck Catchment Area



The Passenger Demand Analysis found the following information.

- The Bismarck Airport catchment area has a population of 154,260 in sixty-four zip codes.
- The airport's true market is estimated at 547,976 annual origin and destination passengers (see **Table 2-7**). An airport's true market is 100% of all passengers that arrive at or depart from an airport's service area. A true market includes those passengers who use an alternate airport. For example, Bismarck's true market include passengers who live in Bismarck but chose to drive to Minot for a particular flight.
- Domestic travelers accounted for 516,465 of the total true market (94 percent). International travelers made up the remaining 31,511 passengers (6 percent).
- 93 percent of catchment area travelers used Bismarck Airport, while 6 percent diverted to Fargo's Hector International Airport (FAR), and 1 percent to Minot International Airport (MOT). 93 percent of domestic travelers and 94 percent of international travelers used Bismarck Airport.
- 66 percent of travelers, or 358,981 passengers, were destined to or from one of the top 25 markets. Las Vegas was the number one destination with 11 percent of passengers. Bismarck Airport retained 98 percent of passengers to Las Vegas. The next largest markets were Denver, Phoenix-Mesa, Orlando-Sanford, and Minneapolis. Bismarck Airport had service to all of its top six markets, with a mixture of leisure (Allegiant) and legacy airlines (American, Delta and United).
- Bismarck Airport is in an isolated area in the center of North Dakota. With the nearest competing airport (one with comparable service) nearly three hours away, diversion to an alternate airport is not a major issue for Bismarck Airport.
- Much of the growth in the state of North Dakota can be attributed to the growth in the oil and gas industry. As the state economy grew at a very fast pace, the air service at BIS grew more rapidly than similar sized markets in

the rest of the U.S. It is expected that service levels and demand at BIS will continue to be influenced by the health of the oil and gas industry in North Dakota. Oil prices plummeted in 2015 and have remained low in 2016 (through July 2016). It is anticipated that the demand for air service will slow to rates below the oil boom peak growth rates. Peak oil boom year-over-year growth rates were as high as 20.2 percent from 2011-2013 and 5.9 percent from 2014-2015.

- Opportunities for more capacity will likely be in the form of larger gauge aircraft as the legacy airlines replace 50-seat regional jets with larger regional jets and smaller mainline aircraft. There is the potential for Allegiant to add service to Tampa-St. Petersburg. The stage length would be comparable to that to Orlando which already has service from Bismarck.

General Approach to Forecasting Enplanements

Enplanement forecasts emphasize methodologies that are independent of the recent 2011-2015 growth rates associated with the oil exploration boom. Therefore, passenger enplanement forecasts look to historical trends, correlated growth indices, and FAA projections to project enplanement levels at Bismarck Airport.

It is noted in Table 2-4 that a correlation analysis compared sixty-four aviation-related and socioeconomic factors to historical aviation activity at Bismarck Airport. Although strong correlation between two variables is not sufficient to determine causation on its own, it can be helpful in investigating what is driving enplanement growth. The four strongest correlations for passenger enplanements were:

- Total personal income within the Bismarck MSA – r = 0.97
- Gross Regional Product – r = 0.97
- Total MSA population – r = 0.97
- Mining earnings within the Bismarck MSA – r = 0.96

Table 2-7 True Market Estimate - Top 25 Destinations					
Rank	**Destination**	**BIS Reported Pax**	**Diverted Pax**	**True Market**	**DPEW**
1	Las Vegas, NV	55,005	1,043	56,048	76.8
2	Denver, CO	42,783	1,617	44,400	60.8
3	Phoenix, AZ (AZA)	41,339	0	41,339	56.6
4	Orlando, FL (SFB)	29,100	0	29,100	39.9
5	Minneapolis, MN	23,870	3,056	26,926	36.9
6	Dallas, TX (DFW)	16,603	339	16,942	23.2
7	Phoenix, AZ (PHX)	11,587	760	12,347	16.9
8	Seattle, WA (SEA)	10,608	1,113	11,721	16.1
9	Chicago, IL (ORD)	10,555	933	11,489	15.7
10	Washington, DC (DCA)	9,096	914	10,010	13.7
11	Houston, TX (IAH)	7,455	1,929	9,384	12.9
12	Los Angeles, CA	8,299	1,069	9,368	12.8
13	Orlando, FL (MCO)	7,519	1,041	8,560	11.7
14	San Francisco, CA	7,223	453	7,677	10.5
15	Atlanta, GA	6,217	1,106	7,324	10.0
16	Portland, OR	6,888	336	7,224	9.9
17	San Diego, CA	6,370	531	6,901	9.5
18	Salt Lake City, UT	6,091	656	6,747	9.2
19	New York, NY (LGA)	5,231	648	5,880	8.1
20	Nashville, TN	4,745	915	5,659	7.8
21	Kansas City, MO	5,105	113	5,217	7.1
22	San Antonio, TX	4,148	828	4,975	6.8
23	St. Louis, MO	4,240	725	4,965	6.8
24	Boston, MA	4,188	374	4,562	6.2
25	Detroit, MI	2,951	1,265	4,216	5.8
	Top 25 destinations	**337,219**	**21,762**	**358,981**	**491.8**
	Total domestic	**477,776**	**38,689**	**516,465**	**707.5**
	Total international	**29,536**	**1,975**	**31,511**	**43.2**
	All markets	**507,312**	**40,664**	**547,976**	**750.7**

Source: Mead & Hunt, 2016

Note: DPEW = daily passengers each way (i.e., both arriving and departing passengers)

BIS Reported PAX = Passengers using BIS

Diverted PAX = passengers using another airport

True market = total number of passengers from the BIS market area including those who used other airports

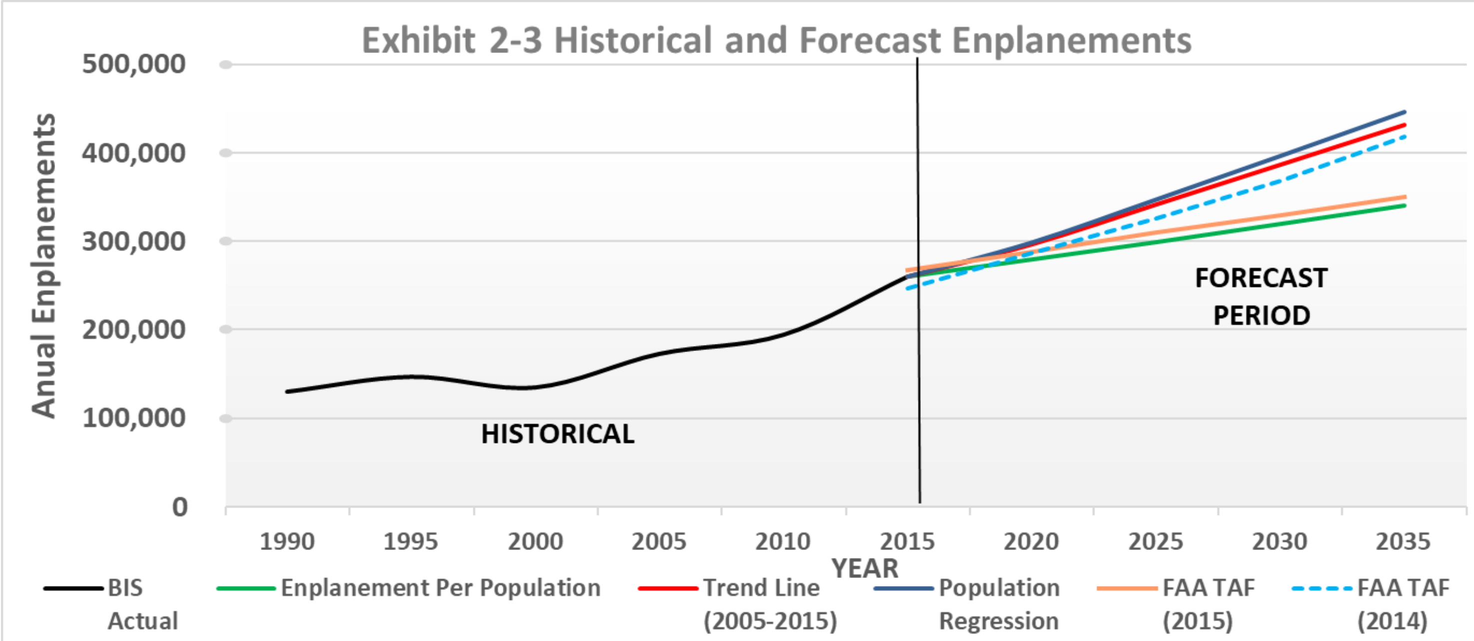
Review of prior planning documents suggests that these r values may overstate the relationship between these variables and enplanements. The 2008 Bismarck Airport Master Plan included regression analyses of similar factors and found a weak correlation of these variables with enplanements. The high r values in this Master Plan's correlation analysis are likely influenced by these variables trending in light of greater economic growth in recent years and do not necessarily indicate that growth of one variable causes enplanements to go up on its own.

Nonetheless, it is appropriate to use this correlation analysis to select a socioeconomic factor to utilize in forecasting enplanements. Due to the concern of the overstated strength of the four variables noted in the prior paragraph, total MSA population has been selected. The region's total population is more stable and less sensitive to economic fluctuations like the oil boom than other economic factors that also showed high correlations to enplanements.

Regression Analysis

Regression analysis is a common method of forecasting passenger enplanements. Regression analysis tests the strength of the relationship between an external factor (i.e., service area population or regional per capita income) and the number of passenger enplanements. It also produces an equation that enables one to forecast enplanements based on one or more other variables.

Population is the most stable of the four variables evaluated in that it varies the least year to year. A regression model was developed utilizing historical population and enplanement data from 2000 to 2012. This time period was selected to exclude the years when the oil exploration boom most influenced enplanements at Bismarck Airport (2012-2015).



Year	FAA Baseline		LOW – Rejected	MODERATE - Preferred	HIGH - Rejected
	FAA TAF (2014)	FAA TAF (2015)	Enplanement Per Population	Trend Line (2005-2015)	Population Regression
2015	246,450	267,147	259,734	259,734	259,734
2020	287,347	288,087	279,079	296,308	298,386
2025	325,576	309,597	299,066	341,525	346,945
2030	367,799	329,589	319,362	386,743	396,251
2035	417,692	350,032	339,856	431,961	446,041
20-Year CAGR	2.6%	1.4%	1.3%	2.7%	2.9%

Source: FAA 2015 and 2016 TAF; Mead & Hunt, 2016

This page is intentionally blank.

This methodology produces a forecast of:

- 289,386 enplanements in 2020
- 346,945 enplanements in 2025
- 396,251 enplanements in 2030
- 446,041 enplanements in 2035

This forecast is compared to the 2014 and 2015 TAF in **Exhibit 2-3**.

Trend Line Analysis

A second forecasting approach was to calculate the trend of historical enplanements for Bismarck Airport and extend this trend through the 2035 forecast period. This trend line will reflect the mix of local and national factors that have historically shaped enplanements at Bismarck Airport. A forecasting method that includes local factors is important, because historical enplanements at Bismarck Airport have had a weak correlation with national enplanement trends:

- National mainline and regional passenger enplanements: r = -0.11
- National mainline passenger enplanements: r = -0.16
- National regional passenger enplanements: r = 0.35

The trend line was calculated for the period of 2005-2015. This period has been selected because it includes both the recent years (2011-2015) in which the oil exploration boom appears to have had the greatest effect on enplanements, as well as seven prior years.

The annual growth rate for this period was 2.7 percent. Applying this growth rate to the 20-year forecast period yields a projection of:

- 296,308 enplanements in 2020
- 341,525 enplanements in 2025
- 386,743 enplanements in 2030
- 431,961 enplanements in 2035

Exhibit 2-3 compares all three Master Plan forecasts with the 2014 and 2015 TAF.

Enplanement per Population Ratio

Another common means of forecasting enplanements is to utilize the ratio of enplanements to the population served by an airport. This ratio represents area residents' historical pattern of airline use. Factors that affect this ratio include disposable income, geographic remoteness, airfares, and proximity to alternative airports. In 2015, Bismarck Airport had 2.09 enplanements per person in the Bismarck MSA (by comparison, the ratio was 1.64 enplanements per person in the Bismarck catchment area). Applying this ratio to the population forecast for the Bismarck MSA produces a projection of:

- 279,079 enplanements in 2020
- 299,066 enplanements in 2025
- 319,362 enplanements in 2030
- 339,856 enplanements in 2035

This forecast is compared to the 2014 and 2015 TAF in Exhibit 2-3.

Preferred Enplanement Forecast

The purpose of the enplanement forecast is to guide development of terminal and airfield facilities to support growth. Both the high forecast (regression analysis) and low forecast (enplanement per population ratio) use the Bismarck MSA as a factor. The Passenger Demand Analysis indicated that 93 percent of residents within the Bismarck catchment area (see Exhibit 2-2) who made airline flights used the Bismarck Airport. However, in 2014-2015 42.8 percent of Bismarck Airport passengers originated from outside of Bismarck's catchment area. With this large a segment of passengers originating outside of the catchment area, the local population can only have a weak direct relationship to total enplanements. Therefore, both the high and low forecasts have been rejected.

The trend line incorporates the contribution of population, local and national economy, and other factors that shaped historical passenger volumes. Because it captures a broader range of factors, it is judged superior to forecasts solely linked to area population. Therefore, the intermediate forecast (trend line) has been selected as the preferred forecast of passenger enplanements.

The trend line forecast anticipates a 2.7 percent compound average growth rate (CAGR) over the next 20 years (through 2035). The CAGR from 2000 to 2015 was 4.5 percent. This higher historical CAGR was influenced by a few years of high growth associated with the beginning of the oil boom where peak year-over-year growth of up to 20.2 percent was experienced.

Comparison with the 2015 Terminal Area Forecast

Master plan forecasts must be evaluated for consistency with the current TAF. Forecasts are considered consistent with the TAF if the five-year forecast is within 10 percent of the TAF and ten-year forecasts are within 15 percent of the TAF. As shown in **Table 2-8**, the preferred enplanement forecast is consistent with the 2015 TAF

Table 2-8 Comparison of Passenger Enplanement Forecasts				
Year	2015 TAF	Preferred Forecast	Difference	% Difference
2015	267,147	259,734	-7,413	-2.8%
2020	288,087	296,308	8,221	2.9%
2025	309,597	341,525	31,928	10.3%
2030	329,589	386,743	57,154	17.3%
2035	350,032	431,961	81,929	23.4%

Source: 2015 Terminal Area Forecasts, Aviation Forecasts complied by Mead & Hunt

2.6 BASED AIRCRAFT

Based aircraft are defined as those stored at an airport on a long-term basis. These aircraft owners buy or lease hangar and parking space from the airport or a third-party developer. The forecast of based aircraft will be used to identify the number of additional hangar spaces which need to be included in this master planning effort. The projected mix of aircraft types will guide planning by defining the size of hangars that will be needed. This information will also be used to assess the need for new or expanded supporting facilities or services.

2.6.1 Historical Patterns

Table 2-9 Military Aircraft Based at Bismarck North Dakota Army National Guard	
8	UH-60 Blackhawk Helicopters
8	UH-72 Lakota Helicopters
1	C-12 Huron (Beechcraft King Air 200)

Source: Army National Guard

In 2015, there were 117 based aircraft at Bismarck; 100 civilian aircraft (85 percent of the based fleet), and 17 military aircraft (15 percent of the based fleet). Military aircraft based at the Airport are listed in **Table 2-9** and civilian aircraft are described below. Military and civilian aircraft are classified separately because civilian aircraft numbers fluctuate due to market forces, whereas military aircraft numbers fluctuate due to orders from the Department of Defense. For this reason, the forecast for based aircraft holds military numbers constant and focuses on civilian aircraft only.

- 65—Single-engine
- 22—Multi-engine
- 10—Jet
- 3—Helicopter
- 100—Based aircraft

The single-engine aircraft make up 65 percent of the based aircraft fleet at Bismarck Airport, and are mostly piston-powered aircraft with two to six seats. The piston-powered, twin-engine aircraft are a mixture of Cessna, Piper, and Beech makes. The twin turboprops are various models of the Beechcraft King Air series. The jets are in the small to mid-sized range (i.e., less than 30,000-pound gross takeoff weight). Most of the jets are various models of the Cessna Citation. However, Falcon, Gulfstream, and Beechcraft jet aircraft are also based on the field. The helicopters are single-rotor Bell models.

Over the last 15 years there has been volatility in the total number of civilian based aircraft. Total counts have been as high as 111 (in 2005) and as low as 78 (in 2010)[1]. As can be seen in **Exhibit 2-4**, the principal source of this volatility are periodic changes in the number of single-engine aircraft, which make up the majority of the based aircraft fleet. To a lesser degree, multi-engine aircraft have also contributed to the changes in based aircraft. During this same 15-year time period, the general trend for multi-engine aircraft has been of minor year-to-year variability with totals around 20 aircraft. The trend for jet aircraft has generally been one of growth over this time period. The greatest year-to-year increase in based jets occurred in the 2004-2011 period, when the number

[1] The numbers quoted are from the Terminal Area Forecast (TAF) with 2015 data coming from Airport records. There are small differences in some years between the TAF and Airport Master Record (Form 5010-1).

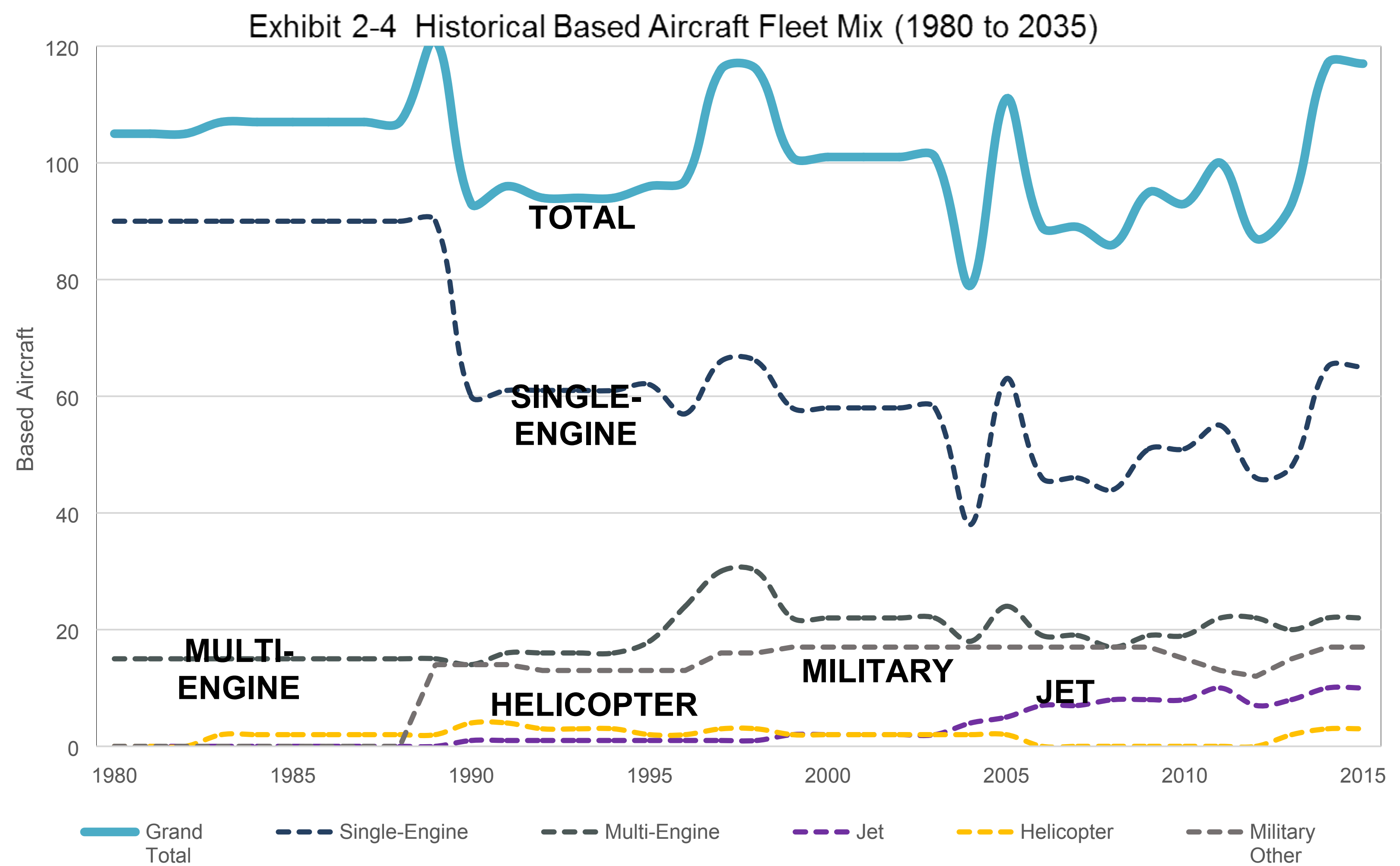
increased from four to ten. Helicopters are a small part of the fleet and have remained stable over recent years.

2.6.2 Based Aircraft Forecasting Methodology

Two forecast methodologies have been prepared for based aircraft: “high” and “low”. Based aircraft growth at the airport has exceeded national trends. Since 2008, the total number of based aircraft has increased from around 90 to 117, which equates to 4.5 percent growth per year. This may have been related to oil exploration boom and associated economic growth in the area as no other factors have been identified that could explain the strong growth trend. As noted in the General Forecasting Approach section, a similar energy boom could occur in the near-term. Therefore, it is appropriate to have a high forecast that captures this boom potential for purposes of facility planning. Because it is not possible to predict when the next oil exploration boom will occur, a low forecast was prepared that reflects base trends during non-boom periods.

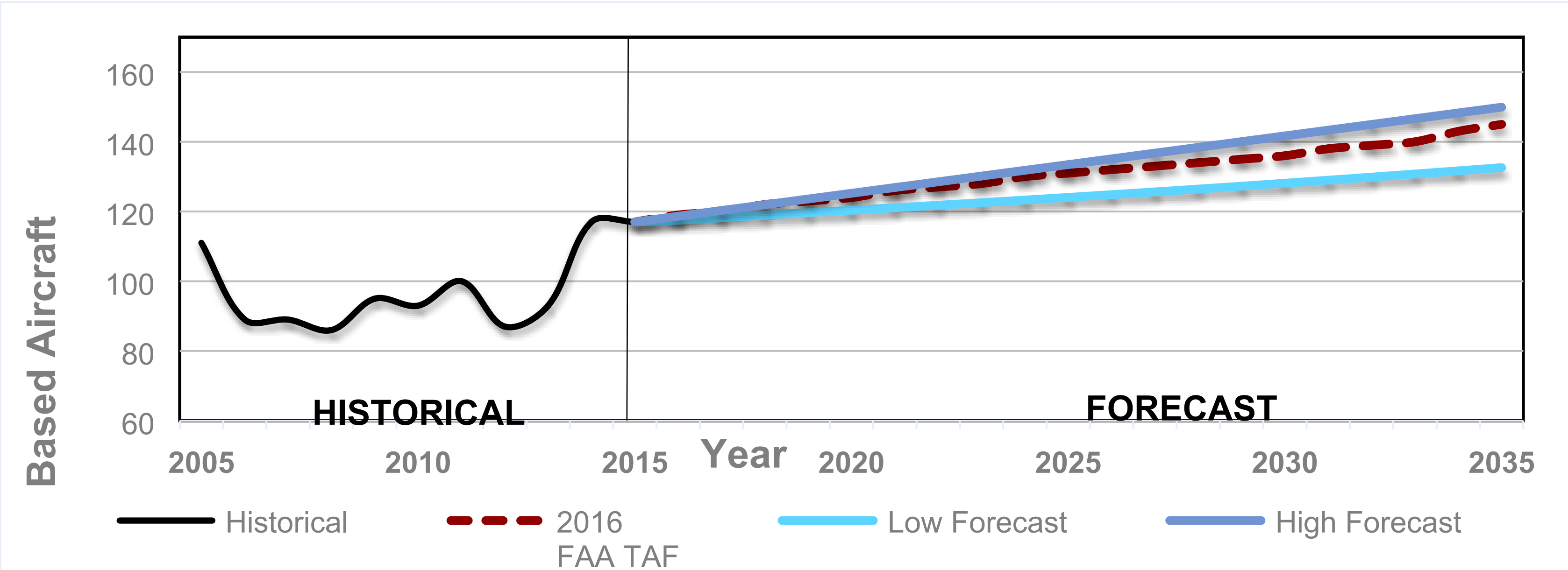
The high forecast is intended to account for the oil exploration boom period’s impact on based aircraft at the airport. The high forecast of based aircraft was developed by projecting a trend line using the total number of based aircraft at Bismarck Airport for each of the last 11 years, which is believed to represent a full cycle of the boom. The high forecast projects 150 based aircraft by 2035.

The low forecast focuses on growth in based aircraft outside of boom years. The low forecast was created by separately projecting growth rates for six categories of aircraft using forecast rates taken from the Aerospace Forecast. These growth rates show strong growth by jet, turbo prop, and helicopter aircraft, and a slow decline by single- and multi-engine piston aircraft. The low forecast projects 133 based aircraft by 2035. The high and low forecasts are presented in **Exhibit 2-5** and **Table 2-10**.



Note: Total includes civilian and military

Exhibit 2-5 Historical and Forecast Based Aircraft



Year	FAA TAF (2016)	Master Plan Low - Preferred	Master Plan High- Rejected
2015	117	117	117
2020	124	120	125
2025	131	124	133
2030	136	128	142
2035	145	133	150
CAGR	**1.08%**	**0.64%**	**1.25%**

Table 2-10 Mix of Based Aircraft Types Historical and Forecast			
Aircraft Type	**2015**	**2035 Forecast**	
		Low	**High**
Total (Civilian + Military)	**117**	**133**	**150**
CAGR	**--**	**0.63%**	**1.25%**
Civilian			
Total Civilian	**100**	**116**	**133**
Single-Engine Piston	63	70	75
Twin-Engine Piston	15	13	15
Single-Engine Turboprop	2	3	3
Twin-Engine Turboprop	7	9	12
Jet - Small Cabin	8	14	17
Jet - Medium/Large Cabin	2	3	4
Helicopter	3	4	6
CAGR	**--**	**0.73%**	**1.43%**
Military - North Dakota Army National Guard			
Total Military	**17**	**17**	**17**
Helicopter	16	16	16
Fixed-Wing	1	1	1

Source: Mead & Hunt, 2016

Fleet Mix

As is shown in Table 2-10, both Master Plan forecasts anticipate a shift in the percentages of aircraft types during the 20-year forecast period. This reflects national trends contained in the Aerospace Forecast which project a reduction in the total number of single-engine piston aircraft and an increase in the number of turboprop and jet aircraft.

Preferred Based Aircraft Forecast

The Low Forecast of based aircraft has been selected as the preferred forecast. While it is possible that a new oil exploration boom would trigger a return in the rapid growth in based aircraft, the timing of this resurgence is not possible to predict. Therefore, the High Forecast has not been selected.

Comparison with the 2015 Terminal Area Forecast

As noted at the beginning of this Chapter, Master Plan forecasts must be evaluated for consistency with the current TAF. Forecasts are considered consistent with the TAF if the five-year forecast is within 10 percent of the TAF and 10-year forecasts are within 15 percent of the TAF. As shown in **Table 2-11**, the preferred based aircraft forecast is below, but consistent with the 2015 TAF. The reason for the large gap between the TAF and the Preferred Forecast is because the Master Plan Forecast is considering the slowing of the oil exploration boom while the TAF was prepared when the boom was still occurring. The Preferred Forecast uses more recent local input information than the TAF.

Table 2-11 Comparison of Based Aircraft Forecasts

Year	2015 TAF	Preferred Forecast	% Difference
2020	124	120	-3.2%
2025	131	124	-5.3%

Source: Mead & Hunt, 2016

2.7 AIRCRAFT OPERATIONS

The forecast of operations will be used to determine whether the airfield will need capacity improvements during the next 20 years to accommodate expected demand.

2.7.1 Historical Pattern

Bismarck Airport supports the full range of aviation uses including:

- Scheduled passenger service with airline aircraft as large as the Airbus A320.

- The entire spectrum of general aviation aircraft from single-engine piston aircraft to corporate jets.
- Air cargo and air mail operations.
- A military air base with both helicopters and a fixed-wing turboprop.

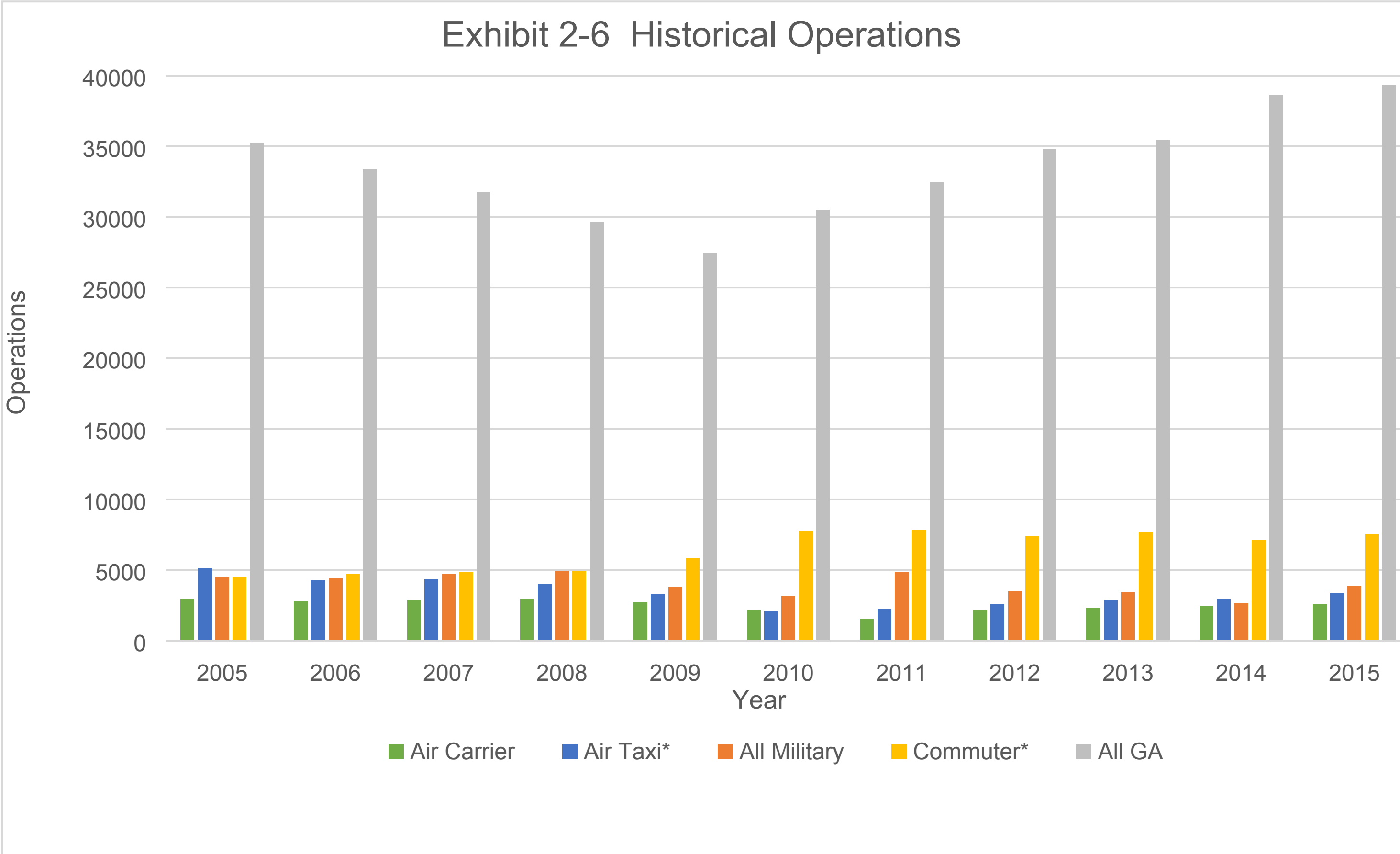
The North Dakota Air National Guard unit based at Bismarck Airport is responsible for the training, operations, and maintenance of the helicopter and fixed-wing aircraft assigned to this location. Its official mission is "to conduct aviation operations by providing Command and Control, Air Movement and Air Assault Operations and Reconnaissance Support Operations to designated military or civilian authorities in support of state or local agencies or the Department of Defense or The Department of Homeland Security."[2] Additionally, four Army medevac helicopters based in Fargo, North Dakota use Bismarck Airport monthly. Total military operations have averaged 3,267 annually over the last 3 years (2013-2015). The base commander indicated that annual operations are expected to remain consistent for the foreseeable future.

Given the many changes that have occurred in aviation since 1990, there is surprising consistency in the number of annual operations at Bismarck Airport. In broad terms, the pattern in the operations at Bismarck Airport can be summarized as follows:

- During the 1990s, total operations averaged 60,000 annually.
- Near the end of the 1990's the volume of operations averaged 55,000 annually and remained at this level through the mid-2000s.
- As the effects of the recession were felt in 2009, operations declined to 45,000 annually.
- Starting in 2010 operations rose to approximately 55,000 annually.

[2] Taken from an e-mail from Lieutenant Colonel Paul R. Helten, Army Aviation Support Facility Commander to Barton Gover, Mead & Hunt, dated January 11, 2016.

This page is intentionally blank.

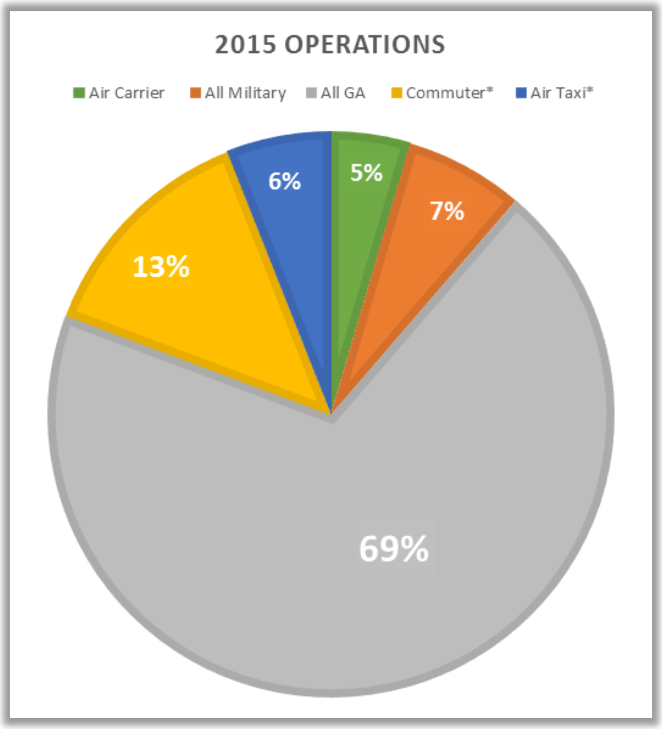


Source: Bismarck Air Traffic Control staff. *Air taxi and commuter airlines are combined in most FAA data sources. They are separated here to show changes to both forms of scheduled passenger service, air carrier and commuter.

This page is intentionally blank.

Exhibit 2-6 illustrates how the operations of various classes of aircraft have varied over the last 11 years. **Exhibit 2-7** shows the mix of operations for 2015 in more detail.

Exhibit 2-7



Source: Bismarck Air Traffic Control staff

2.7.2 Forecasts

Forecasts for total operations are a composite of individual forecasts by operation type. Operations types individually forecasted include scheduled passenger airlines, general aviation aircraft, and military aircraft. General aviation operations forecasts include air taxi and scheduled aircraft cargo operations that are not part of the scheduled airline forecasts. The results are then totaled to produce a forecast of annual operations.

Operations are classified as either itinerant, meaning they originate and depart from different airports; or local, meaning that the flight remains near the airport. Local operations are normally only conducted by general aviation and military aircraft for purposes of flight training and recreation.

Scheduled Passenger Airlines

The forecast of operations by scheduled airliners was derived from the forecast of passenger enplanements presented in Section 2.5.2 of this Chapter. The forecasted compounded average annual growth rate of 2.7 percent (shown in Table 2-3) was based upon the trend of historical enplanements. Note that the forecast of enplanements includes passengers on air carrier and commuter airlines. This previously forecast annual enplanements was divided by projected average seats per departure and then average passenger loads to calculate the number of annual operations.

Historical average seats per departure and load factors were calculated using data from the U.S. Department of Transportation's T100 data base. The results for the most recent six years (2010-2015) are shown in **Table 2-12**. Methodologies for forecasting average seats per departure and load factors are discussed in the paragraphs that follow.

There are several distinct groups of aircraft types currently serving Bismarck Airport. The airport's average seats per departure will be shaped by changes in the mix of aircraft types over time. **Table 2-13** shows that there are currently five aircraft with 50 seats, one with 65 seats, and four aircraft having more than 100+ seats serving Bismarck Airport. Current airline industry trends suggest that within 10 years most of the aircraft of this size will be replaced by aircraft with 70 to 76 seats.

Table 2-12 Scheduled Commercial Operations Forecast							
	Year	Scheduled Pass. Enplanements	Scheduled Airline Departures	Avg. Enplaned Pass. Per Departure	Avg. Aircraft Seats per Departure	Scheduled Airline Operations	Avg. Load Factor
Historical	2010	194,043	4,358	44.5	65.7	8,716	71.7%
	2011	196,414	4,031	48.7	63.6	8,062	78.7%
	2012	236,172	4,294	55.0	67.1	8,588	83.5%
	2013	237,683	4,283	55.5	68.8	8,566	81.7%
	2014	245,205	4,239	57.8	70.1	8,478	83.9%
	2015	259,734	4,639	56.0	70.0	9,278	80.2%
	CAGR	***6.0%***	***1.3%***	***4.7%***	***1.3%***	***1.3%***	***2.3%***
Forecast	2016	260,134	4,569	56.9	71.0	9,139	80.2%
	2017	269,177	4,679	57.5	71.7	9,358	80.2%
	2018	278,221	4,786	58.1	72.4	9,572	80.2%
	2019	287,264	4,891	58.7	73.2	9,783	80.2%
	2020	296,308	4,944	59.9	74.7	9,889	80.2%
	2021	305,351	5,054	60.4	75.3	10,108	80.2%
	2022	314,395	5,162	60.9	75.9	10,325	80.2%
	2023	323,438	5,269	61.4	76.5	10,537	80.2%
	2024	332,482	5,373	61.9	77.1	10,747	80.2%
	2025	341,525	5,476	62.4	77.7	10,953	80.2%
	2026	350,569	5,576	62.9	78.4	11,152	80.2%
	2027	359,612	5,674	63.4	79.0	11,348	80.2%
	2028	368,656	5,771	63.9	79.6	11,541	80.2%
	2029	377,700	5,866	64.4	80.3	11,731	80.2%
	2030	386,743	5,959	64.9	80.9	11,918	80.2%
	2031	395,787	6,049	65.4	81.5	12,099	80.2%
	2032	404,830	6,138	66.0	82.2	12,276	80.2%
	2033	413,874	6,225	66.5	82.9	12,451	80.2%
	2034	422,917	6,311	67.0	83.5	12,623	80.2%
	2035	431,961	6,396	67.5	84.2	12,792	80.2%
	CAGR	***1.9%***	***1.3%***	***0.6%***	***0.6%***	***1.3%***	***0.0%***

Note: National "average seats/departure" were approximated by using "average seats/passenger mile"

Sources: Bismarck Airport Historical seat data - U.S. Department of Transportation T100 database.

Bismarck Airport Enplanement Projections - Mead & Hunt, 2016

Table 2-13 Scheduled Airline Seats Per Departure				
Airline	**Aircraft Type**	**Departures/Week**	**Seats**	**Seats/Departure**
American	ERJ-145	7	350	50
Delta	CRJ	18	900	50
Delta	CRJ-700	9	585	65
Delta	MD-88	4	596	149
Allegiant	A319	3	468	156
Allegiant	MD-80	5	830	166
Allegiant	A320	2	354	177
United	CRJ-200	17	850	50
United	ERJ-145	8	400	50
Frontier	A319	3	468	156
	TOTAL	**83**	**6151**	
			Average Seats per Departure	**74**

Note: Data is for the week of February 4, 2016, except for data for Frontier. Frontier only provides service seasonally, so its data is from September 2015.

There is expected to be smaller incremental growth in average seats per departure for the larger aircraft serving the airport (e.g., MD-88 and Airbus A320). This is largely due to the expected retention of the Airbus A319 and A320, and MD-80 series aircraft continuing to serve Bismarck Airport through at least the next 10 years. The small number of larger aircraft which occasionally serve the airport as charters, such as the Boeing 757, is expected to increase which will incrementally raise the average seats per departure.

For the purposes of this forecast it has been assumed that the growth in seats per departure will continue at the current rate (1.3 percent/year) through 2020. In subsequent years the growth in seats per departure will follow the FAA's projected national trend for regional airlines (0.8 percent annually). This would result in average seats per departure at Bismarck Airport of:

- 74.7 in 2020
- 77.7 in 2025
- 80.9 in 2030
- 84.2 in 2035

Over the last six years (2010-2015) average load factors at Bismarck Airport have increased from the 70% range early in this period to the 80% range in recent years. This has also been the national trend for both regional and mainline carriers (see Table 2-12). For forecasting purposes, it has been assumed that the 2015 load factor (80.2 percent) will continue through 2035. Applying this load factor to the average number of departure seats yields an estimate of the average passengers per departure. Dividing this figure into the previously presented enplanement figures provides a forecast of the number of departures. This number is then doubled to reflect both departure and arrival operations. The resulting operations by scheduled airlines would be:

- 9,889 in 2020
- 10,953 in 2025
- 11,918 in 2030
- 12,792 in 2035

This information is also shown in **Table 2-14**.

General Aviation

As with other forecasts, the forecast of the general aviation component of total operations began with an evaluation of potential correlations between historical itinerant and local operations at Bismarck Airport with the sixty-four aviation and econometric factors mentioned previously in the chapter. Historical itinerant operations at Bismarck Airport had significant correlations with based aircraft (r = 0.79) and national ATP pilots (r = 79). However, there were not comparable strong correlations for local operations. The best correlation for local operations was national student pilots, but its correlation (r = 0.64) was below the threshold of 0.70 previously established. Because there were not significant correlations for both of the two components of general aviation operations, preparing separate forecasts of each was not possible.

As an alternative to regression analysis, a trend line was calculated using total annual general aviation operations at Bismarck Airport from 2005-2015. This method produced forecasts of:

2020	45,381	**2030**	48,153
2025	46,767	**2035**	49,539

This data is also presented in Table 2-14.

FAA forecasts are required to include projections of commercial operations. Commercial operations include both scheduled passenger service and on-demand air taxi operations. Air taxi operations (not including scheduled commuter flights) were estimated to average 6.6 percent in the years 2010-2014. In forecasting commercial operations it will be assumed that 6.6 percent of forecast general aviation operations will be by air taxi.

Military

In the years 2011-2015 military operations have averaged 3,267 operations per year. The commanding officer of the Army National Guard base at Bismarck Airport indicated that the volume of operations would remain about the same as current levels for the foreseeable future. Therefore, annual military aircraft operations will be assumed to remain at 3,267 in this forecast.

Operations Forecast

Combining the Master Plan forecast for airline, general aviation and military operations yields:

2020	58,537	**2030**	63,338
2025	60,987	**2035**	65,598

This data is also presented in Table 2-14 and **Exhibit 2-8**.

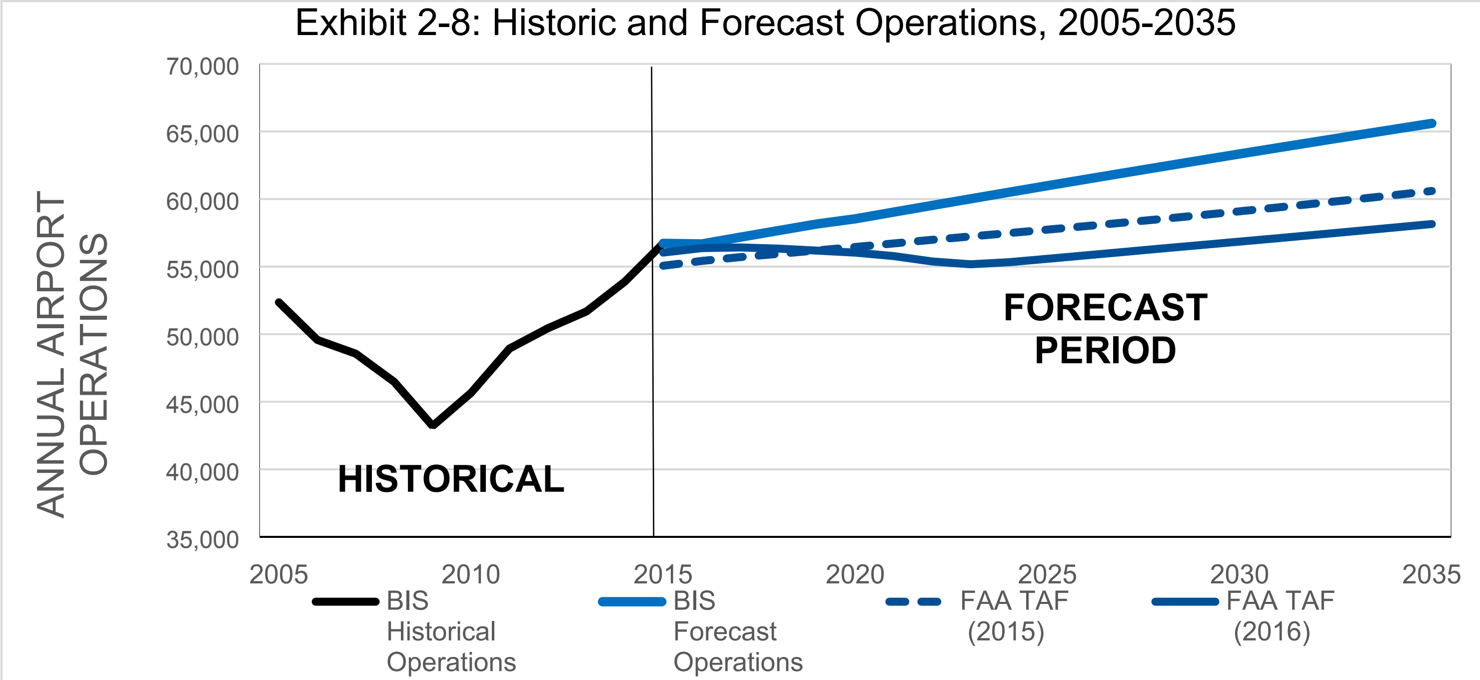
Table 2-14 Operations Forecasts				
Year	**General Aviation**	**Military**	**Airline**	**Total**
2020	45,381	3,267	9,889	58,537
2025	46,767	3,267	10,953	60,987
2030	48,153	3,267	11,918	63,338
2035	49,539	3,267	12,792	65,598

Source: Mead & Hunt, 2016

Comparison with the 2015 Terminal Area Forecast

The table that is part of Exhibit 2-8 presents the calculated percentage difference between the preferred forecast and the 2015 Terminal Area Forecast. The preferred forecast falls within the limits to be considered consistent with the Terminal Area Forecast.

This page is intentionally blank.



Year	Bismarck Airport Total Operations Forecast	2014 TAF Forecast	% Difference 2014 TAF	2015 TAF Forecast	% Difference
2015	56,721	55,064	3.0%	56,037	1.2%
2020	58,537	56,452	3.7%	56,033	4.5%
2025	60,987	57,736	5.6%	55,577	9.7%
2030	63,338	59,092	7.2%	56,849	11.4%
2035	65,598	60,597	8.3%	58,149	12.8%
CAGR	**0.73%**	**0.48%**	**--**	**0.19%**	**--**

Source: 2015 Terminal Area Forecasts, Aviation Forecasts complied by Mead & Hunt

This page is intentionally blank.

Itinerant and Local Operations

Table 2-15 Forecast of Percentages of Local and Itinerant Operations		
Year	**Local**	**Itinerant**
2020	27.4%	72.6%
2025	28.0%	72.0%
2030	27.8%	72.2%
2035	27.5%	72.5%

Nationally, local operations at towered airports as a percentage of total operations have ranged around 28 percent for the last five years, remaining within 1 percent of that level. At Bismarck Airport, local operations averaged 28 percent of total operations over the past five years, but this percentage has shown up to 2.3 percent year-to-year variation. The Aerospace Forecast projects that nationally local operations will decline to 25.6 percent of total operations. This percentage is similar to the level reached at Bismarck Airport (25.4 percent) during the beginning of the recent recession in 2008. The 2015 TAF for Bismarck Airport projects a gradual climb to 28.0 percent by 2023 and then a slow decline to 27.5 percent in 2035. Historically local operations at Bismarck Airport have remained higher than national averages. The 2015 TAF projections remain in the range historically experienced at Bismarck Airport. Therefore, the TAF projections of the local percentages of operations are proposed to be used as the preferred forecast. The forecast local and itinerant percentages are shown in **Table 2-15**.

Peak Operations Forecasts

Peak month operations are forecast based upon historical peak levels at Bismarck Airport. Over the last five years (2011-2015) the peak month has varied from 10.0 percent to 10.8 percent of total annual operations. The average of this time period is 10.4 percent. The peak month occurs during the summer but has varied from May to July. The peak day is calculated by dividing the peak month by the number of days in the peak month. The average peak day over the past five years (2011-2015) was 0.34 percent of annual operations. For forecasting purposes, it is assumed that the average day will continue to be 0.34 percent of annual operations. Applying this percentage to the previously presented operations forecast yields the operations on the average day peak month shown in **Table 2-16**. The number of operations in the peak hour was estimated at 12.0 percent based upon a common industry average for airports with greater than 40,000 annual operations. If it is assumed that this percentage will remain constant during the 20-year forecast period, peak hour operations will increase from 22 in 2015 to 28 in 2035. Intermediate forecasts are shown in **Table 2-17**.

Table 2-16 Historical Operations Peak Month

Year	Peak Month	Peak Month % of Annual Operations	Average Day % of Peak Month
2011	June	10.3	0.34
2012	July	10.8	0.35
2013	July	10.4	0.34
2014	May	10.3	0.33
2015	July	10.0	0.32
	Average %	**10.4**	**0.34**

Source: Bismarck Airport records

Table 2-17 Forecast PMAD Peak Hour Operations

Year	Bismarck Airport Operations Forecast	Peak Month %	Peak Month Operations	PMAD Operations	Peak Hour %	Peak Hour Operations
2020	58,537	10.4%	6,088	207	12%	25
2025	60,987	10.4%	6,343	216	12%	26
2030	63,338	10.4%	6,587	224	12%	27
2035	65,598	10.4%	6,822	232	12%	28

PMAD = Peak Month Average Day

Source: Mead & Hunt, 2016

IFR Operations Forecasts

As can be seen in **Table 2-18**, IFR operations have averaged about 45 percent of total operations at Bismarck Airport for the last five years (2011-2015). No factors have been identified that would cause this historical percentage to change. Therefore, future IFR operations are forecast to remain at the average of the most recent five-year period: 45.4 percent. When this percentage is applied to the previously presented operations forecasts, the resulting forecast of IFR and VFR operations is as shown in **Table 2-19**.

Table 2-18 Historical IFR/VFR Operations		
Year	**IFR %**	**VFR %**
2011	43.1%	56.9%
2012	45.8%	54.2%
2013	47.5%	52.5%
2014	45.9%	54.1%
2015	44.9%	55.1%
Average	**45.4%**	**54.6%**

Source: FAA OPSNET

Table 2-19 Forecast IFR/VFR Operations				
Year	**% IFR**	**IFR Operations**	**% VFR**	**VFR Operations**
2020	45.4%	26,576	54.6%	31,961
2025	45.4%	27,688	54.6%	33,299
2030	45.4%	28,756	54.6%	34,583
2035	45.4%	29,781	54.6%	35,817

Source: Mead & Hunt, 2016

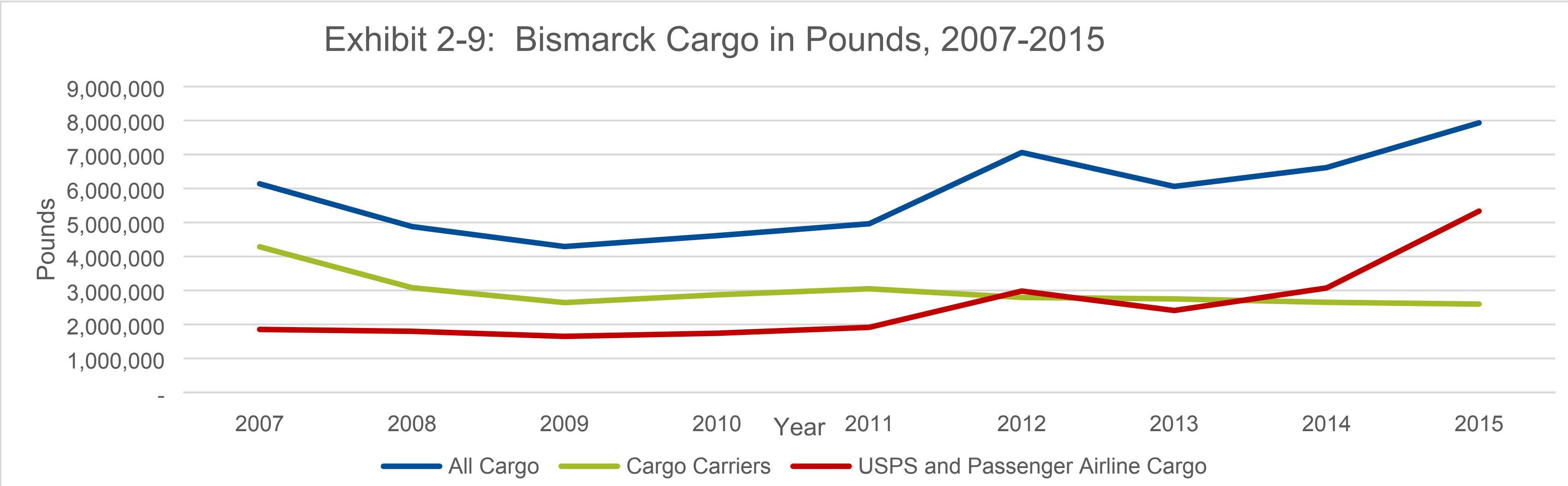
2.8 AIR CARGO

Air cargo activity at Bismarck Airport includes express package, U.S. mail, and general cargo. The forecast of air cargo volumes will be used to evaluate whether additional facilities are required to support these operations in the future.

2.8.1 Recent Trends

Detailed data on air cargo volumes is available from 2007-2015. The data includes inbound and outbound cargo volumes by carrier by month for the entire eight-year period. **Exhibit 2-9** presents the annual cargo volumes for packages (including on-demand freight), mail, and annual totals. As can be seen in the graph, package volumes have been slowly declining since 2007. For some cargo carriers the decline started in 2012, while others continued to increase until 2014. Mail volumes have been increasing since 2011. Examining the monthly data shows that the rate of increase in mail volumes peaked in August 2015. Each month thereafter, the rate of increase slowed. In December 2015, there was a decrease of over 15 percent compared to the same month in 2014. These trends differ from the national trends discussed in Section 2.2.4.

The air freight carriers were interviewed in an effort to determine the source of the increases and decreases in cargo volumes. The mail carrier indicated that most of the recent increases in mail volumes were due to the recent energy boom. Package carriers indicated that some of the year-to-year changes were due to fluctuations in the energy sector. However, major on-line retailer policies such as free shipping were also cited as source of increases. The effect of on-line shipping was not sufficient to counteract the decline associated with the ending of the present oil boom but did delay the point at which volumes for individual cargo carriers began experiencing a decline.



* Note: Because only a small fraction (0.4%) of all cargo passing through Bismarck Airport is carried on scheduled passenger aircraft, data for this category has been combined with U.S. Mail volumes.

Historical Air Cargo Volumes (Millions of Pounds)			
Year	**Air Cargo**	**USPS**	**Total**
2007	4.3	1.9	6.1
2008	3.1	1.8	4.9
2009	2.6	1.6	4.3
2010	2.9	1.7	4.6
2011	3.0	1.9	5.0
2012	2.8	3.0	7.1
2013	2.8	2.4	6.1
2014	2.7	3.1	6.6
2015	2.6	5.3	7.9

Source: Bismarck Airport Records

This page is intentionally blank.

2.8.2 Air Cargo Forecasts

The general conclusion drawn from the historical data is that there would be only modest growth in air cargo volumes at Bismarck Airport without the effect of an energy boom in the state. Therefore, in forecasting cargo volumes, separate forecasts with and without the resumption of the energy boom were prepared.

Baseline Cargo Forecast

The Aerospace Forecast ties its forecast of domestic cargo volumes to changes in the U.S. gross domestic product. That document anticipates that national domestic cargo volumes will increase an average of 0.5 percent annually through 2035. This growth rate will be used as the base growth rate for air cargo at Bismarck Airport, that is, growth without the effect of an oil boom. Applying this growth rate to the 2015 total yields:

- 8.1 million pounds in 2020
- 8.3 million pounds in 2025
- 8.5 million pounds in 2030
- 8.7 million pounds in 2035

Energy Boom Cargo Forecast

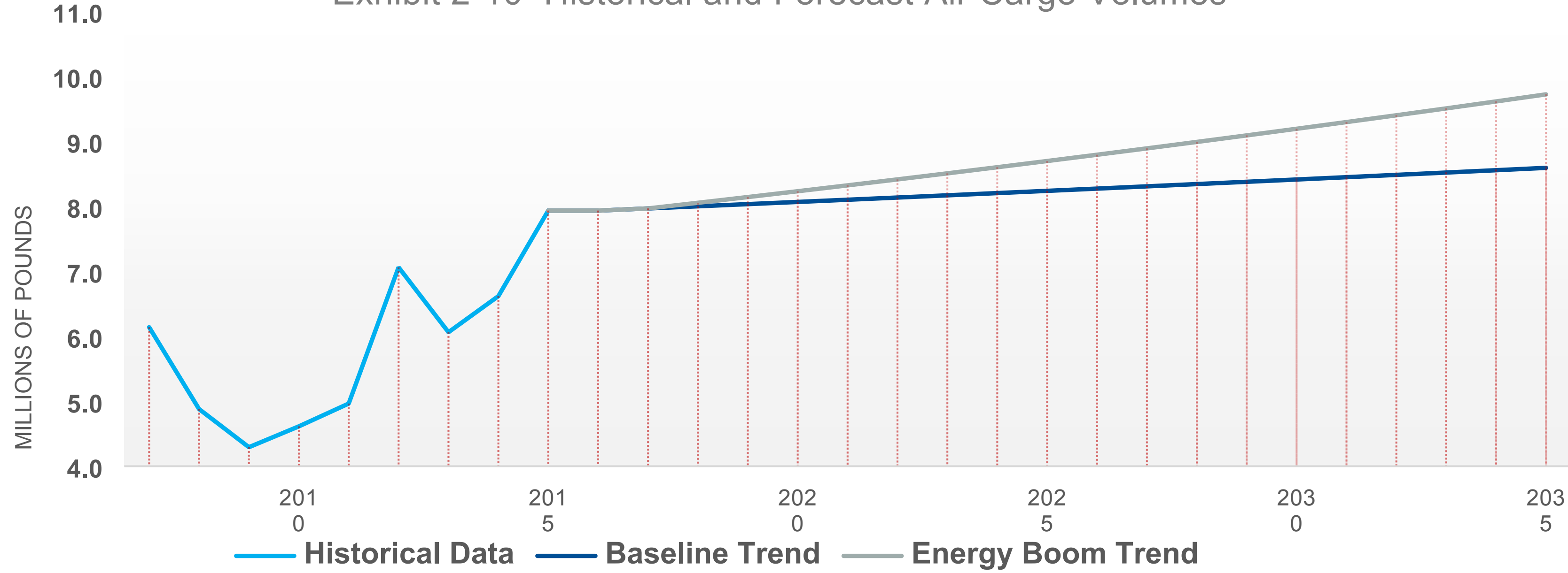
The long-term effect of a return of an oil boom was estimated by calculating the average annual growth rate at Bismarck Airport from 2009-2015. This growth rate (1.1 percent) is lower than the national average (1.4 percent) for domestic cargo during 2009-2014 (2015 national data was not available). This growth rate has been used for the forecast under the scenario which includes a return of the oil boom.

- 8.3 million pounds in 2020
- 8.8 million pounds in 2025
- 9.2 million pounds in 2030
- 9.8 million pounds in 2035

The effect of the ending of the recent oil boom is reflected in all forecasts. In the cargo forecasts it is assumed that the total cargo volume at Bismarck Airport will decrease in 2016 to the level that occurred in 2014 (i.e., about 6.9 million pounds). Under the baseline scenario, cargo volumes will begin growing at the national rate (0.5 percent annually) in 2017. Under the oil boom scenario, it assumed that the resurgence of the oil boom will begin in 2018. Exhibit 2-10 presents historical and forecast cargo volumes. Under the baseline scenario, about 8.7 million pounds of cargo will be shipped in 2035. Under the oil boom scenario this number would rise to 9.8 million pounds of cargo. Given the uncertainty of the return of an oil boom, the baseline forecast is the preferred forecast.

It is appropriate to note that Bismarck Airport has historically had a strong difference between inbound and outbound air cargo volumes. The Bismarck area is not a center for exporting of smaller, high-value items that would likely be shipped via air. Therefore, the historical pattern is heavily weighted towards inbound cargo. During strong periods of boom the percentage of inbound cargo averages around 75 percent. The percentage of inbound cargo decreases to around 70 percent during non-boom periods. It is anticipated that these ratios will continue through the forecasting period.

Exhibit 2-10 Historical and Forecast Air Cargo Volumes



Historical Air Cargo Volumes (Millions of Pounds)			
Year	**Air Cargo**	**USPS**	**Total**
2007	4.3	1.9	6.1
2008	3.1	1.8	4.9
2009	2.6	1.6	4.3
2010	2.9	1.7	4.6
2011	3.0	1.9	5.0
2012	2.8	3.0	7.1
2013	2.8	2.4	6.1
2014	2.7	3.1	6.6
2015	2.6	5.3	7.9

Source: Bismarck Airport Records

Year	Baseline Trend-Preferred	Energy Boom Trend-Rejected
2020	8.1	8.3
2025	8.3	8.8
2030	8.5	9.2
2035	8.7	9.8
CAGR	0.5%	1.1%

Source: Mead & Hunt, 2016

This page is intentionally blank.

2.9 Peak Passenger Activity

Some elements of terminal planning are based upon peak passenger activity. To support these analyses, the peak monthly, daily, and hourly activity levels for passengers for the most recent five calendar years (2011-2015) are first calculated. This data is then used to project these activity levels for the 20-year planning period.

2.9.1 Peak Month Passenger Activity Forecasts

Monthly passenger enplanement data for the period 2011-2015 is presented in **Table 2-20**. The average percentage of passengers in the peak month was 9.8 percent of total annual enplanements. In 4 of the 5 years, the peak month was December. In forecasting peak passenger activity, it will be assumed that December will continue to be the peak month and that enplanements for this month will remain at 9.8 percent of the annual total. Applying this percentage to the preferred annual enplanement forecast yields a peak month enplanement forecast. **Table 2-21** resents the complete forecast of peak monthly enplanements.

Table 2-20 Historical Monthly Enplanements

Month	2011	2012	2013	2014	2015
January	14,551	16,221	19,009	19,445	21,239
February	15,130	17,039	20,025	19,115	20,289
March	16,204	19,112	22,162	20,378	21,200
April	14,417	16,491	17,635	16,784	18,985
May	15,339	19,854	21,744	19,880	20,460
June	16,055	21,140	19,991	19,962	21,478
July	18,318	22,253	20,038	21,688	23,652
August	16,156	21,477	18,986	19,953	21,763
September	16,147	19,525	17,806	17,088	20,234
October	18,001	21,424	19,707	23,491	24,177
November	16,745	19,979	18,088	21,924	21178
December	19,351	21,657	22,492	25,497	25,079
Total Enplanements	196,414	236,172	237,683	245,205	259,734
Maximum Enplanements	19,351	22,253	22,492	25,497	25,079
Peak Month %	9.9%	9.4%	9.5%	10.4%	9.7%
Average % of Enplanements in Peak Month			9.8%		

Source: Bismarck Airport Records, Mead & Hunt, 2016

Table 2-21 Projected Peak Month Enplanements (Scheduled Carriers)			
Year	**Projected Annual Enplanements**	**Peak Month %**	**Peak Month Enplanements**
2020	296,308	9.8%	29,038
2025	341,525	9.8%	33,469
2020	386,743	9.8%	37,901
2035	431,961	9.8%	42,332

Source: Mead & Hunt,2016

2.9.2 Peak Month Average Day Passenger Activity Forecasts

Daily peak activity figures are based on a regularly occurring level of daily activity during the peak, or busiest, month. A review of airline activity schedules for the peak month of December 2015 indicates that activity regularly peaks on Sundays. Sunday typically has 15 departures and 15 arrivals and accounts for about 17.4 percent and 17.6 percent of weekly departing and arriving seats, respectively (Table 2-22). 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 Sunday to determine the average daily number of total passengers that are enplaned and deplaned in the peak month.

Table 2-22 Peak Month Average Day Passenger Projections						
Seats per Day (Scheduled Carriers)						
Day of the Week	Departures			Arrivals		
	Departures	Departing Seats	Percentage of Weekly Dep Seats	Arrivals	Arriving Seats	Percentage of Weekly Arrival Seats
Mon	13	911	13.3%	13	933	13.6%
Tue	13	929	13.6%	13	924	13.5%
Wed	14	1,025	15.0%	14	1,035	15.1%
Thu	14	1,116	16.3%	13	1,128	16.5%
Fri	11	780	11.4%	12	777	11.3%
Sat	12	897	13.1%	12	850	12.4%
Sun	15	1,191	17.4%	15	1,210	17.6%
Total	91	6,847		91	6,856	

Average Day Passengers (Scheduled Carriers)								
Year	Peak Month Enpl/Depl	Weeks in Peak Month	Avg Week Enpl/Depl	Percent of Weekly Activity on a Typical Sunday		Average Day Passengers		
				Enplaning	Deplaning	Enpl	Depl	Total Pass.
2015	25,079	4.4	5,679	13.1%	12.4%	744	704	1,447
2020	29,038	4.4	6,575	13.1%	12.4%	861	815	1,676
2025	33,469	4.4	7,578	13.1%	12.4%	993	939	1,932
2030	37,901	4.4	8,582	13.1%	12.4%	1,124	1,063	2,188
2035	42,332	4.4	9,585	13.1%	12.4%	1,256	1,188	2,443

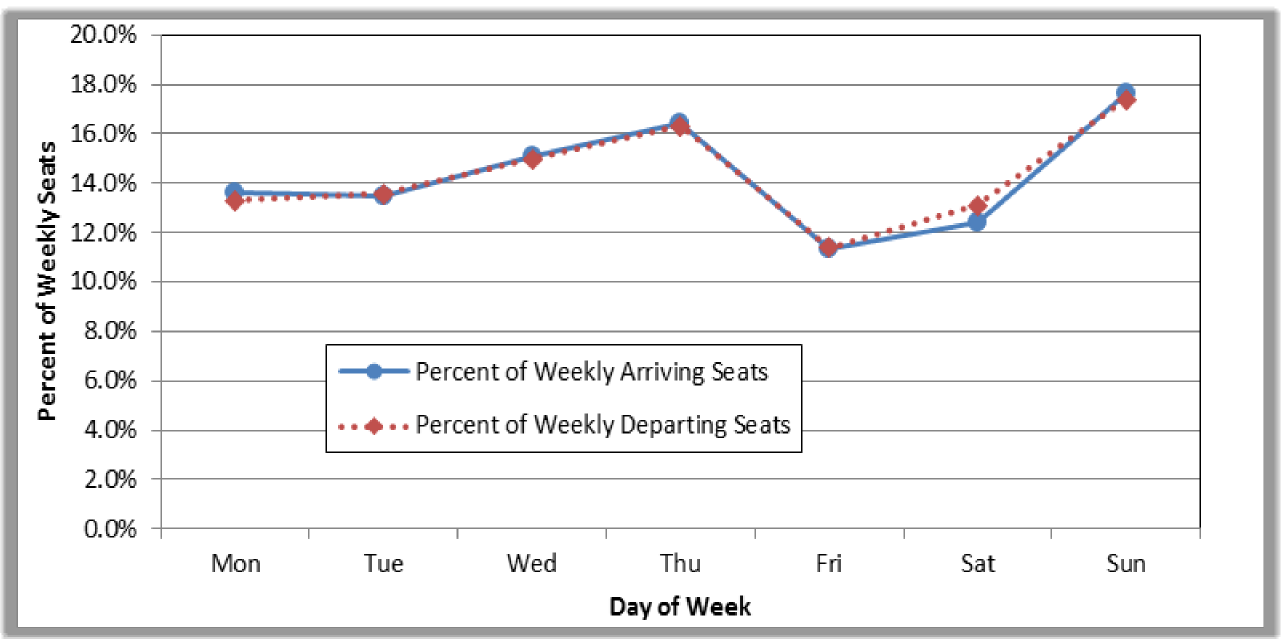


Table 2-23 Peak Hour Passenger Projections

2.9.3 Peak Hour Passenger Forecast

The number of hourly arriving and departing seats during a typical Sunday in the peak month (December) is shown in **Table 2-23**. Peak hour departing seats currently (December 2015) occur between 16:28 to 16:35 (4:28 p.m. to 4:35 p.m.). Peak hour arriving seats occur between 16:44 to 16:54 (4:44 p.m. and 4:54 p.m.). The peak total arriving and departing seats occurs between 16:44 to 16:54 (4:44 p.m. and 4:54 p.m.).

Peak hour passenger volumes through 2035 were calculated by applying the current (December 2015) peak hour percentages (described above) to the annual passenger volumes previously projected. These projected peak hour passenger volumes are presented in **Table 2-24**.

2.10 Design Aircraft

Plans for airport facilities must conform to FAA design standards. Design standards accommodate the physical and operational characteristics of the most demanding 'design aircraft'. In some cases, the design aircraft will actually be a composite of the characteristics of the most demanding aircraft. For airfield planning purposes the design aircraft is classified by three parameters:

- Aircraft Approach Category
- Airplane Design Group
- Taxiway Design Group

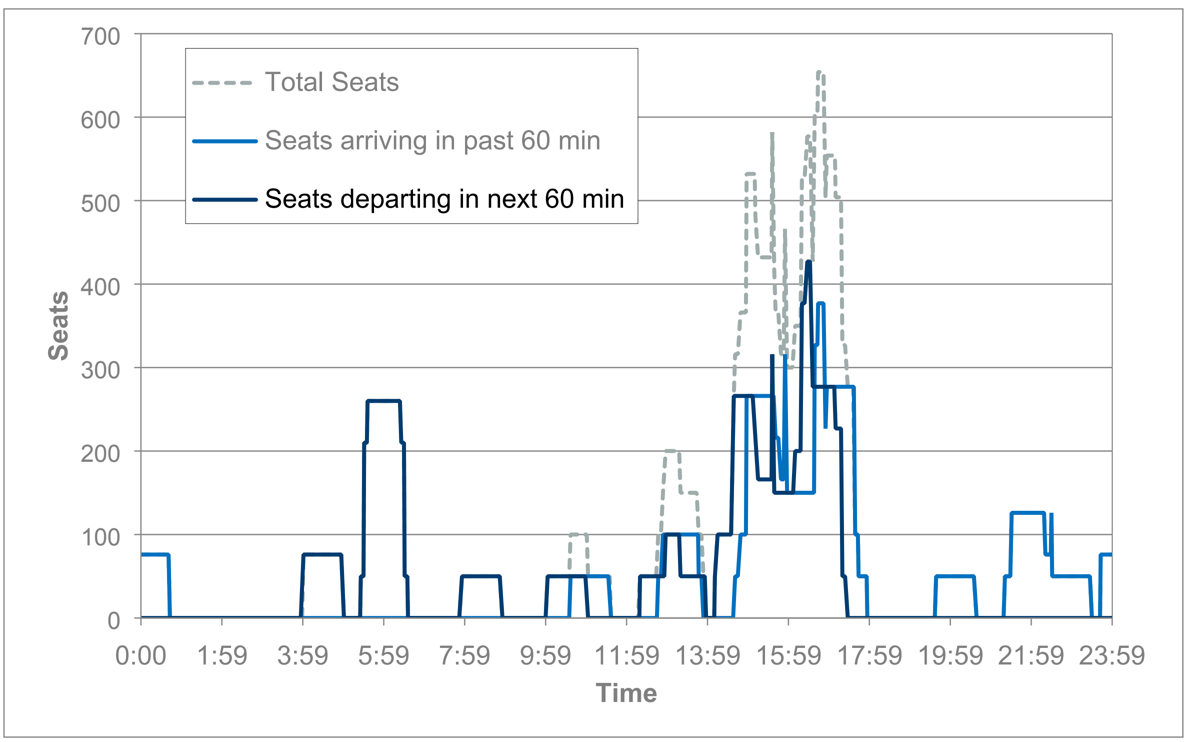
The Aircraft Approach Category (AAC) relates to aircraft approach speed and is classified by a letter (from A – E). The Airplane Design Group (ADG) component, depicted by a Roman numeral (from I – VI), relates to the aircraft's wingspan and tail height. The Taxiway Design Group (TDG) is based upon the undercarriage (i.e., wheel) spacing of the design aircraft.

December 2015 Peak Hour Passengers			
Time of Day	**Number of Seats**	**Total Daily Seats**	**Percent of Day in Peak Hour (PH)**
Enplanements (16:28 to 16:35)	427	1,229	34.7%
Deplanements (16:44 to 16:54)	377	1,145	32.9%
Total Peak Passengers (16:44 to 16:54)	**654**	**2,374**	**27.5%**

Source: Mead & Hunt, 2016

Table 2-24 Projected Peak Hour (Scheduled Carriers)					
Year	**Peak Month**		**Peak Hour Passengers**		
	Average Day Passengers		**Enplanements**	**Deplanements**	**Total Pass.**
	Enplanements	**Deplanements**	***34.7%***	***32.9%***	***27.5%***
2015	744	704	258	232	399
2020	861	815	299	268	462
2025	993	939	345	309	532
2020	1,124	1,063	391	350	603
2035	1,256	1,188	436	391	673

Source: Mead & Hunt, 2016



2.10.1 Critical Aircraft

Runway Length

The Engineering Design Report (EDR) for reconstruction of Runway 13-31 at Bismarck Airport included a detailed analysis of the critical aircraft for runway length. As this report was issued in January 2016 and accepted by the FAA, its analysis has been incorporated into this Master Plan. The EDR concluded that the most demanding aircraft for runway length is a composite of 100 percent of general aviation aircraft with maximum certificated takeoff weights of more than 12,500 pounds up to and including 60,000 pounds. This mix of aircraft have Airport Reference Codes of B-II, C-I, C-II, and D-I. Among this group, the most demanding aircraft that use Bismarck Airport are medium size business jets such as the Hawker 800, Falcon 50, and Learjet 35. The most common medium size business jet was identified based upon data tabulated from Bismarck's Instrument Flight Rule (IFR) operations recorded in the FAA Traffic Flow Management System Counts (TFMSC). Although this IFR tacking data does not include 100 percent of all aircraft operations, it represents an adequate sample for use in future planning. In 2014 and 2015, the Dassualt Falcon 50 had the highest number of TFMSC counts of all medium size business jets operating at Bismarck. As a result, the Dassualt Falcon 50 was selected as the representative medium size corporate aircraft anticipated to operate from Bismarck Airport over the 20-year planning period.

Other Runway Design and Protection Standards

A design aircraft has also been identified for runway design and protection standards. These standards include runway width, runway safety area, object free area, obstacle free zone, and runway protection zone. The critical aircraft for the remaining runway design and protection standards was identified using data tabulated from TFMSC counts for Bismarck Airport. As shown in **Table 2-25**, approximately 11,540 Category C operations, 641 Category D operations and 2,500 Design Group III operations were reported in the 2015 TFMSC. These operations included both commercial and general aviation aircraft traffic. Nearly 80 percent of the Category C aircraft activity is attributable to commercial transport aircraft, and 20 percent to corporate jet activity. Similarly, nearly 95 percent of the Design Group III activity is attributable to commercial transport aircraft, and 5 percent to corporate jet activity.

Table 2-25 Aircraft Characteristics of Documented IFR Operations

IFR Tracked Aircraft Operations (By Functional Category)	Approach Category			Design Group			
	B	C	D	I	II	III	IV
Commercial Transports	0	9,254	606	0	7,348	2,498	14
Commercial Transports (%)	0%	80%	95%	0%	71%	100%	100%
General Aviation	1,110	2,286	35	412	3,013	6	0
General Aviation (%)	100%	20%	5%	100%	29%	0%	0%
Total IFR Tracked Operations	1,110	11,540	641	412	10,361	2,504	14
% IFR to Total Commercial Operations (57,000)	1.9%	20.2%	1.1%	0.7%	18.2%	4.4%	0.0%

Source: 2015 FAA Traffic Flow Management System Counts

Table 2-26 depicts the IFR commercial aircraft operations for years 2012 through 2015. Based on this IFR data, two series of aircraft qualify for critical aircraft selection at Bismarck Airport over the next 20-years. These include:

- Airbus 320 series (A318, A319, A320)
- Boeing MD-80 series (MD-83, MD-88, MD-90)

Both the Airbus 320 and MD-80 series aircraft exceed the FAA's threshold of 500 annual operations required for critical aircraft selection. Additionally, both aircraft types are popular narrow-body, twin-engine transport aircraft that are predominately operated by Allegiant Airlines at Bismarck. The aircraft differ in two important ways. The Airbus 320 series aircraft are categorized as Airport Reference Code C-III, while the MD-80 series is classified as D-III. Additionally, the Airbus 320 series is in TDG-3 while the MD-80 series aircraft are in TDG-4. The primary difference in TDG-3 and TDG-4 is the required width of taxiways. A detailed explanation of TDG is included in Chapter 4.0 Facility Requirements.

Table 2-26 Commercial Aircraft IFR Operations 2012-2015						
Aircraft Type	**Aircraft Model**	**ARC**	**2012**	**2013**	**2014**	**2015**
Narrow-body Transport	B752 - Boeing 757-200	D-IV	0	0	0	14
Narrow-body Transport	A318 - Airbus A318	C-III	0	2	0	0
Narrow-body Transport	A319 - Airbus A319	C-III	230	588	629	777
Narrow-body Transport	A320 - Airbus A320 All Series	C-III	210	230	256	310
Narrow-body Transport	B712 - Boeing 717-200	C-III	0	0	0	59
Narrow-body Transport	B722 - Boeing 727-200	C-III	2	0	0	0
Narrow-body Transport	B732 - Boeing 737-200/VC96	C-III	2	4	2	0
Narrow-body Transport	B734 - Boeing 737-400	C-III	0	2	0	0
Narrow-body Transport	B737 - Boeing 737-700	C-III	0	5	16	16
Narrow-body Transport	B738 - Boeing 737-800	C-III	36	38	20	38
Narrow-body Transport	B739 - Boeing 737-900	C-III	0	0	0	2
Narrow-body Transport	DC93 - Boeing (Douglas) DC 9-30	C-III	4	0	4	0
Narrow-body Transport	MD80 - Boeing (Douglas) MD 80 Series	C-III	1	1	0	0
Narrow-body Transport	MD82 - Boeing (Douglas) MD 82	C-III	9	0	0	0
Narrow-body Transport	MD83 - Boeing (Douglas) MD 83	D-III	561	551	386	385
Narrow-body Transport	MD88 - Boeing (Douglas) MD 88	D-III	141	22	66	109
Narrow-body Transport	MD90 - Boeing (Douglas) MD 90	C-III	17	5	56	98
Large Regional Jet	E170 - Embraer 170	C-III	598	688	221	247
Large Regional Jet	E190 - Embraer 190	C-III	333	60	24	20
Medium Regional Jet	CRJ7 - Bombardier CRJ-700	C-II	6	6	2	259
Medium Regional Jet	CRJ9 - Bombardier CRJ-900	D-II	209	342	974	437
Small Regional Jet	CRJ - Bombardier CRJ All Series	C-II	1	2	2	3
Small Regional Jet	CRJ1 - Bombardier CRJ-100	C-II	4	1	1	4
Small Regional Jet	CRJ2 - Bombardier CRJ-200	C-II	5,217	5,696	5,053	5,308
Small Regional Jet	E135 - Embraer ERJ 135/140/Legacy	C-II	6	130	201	337
Small Regional Jet	E145 - Embraer ERJ-145	C-II	422	14	308	1,425
Small Regional Jet	E45X - Embraer ERJ 145 EX	C-II	792	583	656	10
Small Regional Jet	J328 - Fairchild Dornier 328 Jet	C-II	0	0	2	2
		TOTAL	**8,801**	**8,970**	**8,879**	**9,860**
		Approach Category C	**7,890**	**8,055**	**7,453**	**8,915**
		Approach Category D	**911**	**915**	**1,426**	**945**
		Design Group II	**6,657**	**6,774**	**7,199**	**7,785**
		Design Group III	**2,144**	**2,196**	**1,680**	**2,061**
		Design Group IV	**0**	**0**	**0**	**14**
		Total (MD-80 Series Critical Aircraft)	**712**	**574**	**452**	**494**

Source: 2015 FAA Traffic Flow Management System Counts

It is important to consider potential changes to aircraft fleet mix over the 20-year planning period. For example, most regional airlines have indicated they will begin phasing out or supplementing the use of 50-seat aircraft over the next three to five years. At Bismarck, this trend has already begun as evident in the recent transition from 50-seat jet aircraft to larger new generation ARC C-III aircraft such as the CRJ 1000, EMB 170E2/EMB 190E2, MRJ-300, and Bombardier CS-100 Series aircraft. This pattern is also consistent with nationwide trends, as substantiated by FAA forecasts, in which the narrow-body aircraft fleet is expected to grow at a rate of 1.1 percent annually between 2014 and 2035, while the regional jet aircraft fleet is projected to decline by 1.1 percent annually during the same period. The decline in regional jet aircraft is largely attributable to the phasing out of the 50-seat regional jets.

For the purpose of planning Bismarck's future airside facility needs, the MD-80 series aircraft has been selected as the critical aircraft. The MD-80 series aircraft is expected to continue to serve Bismarck throughout the 20-year forecast period (2015-2035At some point during the 20-year forecast period it is anticipated that Allegiant will slowly begin to retire its earliest models of the MD-80 series. However, given Allegiant's operational history, it is anticipated that Bismarck Airport will continue to receive more than 500 operations by the MD-80 during the forecast period.

Fortunately, the selection of the MD-80 series aircraft as the critical aircraft for Bismarck will not impede the Airport's ability to accommodate the use of the A320 series aircraft in the future. Runway design standards are identical for ADG C-III and D-III; therefore, the applicable FAA design standards will only differ in the selection of the future TDG for the Airport. The applicable taxiway design standards for the MD-80 series aircraft is TDG-4. As a result, the A320 series aircraft, having a less stringent taxiway width requirement (TDG-3), can operate without difficulty on a wider taxiway (TDG-4). The MD-80 series aircraft will be used as the critical aircraft throughout the development of the Bismarck Airport Master Plan.

The selection of the MD-80 series as the critical aircraft results in the use of FAA Design Standards for Airport Reference Code C-III. **Table 2-27** depicts the Airport Reference Code standards for D-III. The combination of the AAC, ADG and the Airport's approach visibility minimums form the determination of the Runway Design Code (RDC). The selection of the RDC results in the use of specific criteria needed to meet FAA design standards for runways and other airfield components. A detailed discussion about FAA design standards is included in Chapter 4.0 Facility Requirements.

Other comparable C-III transport aircraft operating at Bismarck include the Boeing 737 series, Boeing 717, Embraer 170/175, Embraer 190, and CRJ-900. Also, it should be noted that the Airport periodically experiences operations by aircraft larger than Category C and Design Group III. These larger aircraft include the Boeing 747 and Boeing C-17. Operations resulting from these larger aircraft are related to government and military operations that are associated with Bismarck state government activities and the presence of the Army National Guard base located at Bismarck Airport. The main constraint in serving these larger aircraft are the widths of the exit taxiways associated with Runway 13-31. **Table 2-28** compares the taxiway design factors for the selected critical aircraft (MD-80) and the most demanding aircraft anticipated to use the Airport throughout the 20-year planning period. However, it appears it would be prudent and cost-effective to retain wider-than-standard exit taxiways along Runway 13-31 to accommodate ADG-V operations in the future.

Table 2-27 Bismarck Airport Design Aircraft Specifications	
FAA Design Criteria	**FAA Airport Reference Code Specifications**
Primary Runway (Existing and Future)	Runway 13-31
Critical Aircraft Type	MD-80 Series (Narrowbody)
Approach Category	Category D
Design Group	Group III
Approach Speed (Knots)	141 to <166 Knots
Wingspan (feet)	79' to < 118'
Tail Height (feet)	30' to < 45'
Operator	Air Carrier

Source: FAA Advisory Circular 150/5300-13A, Change 1, *Airport Design*

Table 2-28 Taxiway Design Factors				
Factors	**Existing**		**Future**	
	Critical Aircraft	**Most Demanding Aircraft**	**Critical Aircraft**	**Most Demanding Aircraft**
Aircraft Type	MD-80 Series (Narrowbody)	Boeing 757-200 (Widebody)	MD-80 Series (Narrowbody)	Boeing 757-300 (Widebody)
Taxiway Design Group	Group 4	Group 4	Group 4	Group 4
Cockpit to Main Gear	70.5'	72.2'	70.5'	85.3'
Main Gear Width	20.3'	28.2	20.3'	28.2'
Operator	Air Carrier	Government /Military	Air Carrier	Government /Military

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

2.11 SUMMARY

Table 2-29 lists the preferred forecast alternatives that were selected. Note that for some activities, only one alternative was considered. **Table 2-30** contains a summary of the preferred Master Plan activity forecasts. These are all demand forecasts which assume that facilities will be available at Bismarck Airport to accommodate the projected activity level.

Table 2-29: Summary of Preferred Forecast Alternatives

Activity Category	Preferred Forecast Alternative
Passenger Enplanements	Trend Line
Based Aircraft	Low Forecast
Operations	N/A, Single Forecast
Air Cargo	Baseline Forecast
Peak Passengers	N/A, Single Forecast

Table 2-30 Summary of Preferred Forecasts

Category	2015	2020	2025	2030	2035
PASSENGER ENPLANEMENTS	**259,734**	**296,308**	**341,525**	**386,743**	**431,961**
TOTAL ANNUAL OPERATIONS	**56,709**	**58,537**	**60,987**	**63,338**	**65,598**
Itinerant Operations	41,012	42,498	43,911	45,730	47,559
Local Operations	15,697	16,039	17,076	17,608	18,039
BASED AIRCRAFT	**117**	**120**	**124**	**128**	**133**
Single-Engine Piston	65	66	67	68	70
Twin-Engine Piston	13	13	13	12	13
Turboprop	9	10	10	11	12
Jet	10	11	13	15	17
Helicopter	3	3	4	4	4
Military	17	17	17	17	17
AIR CARGO (Million Pounds)	**7.9**	**8.1**	**8.3**	**8.5**	**8.7**

Source: Mead & Hunt, 2016

2.12 FAA REVIEW TEMPLATES

Aviation forecasts are required to include two FAA-defined templates. These templates are presented in **Tables 2-31** and **2-32**.

Table 2-31 Template for Comparing Airport Planning and TAF Forecasts				
Airport Name: Bismarck Airport (BIS)				
	Year	Airport Forecast	2015 TAF	AF vs.TAF (% Difference)
Passenger Enplanements				
Base yr.	2015	259,734	267,147	-2.8%
Base yr. + 5yrs.	2020	296,308	288,087	2.9%
Base yr. + 10yrs.	2025	341,525	309,597	10.3%
Base yr. + 15yrs.	2030	386,743	329,589	17.3%
Commercial Operations				
Base yr.	2015	13,495	13,495	0.0%
Base yr. + 5yrs.	2020	12,884	12,610	2.2%
Base yr. + 10yrs.	2025	14,040	11,543	21.6%
Base yr. + 15yrs.	2030	15,096	12,194	23.8%
Total Operations				
Base yr.	2015	56,709	56,037	1.2%
Base yr. + 5yrs.	2020	58,537	56,033	4.5%
Base yr. + 10yrs.	2025	60,987	55,577	9.7%
Base yr. + 15yrs.	2030	63,338	56,849	11.4%
Based Aircraft				
Base yr.	2015	117	117	0%
Base yr. + 5yrs.	2020	120	124	-3.2%
Base yr. + 10yrs.	2025	124	131	-5.3%
Base yr. + 15yrs.	2030	128	136	-5.9%

Note: TAF data is based on a U.S. Government fiscal year basis (October through September).
Source: FAA 2015 Terminal Area Forecasts, Airport Forecasts (AF) complied by Mead & Hunt, 2016.
Table 2-31 Template for Comparing Airport Planning and TAF Forecasts

This page is intentionally blank.

Table 2-32A Summary of Bismarck Airport (BIS) Aviation Forecasts									
Operational Factors	**Aviation Forecasts**					**Compound Average Annual Growth Rates**			
	Base Yr. Level	**Base Yr. + 1yr.**	**Base Yr. + 5yrs.**	**Base Yr. + 10yrs.**	**Base Yr. + 15yrs.**	**Base yr. to +1**	**Base yr. to +5**	**Base yr. to +10**	**Base yr. to +15**
	2015	2016	2020	2025	2030	2016	2020	2025	2030
Passenger Enplanements									
Air Carrier	102,742	129,807	147,858	170,421	192,985	26.3%	7.6%	5.2%	4.3%
Commuter	156,992	130,327	148,450	171,104	193,758	-17.0%	-1.1%	0.9%	1.4%
TOTAL	259,734	260,134	296,308	341,525	386,743	0.2%	2.7%	2.8%	2.7%
Operations									
Itinerant									
Air carrier[1]	2,570	3,243	5,933	7,667	11,322	26.2%	18.2%	11.6%	10.4%
Commuter/air taxi[2]	10,925	10,130	6,951	6,373	3,774	-7.3%	-8.6%	-5.2%	-6.8%
Total Commercial Operations	13,495	13,373	12,884	14,040	15,096	-0.9%	-0.9%	0.4%	0.8%
General aviation[3]	25,131	26,259	30,772	31,450	32,472	4.5%	4.1%	2.3%	1.7%
Military	2,386	2,359	2,250	2,250	2,250	-1.1%	-1.2%	-0.6%	-0.4%
Local									
General aviation[3]	14,234	13,710	11,614	12,231	12,503	-3.7%	-4.0%	-1.5%	-0.9%
Military	1,463	1,374	1,017	1,017	1,017	-6.1%	-7.0%	-3.6%	-2.4%
TOTAL OPERATIONS	56,709	57,074	58,537	60,987	63,338	0.6%	0.6%	0.7%	0.7%
Instrument Operations	25,444	25,505	25,751	27,688	28,756	0.2%	0.2%	0.8%	0.8%
Peak Hour Operations	23	23	25	26	27	1.7%	1.7%	1.2%	1.1%
Cargo/mail (enplaned+deplaned tons)	7.9	7.9	8.1	8.3	8.5	0.5%	0.5%	0.5%	0.5%
Based Aircraft									
Single Engine (Nonjet)	67	67	68	69	71	0.0%	0.3%	0.3%	0.4%
Multi Engine (Nonjet)	20	20	20	21	21	0.0%	0.0%	0.5%	0.3%
Jet Engine	10	10	12	13	15	0.0%	3.7%	2.7%	2.7%
Helicopter	3	3	3	4	4	0.0%	0.0%	2.9%	1.9%
Other	17	17	17	171	17	0.0%	0.0%	26.0%	0.0%
TOTAL	117	118	120	124	128	0.5%	0.5%	0.6%	0.6%

Source: FAA 2015 Terminal Area Forecasts, Airport Forecasts (AF) complied by Mead & Hunt, 2016.
Notes: [1] Aircraft are considered air carrier when 60 seats or more. The anticipated transition to larger aircraft mean this category will grow as commuter aircraft become less common.
[2] Commuter/Air Taxi includes both GA on demand flights and air carrier of less than 60 seats.
[3] Totals will not reflect Table 2-14 as air taxi operations are considered separately under this table.

Table 2-32B Summary of Bismarck Airport (BIS) Aviation Forecasts					
Operational Factors	Base Yr. Level	Base Yr. + 1yr.	Base Yr. + 5yrs.	Base Yr. + 10yrs.	Base Yr. + 15yrs.
	2015	2016	2020	2025	2030
Average aircraft size (seats)					
Air carrier	161	161	162	163	164
Commuter	52	52	58	65	72
Average enplaning load factor					
Air carrier	80.2%	80.2%	80.2%	80.2%	80.2%
Commuter	75.9%	77.0%	80.2%	80.2%	80.2%
GA operations per based aircraft	378	378	378	377	376

Source: FAA 2015 Terminal Area Forecasts, Airport Forecasts (AF) complied by Mead & Hunt, 2016.