Airport Master Plan

Duluth International Airport

Prepared for The Duluth Airport Authority

3 Aviation Forecast

3.1 Introduction

The Aviation Forecasts chapter of the Airport Master Plan analyzes current and future airport activity at the Duluth International Airport (DLH). Forecasting provides an airport with a general idea of the magnitude of growth, as well as fluctuations in activity anticipated over a 20-year forecast period. They assist the Airport in determining existing and planned future facility needs based on airport activity level estimates and projections. Forecasts attempt to develop a realistic estimate of future changes. When conditions dramatically change, forecasts should be reviewed and updated.

This forecast was prepared at the same time as the evolving impacts of the COVID-19 public health emergency. Forecast approval is based on the methodology, data, and conclusions at the time the document was prepared. However, consideration of the impacts of the COVID-19 public health emergency on aviation activity is warranted to acknowledge the reduced confidence in growth projections using currently available data.

Accordingly, FAA approval of this forecast does not constitute justification for future projects. Justification for future projects will be made based on activity levels at the time the project is requested for development. Documentation of actual activity levels meeting planning activity levels will be necessary to justify AIP funding for eligible projects.

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

To thoroughly analyze and develop a probable aviation forecast, a technical review has been completed using several methods to help quantify the potential aviation activity over the next 20 years. The forecasts for this Airport Master Plan study were prepared by Landrum and Brown (L&B).

3.2 Forecast Rationale

It allows an airport to examine its ability to satisfy the needs of the aircraft and people it serves, and to determine the approximate timing of necessary improvements by projecting airport user activity levels.

Forecasts developed for airport master plans and/or federal grants must be approved by the Federal Aviation Administration (FAA). It is the FAA's policy, listed in *Advisory Circular 150/5070-6B, Airport Master Plans*, that FAA approval of forecasts at non-hub airports with commercial service should be consistent with the Terminal Area Forecasts (TAF). Master plan forecasts for operations, based aircraft and enplanements are consistent with the TAF if they meet the following criteria:

1. Forecasts differ by less than 10% in the five-year forecast and by less than 15% in the 10-year period, or
2. Forecasts do not affect the timing or scale of an airport project, or

– Forecasts do not affect the role of the airport as defined in the current version of FAA Order 5090.3, *Field Formulation of the National Plan of Integrated Airport Systems.*

The TAF model used for this report is from the 2018 FAA TAF available in January 2018. This was the latest data available when the forecasting effort began for this airport master plan.

Furthermore, *FAA Order 5090.3C* states forecasts should be:

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

3.3 Economic Base for Air Traffic

Air travel demand is typically correlated with a region's demographic and economic characteristics. The economic strength of the Air Service Area has a major impact on the aviation activity at the Airport. The next sections review economic trends and conditions in the Airport's Air Service Area present prior to the Coronavirus Pandemic in 2020 and present data indicative of the Air Service Area's capability to generate growing demand for air transportation throughout the forecast period. Where possible, anticipated trend changes expected post-pandemic have been included.

3.3.1 Socio-Economic Trends

Data for population, income, and gross regional product for the Air Service Area are discussed below. Parallel data for the United States is shown to provide a basis of comparison to trends in the Air Service Area. Where available, historical data will be presented for the 2008-2018 period, which is representative of a longer-term trend and the most recent 10 years of historical data available. Where available, forecast data will be presented through 2038, so as to be consistent with air traffic forecasts presented later in this chapter.

3.3.1.1 Historical and Forecast Population

Population is a significant source of demand for air travel. **Table 3-1** includes 2008 and 2018 population data and provides population trends in the Air Service Area and the U.S. during this period. Forecasts through 2038 are also included. Data in **Table 3-1** below shows that between 2008 and 2018, the population in the Air Service Area increased from 289,433 to 290,763, or 0.4% (0.05% CAGR). During the same period, U.S. population increased by 7.9% (0.76% CAGR).

Table 3-1 – Historical and Forecast Population (2008-2038)

Area	Historical Population		Forecast Population 2038	Percent Change 2008-18	CAGR[1]	
	2008	2018			2008-2018	2018-2038
Air Service Area	289,433	290,763	292,394	0.4%	0.05%	0.03%
United States	304,094	328,094	372,691	7.9%	0.76%	0.64%

[1]Compound annual growth rate; U.S. Population in 000's

Source: Woods & Poole Economics

Population growth data are based on estimates of the Air Service Area's birth rate, death rate, and net in-migration. The forecast population increase in the Air Service Area for the period 2018 to 2038 reflects a CAGR of 0.03% and is less than the U.S. rate during the same period (0.64%). The increase in new residents

in the Air Service Area, approximates 1,600 between 2018 and 2038, is expected to generate additional demand for air service.

The Coronavirus pandemic has initiated new trends in population migration within the United States (U.S.). The pandemic and remote work have changed the way and location that some Americans live. Some population has begun moving out of larger cities and into suburbs and other rural areas. Throughout 2020 and the pandemic, the Duluth area housing market surged, with closed sales up 10%. A December 1, 2020 Star Tribune[1] article noted that closed sales in northeast Minnesota surpassed even the fast-moving Twin Cities market in periods of the fall of 2020. As the pandemic recovery continues, changes in where people choose to live may impact the need for air service in Duluth, likely in a positive direction.

3.3.1.2 Household Income

Table 3-2 includes estimated 2018 and forecast 2038 average household income data for the Air Service Area and the U.S. The Air Service Area's 2017 median household income was lower than that of the U.S. **Table 3-2** shows that in 2017, the Air Service Area's median household income of $47,227 was 23.0% below that of the U.S. ($61,372). Forecasts for 2038 show that the Air Service Area is expected to reach average household income level of $122,064 by 2038.

Table 3-2 – Median Household Income and Income Distribution (2018-2038)

	Air Service Area	United States
2017 Median Household Income	$47,227	$61,372
2018 Average Household Income	$93,476	$124,604
2038 Average Household Income	$122,064	$163,010
2018 Household Income	**Household Income Distribution (Percent)**	
	Air Service Area	**United States**
Less than $20,000	21.0%	23.7%
$20,000 to $45,000	26.5%	31.9%
$45,000 - $75,000	25.6%	30.0%
$75,000 - $99,999	12.7%	16.7%
$100,000 - $199,999	12.5%	22.1%
$200,000 or more	1.7%	5.7%
Total	**100.0%**	**100.0%**
2038 Household Income	**Air Service Area**	**United States**
Less than $20,000	13.9%	12.5%
$20,000 to $45,000	17.5%	17.2%
$45,000 - $75,000	27.6%	22.6%
$75,000 - $99,999	19.4%	17.5%
$100,000 - $199,999	19.1%	24.2%
$200,000 or more	2.5%	6.1%
Total	**100.0%**	**100.0%**
Amounts are shown in 2012 dollars		

Source: Woods & Poole Economics

The percentage of higher income households, defined as those earning $100,000 or more annually, within the Air Service Area is another key indicator of potential demand for air travel services. In 2018, approximately

[1] Duluth home prices hit new record as market stays hot - StarTribune.com, December 1, 2020

18,000 Air Service Area households had an income of $100,000 or more. This is equal to approximately 14.2% of all Air Service Area households. According to Consumer Expenditure Survey data from the U.S. Bureau of Labor Statistics, 54% of airline fare expenditures are made by households with annual income of $100,000 or more. Data in **Table 3-3** shows that between 2018 and 2038, the Air Service Area will gain an additional 9,735 households with annual income greater than $100,000.

Table 3-3 – Households with Income of $100,000 and Above: 2018-2038

Total Households	Air Service Area	United States
2018 Estimate	127,261	127,609,928
2038 Forecast	128,472	143,107,833
Increase in households	1.0%	12.1%
CAGR 2018-2038[1]	0.05%	0.57%
Households with Income of $100,000 and Above[2]		
2018 Estimate	18,004	27,221,835
2038 Forecast	27,739	43,395,549
Increase in households with income of $100,000 and above	54.1%	59.4%
CAGR 2018-2038	2.48%	2.36%
% of Households with Income of $100,000 and Above[2]		
2018 Estimate	14.2%	27.8%
2038 Forecast	21.6%	28.3%

[1]Compound annual growth rate; [2]2012 dollars

Source: Woods & Poole Economics

3.3.1.3 Gross Regional Product / Gross Domestic Product

Gross domestic product (national level) and gross regional product (state- and county-level) are measures of the value of all final goods and services produced within a geographic area. These measures are general indicators of the economic health of a geographic area and, consequently, of the area's potential demand for air transportation services.

Table 3-4 shows the CAGR for the Air Service Area's gross regional product and gross domestic product for the U.S. **Table 3-4** indicates that gross regional product for the Air Service Area increased at a CAGR of 2.52% between 2008 and 2018, which was above the U.S. CAGR of 1.85%.

Forecasts for 2038 in **Table 3-4** show that gross regional product for the Air Service Area is forecast to increase at a CAGR of 2.90%, which is above the forecasted CAGR of the U.S. of 1.73% between 2018 and 2038.

Table 3-4 – Historical and Forecast per Capita Gross Regional and Gross Domestic Product (2008-38)

CAGR[1/]	Gross Regional & Domestic Product Growth	
	Air Service Area	United States
Historic - 2008-2018	2.52%	1.85%
Forecast - 2019-2038	2.90%	1.73%

1/ Compound annual growth rate; in 2012 dollars

Source: Woods & Poole Economics

3.3.1.4 Labor Market Trends

Civilian labor force data, unemployment rates, and employment for the Air Service Area are discussed below and are presented in **Table 3-5**. Parallel data for the U.S. is also shown to provide a basis of comparison for trends in the Air Service Area.

3.3.1.4.1 2008 – 2018 Non-Farm Payrolls and Unemployment Rate

Table 3-5 includes annual civilian labor force and unemployment data from 2000 through 2018 for the Air Service Area, and the U.S. Data in **Table 3-5** show that between 2000 and 2018, the Air Service Area labor force increased 0.16%. At the same time, the U.S. increased from 1.58 billion to 1.78 billion, or a CAGR of 0.68%.

Table 3-5 – Historical and Forecast Non-Farm Payrolls and Unemployment Rate (2000-2018)

Year	Non-Farm Payrolls		Year	Unemployment Rate	
	Air Service	United States		Air Service	United States
2000	133,000	122,028	2000	4.5%	4.0%
2001	131,000	122,087	2001	5.6%	4.7%
2002	130,400	120,756	2002	5.8%	5.8%
2003	129,500	120,472	2003	6.3%	6.0%
2004	129,700	121,792	2004	5.9%	5.5%
2005	130,600	123,883	2005	5.1%	5.1%
2006	132,800	126,109	2006	5.0%	4.6%
2007	134,100	127,534	2007	5.5%	4.6%
2008	134,100	126,839	2008	6.2%	5.8%
2009	129,200	121,360	2009	8.9%	9.3%
2010	130,000	120,481	2010	8.2%	9.6%
2011	130,600	121,944	2011	7.4%	8.9%
2012	131,400	124,007	2012	6.6%	8.1%
2013	133,600	126,038	2013	6.1%	7.4%
2014	135,200	128,408	2014	5.2%	6.2%
2015	135,800	131,072	2015	4.9%	5.3%
2016	135,800	133,399	2016	5.6%	4.9%
2017	136,800	135,488	2017	4.6%	4.4%
2018	136,900	137,753	2018	3.8%	3.9%
CAGR[2/]					
2000-2018	0.16%	0.68%			
Notes: United States Non-Farm Payroll in 000s					

Source: Bureau of Labor Statistics, U.S. Department of Labor; U.S. non-farm payrolls in 000s

Duluth International Airport (DLH) is the primary commercial service airport serving the area of northern Minnesota. Duluth is home to a growing healthcare, hospitality, education and government sectors.

Economic development officials in the Air Service Area underscore the importance of the Airport's links to destinations in the U.S. and around the world. Because access to domestic and international markets is a major factor in the site selection process, the Airport plays a significant role in attracting new businesses and the expansion of existing enterprises in the Air Service Area.

3.3.1.4.2 Major Employers

Major employers in the Air Service Area for which employment data are available are shown in **Table 3-6**. These employers represent a variety of industries including: Healthcare (Essentia Health, St. Luke's) government, education, transportation, energy, and defense.

Table 3-6 – Major Air Service Area Employers

Company	Approx.
Essentia Health	6,569
St. Luke's	2,348
St. Louis County	1,847
University of Minnesota - Duluth	1,635
Duluth Public Schools	1,426
ALLETE	1,314
Duluth Air National Guard Base	1,068
Cirrus Aircraft	1,000
United HealthCare	999
City of Duluth	850

Source: Northland Connection, Top Employers, accessed 4/19/2021[2]

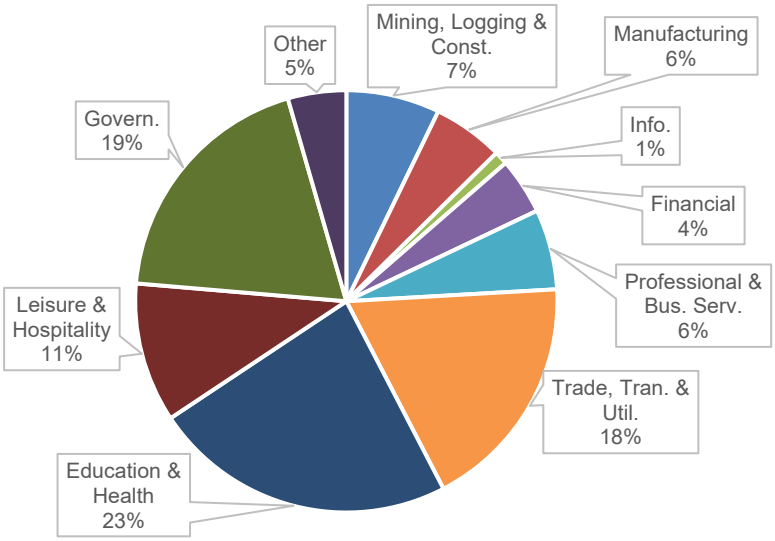
3.3.2 Economic Outlook

As has been illustrated earlier in this chapter, the Duluth economy is typically slower growing as compared to U.S. averages – based upon trends over the past (nearly twenty) years. Currently, these trends are anticipated to continue post-pandemic. However, changes in population patterns after the pandemic may alter these trends.

More recently, the Duluth area economy has undergone somewhat of a transformation. What was historically a regional economy driven by highly cyclical manufacturing and mining industries, is today a stable economy, driven by the healthcare, education and government sectors**. Chart 3-1** below illustrates a breakdown of Duluth's economy today.

[2] https://northspan-dev.communitysys.com/site-selection/top-employers/

Chart 3-1 – Duluth-Superior Employment by Sector



Source: U.S. Department of Labor: Bureau of Labor Statistics

Furthermore, over the next few years, Duluth will see sizable growth in its healthcare sector. This will be driven by two events: 1) Essentia Health is making an $800 million investment (largest in Duluth's history) in a new Vision Northland, which will transform its downtown medical campus. This project is estimated to be completed in 2022. 2) Another major healthcare provider, St. Luke's is in the middle of a large campus expansion, St. Luke's Health Forward Initiative.

In addition to the planned healthcare initiatives, a $75 million apartment complex is being designed for downtown Duluth, nearby the planned medical facilities growth. This will be Duluth's first new downtown multi-family addition in recent history and would cater to Duluth-Superior's growing millennial population base.

Finally, is the planned cruise ship operations that are tentatively planned to start in the summer of 2021. Hapag-Lloyd Cruises and Victory Cruise Lines are expected to begin visits to Duluth in 2021, and Viking Cruise Lines is scheduled to begin a Great Lakes Cruise that stops in Duluth in 2022. The City of Duluth is investing in dock wall and Lakewalk improvements near the Duluth Entertainment Convention Center and US Customs facilities to accommodate the start of cruise ship traffic.

A key component of the Duluth area economy, specifically at the airport, is that Duluth has become an area known for its Aviation sector. Specifically, this includes the following:

- **Duluth Air National Guard Base** –This includes 21 F-16C Fight Falcon aircraft based at the airport. According to the 2020 Annual Report published by the 148th, the base consists of 490 FTEs, and has 1,049 airmen assigned to the base.
- **Cirrus Aircraft –** Manufactures light aircraft and has delivered over 7,000 aircraft in its roughly 20 years of production. Consists of 1,000 employees. Cirrus also has 7 GA aircraft based at DLH.
- **Lake Superior College (LSC) –** LSC aviation school is one of the largest in the region, regularly training both pilots and mechanics., LSC has a partnership with Delta Air Lines (Delta) to serve as a pipeline for aviation maintenance technicians (AMTs). It also works as a pipeline to other aviation entities in the region, such as Cirrus and Monaco Air. As a part of LSC's pilot training program, LSC

has 12 GA aircraft based at DLH. Both the pilot program and the mechanic program saw double digit growth in enrollment in 2019 alone.

- **MRO Facility** – AAR is one of the largest aircraft maintenance companies in the world occupied a large MRO facility located at DLH until mid-2020. The pandemic and the impact on the airline industry contributed to their departure. AAR began operations at DLH in 2012 and had approximately 400 employees. It conducted heavy maintenance for United Airlines Airbus fleet (among many clients). This contract drove United's decision to launch A319 aircraft in the DLH-ORD market in 2018. While the facility is currently empty, the Duluth Economic Development Authority (DEDA), which owns the building, is in discussions with several potential new tenants. It is expected that this facility will be leased to a similar type tenant in the near future.

Population and Economic forecasts for the Air Service Area are included below and are also compared to the U.S. As illustrated, the population, employment, total personal income, and total gross regional product are expected to have relatively lower growth rates in the Air Service Area as compared to the U.S. While this continues trends that have been noted previously, it is also a faster growth than historically and likely portends well for traffic growth as compared to historical averages. As it pertains to the Air Service Area's forecasted economic growth, a few key characteristics should be considered:

- While Duluth's population growth may continue to lag U.S. trends, the region's GDP and income growth is quite close to U.S. averages, the first time this has ever occurred.
- Personal income CAGR of 1.45% in the region as compared to the U.S. at 1.54%.
- Per Capita Income in the region is forecasted to experience 1.36% CAGR as compared to the U.S. CAGR of 1.29%.
- Regional GDP growth is forecasted to grow at a 1.45% CAGR as compared to U.S. CAGR of 1.73%.
- The number of households with incomes over $100.000 in the region is expected to grow by one third over the next 20 years.

Table 3-7 – Passenger Demand Forecast Variables (2018-2038)

	2018	2038	CAGR
Air Service Area Population	289,763	292,394	0.05%
U.S. Population (000s)	328,094,150	372,690,931	0.64%
Air Service Area Total Employment	172,009	196,665	0.67%
U.S. Total Employment	199,425,624	249,606,303	1.13%
Air Service Area Total Personal Income ($ billion)	$12.3	$16.4	1.45%
U.S. Total Personal Income ($ billion)	$17,558.6	$23,814.2	1.54%
Air Service Area Per Capita Personal Income	$42,541	$56,030	1.39%
U.S. Per Capita Personal Income	$49,448	$63,898	1.29%
Air Service Area Gross Regional Product ($ billion)	$12.9	$17.2	1.45%
U.S. Gross Domestic Product ($ billion)	$18,647.4	$26,289.7	1.73%

Source: Woods & Poole Economics, Inc., Data Profiles for MSA, state, and U.S.

3.4 Commercial Forecasts

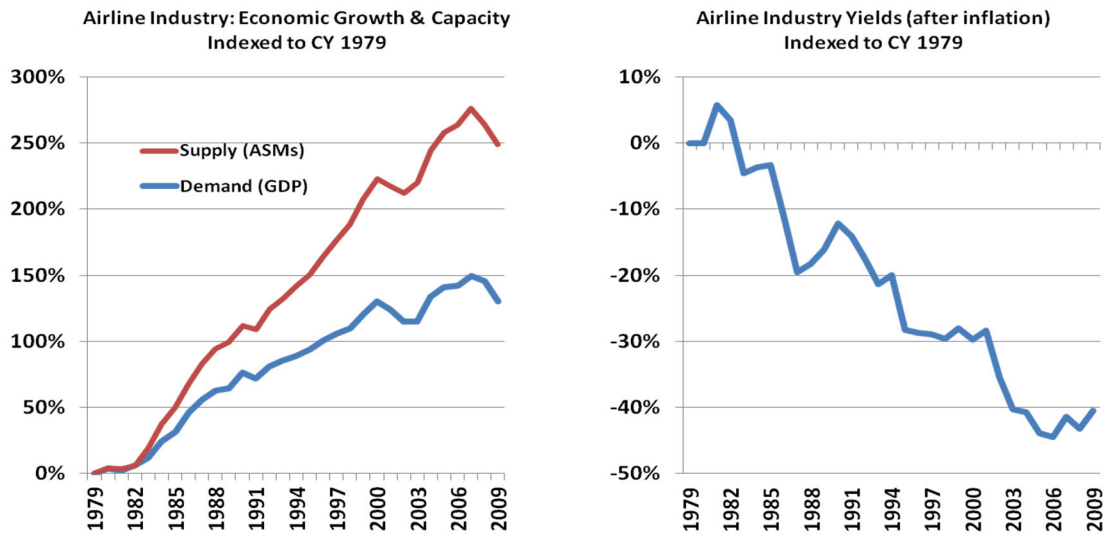
3.4.1 Commercial Passenger Industry Aviation Trends

The trends presented in this section are intended to provide a framework for better understanding past and future trends across the U.S. airline industry and how that has and will affect air service at the Duluth International Airport (DLH). It will also establish a basis for estimating how aviation activity may be expected to grow and change in the future. This frame of reference is essential when identifying potential activity scenarios for the airport.

3.4.1.1 Long-term History (1978-2008)

From de-regulation in 1978, through 2008, the U.S. airline industry cumulatively lost approximately $40 billion dollars. This was primarily a function of overcapacity in the industry, where the supply of seats was greater than demand. The result was that airlines had to price airline seats below cost. The trends in **Chart 3-2** illustrate: 1) the widening gap between the supply of seats and demand that took place during this period, and 2) the resulting decline in airline price (yield).

Chart 3-2 – Industry ASM, GDP Growth & Inflation-adjusted Yields



After roughly thirty (30) years of overcapacity, the airline industry had amassed massive financial losses, numerous airlines had gone out of business or merged, and airline balance sheets consisted of heavy debt levels. These financial results had been generated despite oil prices being tame during this period, typically ranging from $20-$50 per barrel.

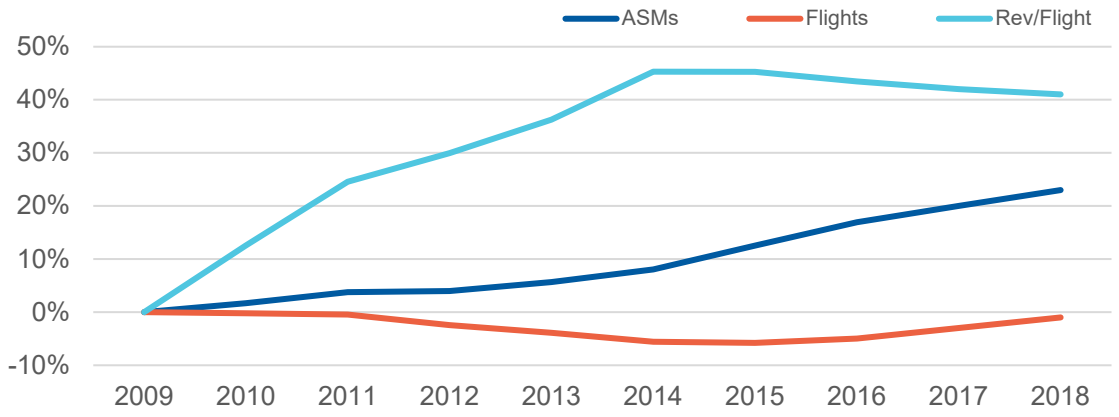
There were two primary beneficiaries from excess capacity: airports and the traveling public, who benefited from relatively low air fares. The effect was elevated, but unsustainable passenger volumes. During this period, passenger volumes across the U.S. increased at a Compounded Annual Growth Rate (CAGR) of 2.65% (2008 vs 1978, source: A4A).

Beginning in 2007, oil prices spiked, eventually peaking at around $150/barrel and a subsequent, severe economic recession. The airline industry's very survival depended upon a significant transformation. The key component would be to sharply reduce capacity, particularly fuel inefficient aircraft fleets such as 50-seat regional jets. The airlines began to reduce seat capacity in 2008 as fuel prices spiked and the economic recession worsened.

3.4.1.2 Airline Industry Transformation (2009-Today)

Chart 3-3 below illustrates what has occurred since 2009: airlines cut flight capacity and revenues improved sharply. Revenue increases were driven by higher yields (prices), marginally higher load factors and ancillary fees. Airlines have also benefited from sharply lower oil prices. The result was that a habitually unprofitable industry has become quite profitable, recording the most profitable years in industry history over the past five years.

Chart 3-3 – Industry Capacity and Key Revenue Metrics



Source: Air Transport Association (A4A)

The biggest changes came at the largest network airlines (Delta, United & American), where the financial results had historically been the worst. These airlines drastically cut capacity, primarily in the form of eliminating the most unprofitable fleet types, focusing upon improved profitability. At the same time, ultra-low cost carriers (ULCCs) such as Allegiant, who had been profitable over time, continued to grow significantly while at the same time generating consistent profitability.

Table 3-8– Industry Profitability for Nine (9) Publicly Traded Airlines

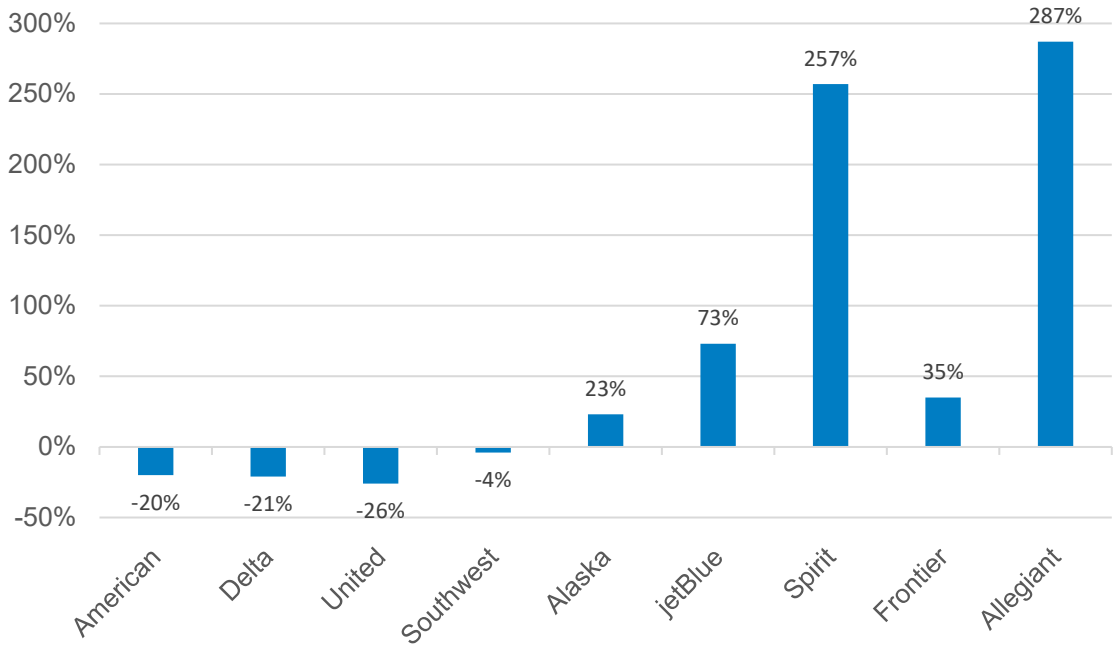
Calendar Years 2014 – 2017												
	Pre-Tax: 2014 (millions)			Pre-Tax: 2015 (millions)			Pre-Tax: 2016 (millions)			Pre-Tax: 2017 (millions)		
Airline	**Rev**	**P&L**	**Margin**	**Rev**	**P&L**	**Margin**	**Rev**	**P&L**	**Margin**	**Rev**	**P&L**	**Margin**
Delta	$40,362	$4,500	11.1%	$40,704	$7,802	19.2%	$38,639	$6,952	17.5%	$41,244	$6,114	14.8%
Southwest	$18,605	$1,816	9.8%	$19,820	$4,116	20.8%	$20,425	$3,760	18.4%	$21,171	$3,515	16.6%
United	$38,901	$2,373	6.1%	$37,864	$5,166	13.6%	$36,556	$4,338	11.9%	$37,736	$3,498	9.3%
American	$42,650	$4,249	10.0%	$40,990	$6,204	15.1%	$40,180	$5,284	13.2%	$42,207	$4,058	9.6%
JetBlue	$5,817	$515	8.9%	$6,416	$1,216	19.0%	$6,632	$1,312	19.8%	$7,015	$1,000	14.3%
Alaska	$5,368	$962	17.9%	$5,598	$1,298	23.2%	$5,931	$1,349	22.7%	$7,933	$1,260	15.9%
Allegiant	$1,137	$157	13.8%	$1,262	$372	29.5%	$1,363	$371	27.2%	$1,504	$227	15.1%
Spirit	$1,932	$355	18.4%	$2,141	$509	23.8%	$2,322	$444	19.1%	$2,648	$389	14.7%
Total	**$154,772**	**$14,927**	**9.6%**	**$154,795**	**$26,683**	**17.2%**	**$153,048**	**$23,810**	**15.6%**	**$161,458**	**$20,061**	**12.4%**

The effects of these changes and its effect upon smaller communities has been vast. Since the oil price spike and subsequent U.S. recession in the late 2000s, the three major network airlines that serve relatively smaller markets (Delta, United and American) have generally reduced flight capacity. Most of the capacity growth across the U.S. has generally come from niche airlines who primarily serve certain areas of the country (JetBlue, Alaska) or ULCCs who primarily cater to leisure travelers, flying to popular vacation spots (Allegiant, Spirit, Frontier).

The one positive during this period was that ULCC Allegiant was growing significantly into smaller markets, backfilling for some of the lost service from network airlines. Still, the Allegiant Airlines service was limited to vacation travelers, flying to popular vacation spots, where lost network airline service would have allowed for travel to pretty much any market in the world.

Chart 3-4 illustrates just how disproportionate capacity changes have been by carrier type. It should be noted that the four largest airlines in aggregate (Delta, United, American and Southwest) control approximately 80% of industry seat capacity today.

Chart 3-4 – Departing Flight Capacity Change (% Change, 2018 vs 2007)



Source: Innovata via Diio

While major airlines constrained capacity prior to the pandemic, the effect was disproportionate across the U.S. For example, Delta Air Lines, over the past twelve years, reduced flight capacity approximately 21% across their U.S. system. Still, Delta increased capacity significantly on the U.S. West Coast, where Delta's Seattle seat capacity is up well over 100% and Los Angeles' is up approximately 100%. In general, airlines placed additional capacity where economic growth was the most vibrant and this is on the U.S. Coasts – particularly the West Coast. United, American and Southwest are also focusing most of their capacity growth currently in this region of the U.S. – with an emphasis in California. These trends can be expected to continue post-pandemic.

As the industry transformation has taken place, one of the major effects upon the industry is the increased gauge (larger aircraft) and longer stage length (nonstop flight miles). Part of this effect is occurring because of the sharp reduction in 50-seat regional jet flying that was noted earlier. This flying is then, in many cases, being replaced with 76-seat regional jet aircraft, flying less frequency than was flown with the 50-seat aircraft.

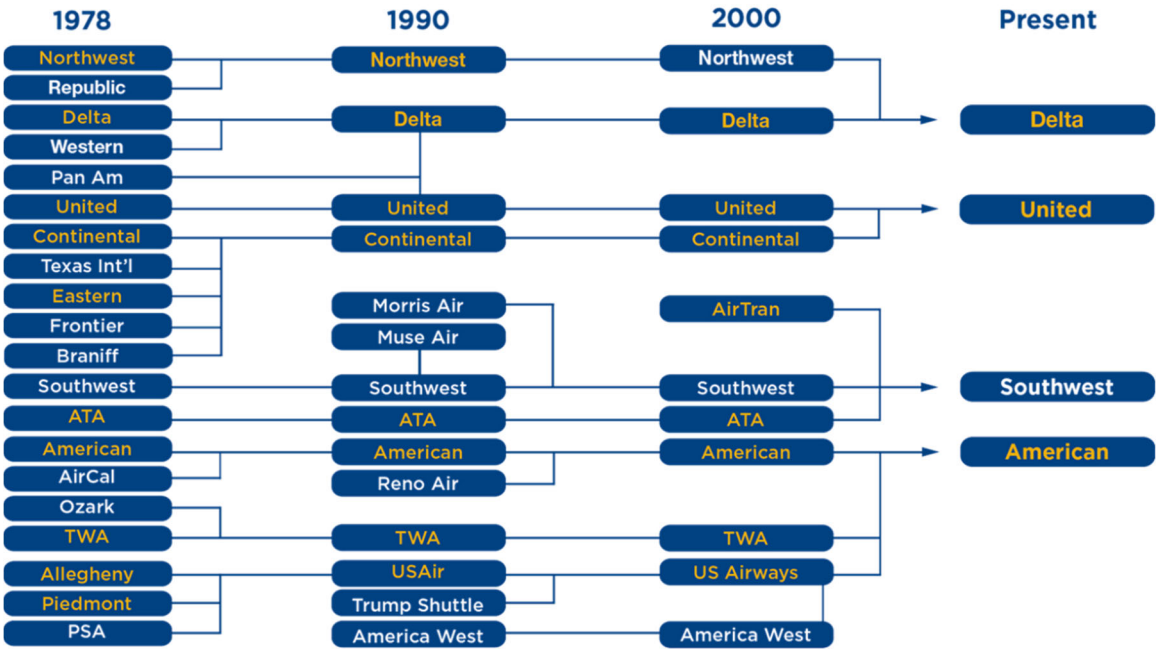
As an example, for many markets across the U.S. over the past few years, it is not uncommon that frequency has been reduced from 2 or 3 daily 50-seat regional jet departures and replaced with 1-2 daily 76-seat jet departures, resulting in less frequency, more seats per departure and similar-to-less overall seat capacity levels.

3.4.1.3 Consolidation

The transformation of the U.S. airline industry had its origins in 2007 with the spike in oil prices to $150/barrel and the subsequent U.S. economic recession that began in 2008.

A major part of the industry's transformation has been a continuing consolidation of the industry. The evolution of the industry is shown in **Chart 3-5**. Today, the four largest airlines control 80% of industry seats. This consolidation will in large part work to ensure that airline capacity discipline that has been so prevalent over the past few years, will likely work in a similar fashion going forward.

Chart 3-5 – Network Airlines from De-regulation Through Today



A key consideration is that the airlines highlighted in yellow (Delta, United and American) are major network airlines offering connecting service to large and smaller markets across the U.S., while Southwest Airlines, highlighted in white, focuses upon carrying point-point traffic typically in the largest markets in the U.S. Hence, consolidation has had a more adverse effect upon smaller communities as opposed to larger markets, as noted earlier.

In summary, the U.S. airline industry lost approximately $40 billion during the approximate 30-year period following de-regulation in 1978. These operating losses were largely driven by excess seat capacity which resulted in pricing (yield) that was below airlines cost.

Since 2010, a transformation took place, when airlines drastically reduced seat capacity, mostly in the form of reduced regional jet flying, to the point where prices (yields) increased to the level where airlines were profitable. In addition, airlines were able to add ancillary fees that were another form of a price increase. In addition, carrier Load Factors have also trended higher, from the mid-70% range (in the 1990s) to roughly 85% today. The past five years have been the most profitable in industry history, with industry operating margins averaging close to 15% on an annual basis.

3.4.1.4 The Future

Going forward post-pandemic, the future will likely look very much like the recent past. There are likely to be four primary trends driving the U.S. airline industry air service trends:

- **Limited network airline capacity growth (American, Delta, United, Southwest).** In addition, where growth does occur, it will be focused in areas of faster economic growth (east/west coast and international). In general, large network airlines typically target overall capacity growth closely to U.S. GDP growth. Hence, system capacity growth is typically in the 2%-3% range for large, network airlines over extended periods of time.
- **Relatively faster growth by ULCCs (Allegiant, Spirit, Frontier, Sun Country).** These airlines will continue growing much faster, although likely a bit slower than recent 10%-20% annual growth rates. In addition, while Allegiant has a large presence in smaller airports, going forward, Allegiant will focus their growth in relatively larger markets, a trend that started in 2014. Finally, expect this sector to start growing faster into international markets, particularly to the Caribbean and Mexico. It is expected that leisure markets may rebound to pre-pandemic levels earlier than business travel. This may also contribute to faster growth by ULCCs.
- **Trend of larger aircraft.** This trend has been firmly in place since the end of the recession and will likely continue. While taking place across entire carrier fleets, smaller markets will experience this trend primarily in the form of less 50-seat regional jet flying and more 76-seat jet flying. In addition, over time, more 100-115 seat aircraft flying could enter the mix (in the form of Airbus 220 and 717 aircraft). Bombardier, the largest manufacturer of regional jets in the world, expects larger regional jet aircraft (64-90 seats) to more than double, from 3,300 aircraft today to 6,950 by 2038. In addition, they expect aircraft in the 90-150 seat range to grow from 3,600 aircraft today to 7,300 aircraft in 2038. In total, Bombardier forecasts that aircraft in the 60-to 150-seat segment to double (worldwide) by 2038. Finally, Bombardier expects the small regional jet segment (<= 50 seats) to shrink from 2,500 aircraft today to only 390 by 2036. Furthermore, regionally, most of these remaining 50-seat aircraft are expected to be operated in 3rd world countries, primarily in the continent of Africa. This forecast is consistent with other aircraft manufacturers, including Boeing, Airbus and Embraer.
- **Larger airports will continue to outpace smaller airports.** This has been occurring since the end of the latest U.S. recession and will likely continue. Larger metropolitan areas, particularly those on the east/west coast are generating higher economic growth that is translating into additional air travel demand.
- **Pilot shortages may impact airlines.** Even with the industry contraction during and likely for a period post-pandemic, pilot shortages are expected to impact the airline industry. Before the pandemic began, the Regional Airline Associated estimated that 50% of the pilot workforce would face mandatory retirement within 15 years. While the airlines have reacted to the pandemic by offering early retirements to employees including pilots as a means to control costs, the pilot shortage may continue to impact routes, schedules and airlines ability to meet their goals post-pandemic.

Below is a summary of the FAA Forecast (2018-2038), the most current at the time this forecast was prepared. As will be seen, the FAA Forecast has similar expectations as noted directly above.

3.4.1.5 FAA Forecast Summary: 2017-2037

Over the next 20 years, large airports will continue to grow faster than their smaller counterparts in the United States. The FAA is forecasting that the number of larger regional jets will increase, while most of the smaller regional jets will be retired from the fleet. The following is a summary of the main points outlined in the FAA Aerospace Forecasts 2018-2038:

- Enplanements are forecast to increase 2.4% in 2018. For the remaining 20 years, enplanements are forecasted to grow at an average annual rate of 1.81%.
- U.S. GDP CAGR of 1.81% from 2018-2038.
- Baseline Available Seat Miles forecast of a 2.1% CAGR from 2018-2038, while departures are forecasted at a 1.9% CAGR during this same time period.
- Baseline nominal yields are forecast to grow at a 2.1% CAGR (essentially flat when considering inflation forecasts). Ancillary revenue growth is expected to continue growth.

Table 3-9 – U.S. Historic and Forecasted Enplaned Passengers

Fiscal Year	Enplaned Passengers	Fiscal Year	Enplaned Passengers
Historic		**Forecast**	
2000	641,200	2018	762,000
2001	625,000	2019	783,000
2002	626,800	2020	794,000
2003	574,500	2021	805,000
2004	628,500	2022	815,000
2005	669,500	2023	826,000
2006	668,400	2024	838,000
2007	690,100	2025	851,000
2008	680,700	2026	863,000
2009	630,800	2027	877,000
2010	635,200	2028	892,000
2011	650,100	2029	907,000
2012	653,800	2030	921,000
2013	654,300	2031	937,000
2014	669,000	2032	953,000
2015	696,000	2033	968,000
2016	726,000	2034	985,000
2017	744,000	2035	1,002,000
CAGR[1] 2000-2017	**0.88%**	2036	1,019,000
		2037	1,037,000
		2038	1,090,000
		CAGR[1] 2018-2038	**1.81%**
		CAGR[1] 2000-2038	**1.41%**

[1]CAGR = Compounded annual growth rate; Passenger Figures are in 000s

Source: FAA Aerospace Forecast (2018-2038)

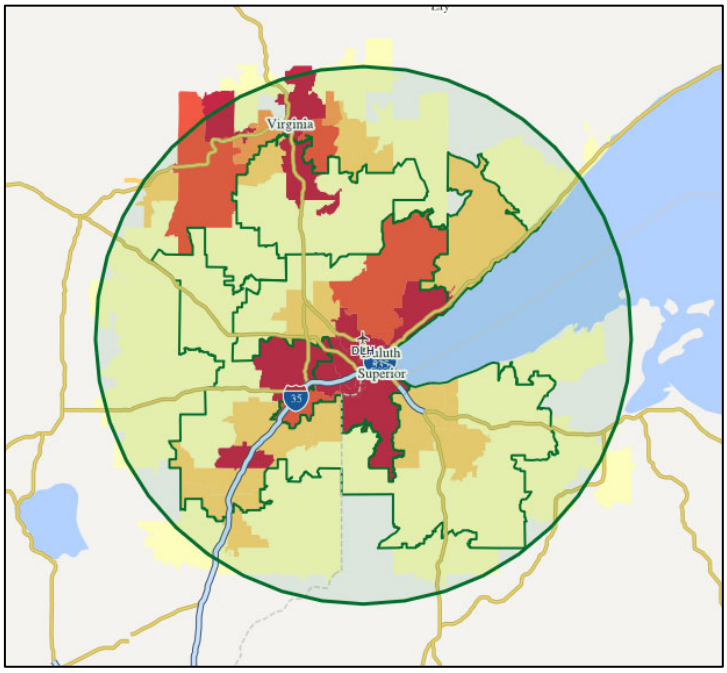
3.4.2 Duluth International Airport Air Service and Traffic Analysis

This section evaluates and describes the current state of air service at the Duluth International Airport, analyzes historical trends in air traffic, and identifies key factors that generally affect demand for air travel.

3.4.2.1 Regional Role and Catchment Area Analysis Overview

Duluth International Airport (DLH) is the primary commercial service airport serving the area of northern Minnesota. This area makes up the Duluth Metropolitan Statistical Area. The Airport is a point of air access for the region, including being a center for healthcare and education.

Air Service Area and Proximity to Other Airports

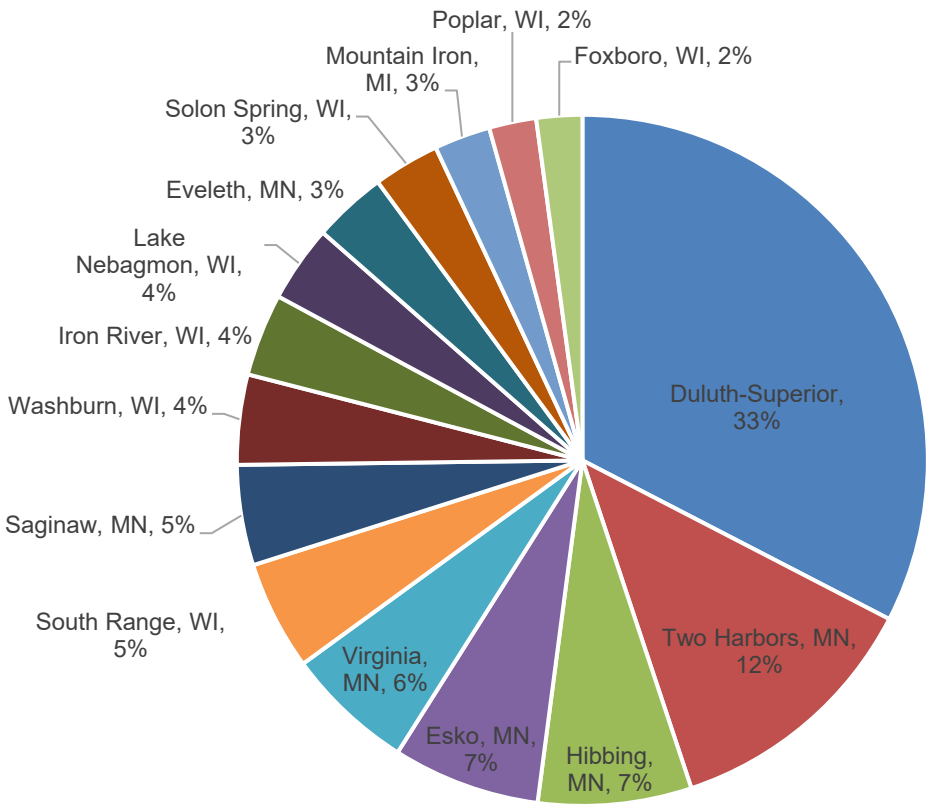


Source: Diio Mi, Catchment Mapper for DLH, 60 Miles

There are approximately 308,276 people that reside within 60 miles of DLH (DLH Catchment Area). DLH is the closest commercial airport to this population base, although there are options in the region. These include: Range Regional Airport (HIB - 65-mile drive), Brainerd Lakes Regional Airport (BRD – 113-mile drive) and Bemidji Regional Airport (BJI – 149-mile drive). But the biggest competitive threat is from the Minneapolis-St. Paul International Airport (MSP – 164-mile drive).

As can be seen on **Chart 3-6**, DLH draws traffic from across Northern Minnesota (and while not shown, parts of Canada, particularly Thunder Bay). As shown, while Duluth-Superior generates the majority of DLH's traffic, it still only represents 33% of DLH traffic. Smaller points within the State of Minnesota generate 46% of traffic, while another 18% comes from smaller, State of Wisconsin markets and 3% comes from as far away as Iron Mountain, from the Upper Peninsula of Michigan. This illustrates the range of cities/towns that DLH can draw air travel traffic from, including some with their own smaller commercial service airports.

Chart 3-6 – Where DLH Origin Passengers Come From: % of Bookings by Locale (CY 2018)

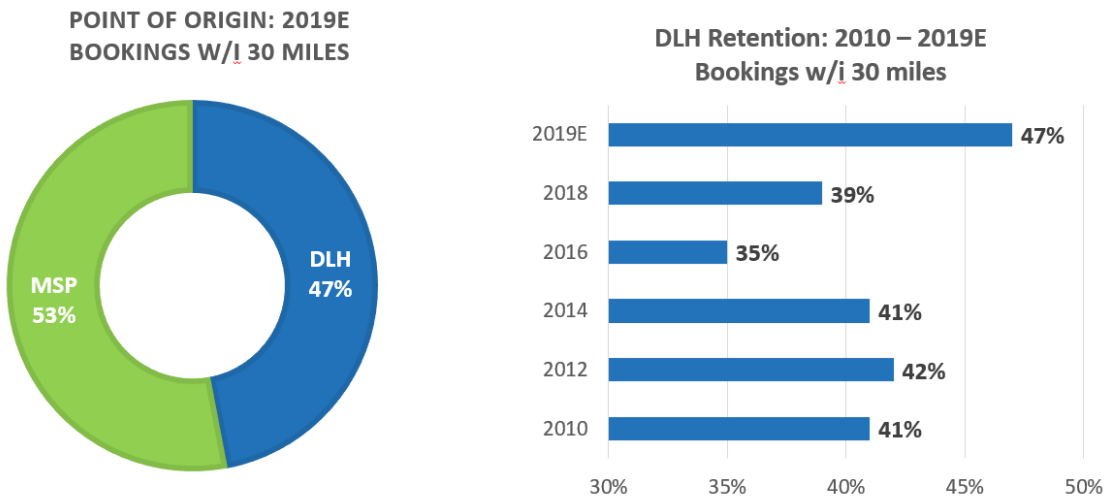


Source: Agency Reporting Corporation (Calendar Year 2018)

As noted earlier, MSP makes up a significant competitive threat to DLH. MSP is an estimated 2.5 to 3.0-hour drive from the Duluth region. Because of the significant amount of nonstop service and the availability of lower air fares at MSP, a significant portion of DLH's traffic base is "leaking" to MSP. However, it should also be noted that passengers from communities with smaller regional air carrier airports such as Hibbing leak from their local airport and fly out of DLH.

Chart 3-7 illustrates both DLH's current retention (estimated 2019) of regionally booked travelers as well as historic retention from 2010 through 2019 (estimated).

Chart 3-7 – Airport of Origin Trends: Passengers Booked from the DLH Catchment Area

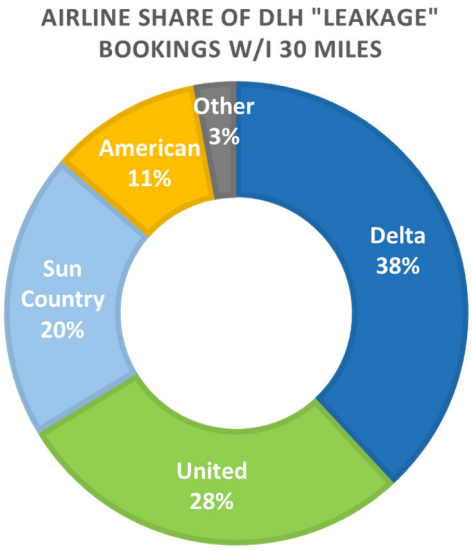


Source: Agency Reporting Corporation (ARC), Calendar Year

Much of these trends are dictated by changes in both MSP's and DLH's air service. As MSP experienced significant ULCC growth earlier in the decade, DLH began to experience worsening leakage, eventually contributing to Allegiant Airlines exiting the DLH market in 2015. The result was that DLH's retention of regional bookings fell from 41% in 2014, eventually bottoming in 2016 at 35%. With United Airlines adding a larger Airbus 319 aircraft on the overnight pattern of their ORD-DLH service in March 2018, the availability of discounted fares increased significantly and resulted in a large increase in DLH's traffic retention throughout 2018 (and resulting traffic increases). American Airlines briefly entered the market in 2019 (exiting in early 2020) and contributed to the retention rate increasing to 47% in 2019.

Chart 3-8 illustrates which airlines consumers fly when they "leak" to MSP.

Chart 3-8 – Carrier share of "leakage" to MSP



Surprisingly, Delta Air Lines only draws 38% of booked leaked traffic. While still the #1 airline, it is far less than Delta's typical 60% share of MSP origin and destination traffic.

After Delta, United is the #2 airline. This is likely due to United's long-term presence of flying from DLH and that it appears to have generated some frequent flyer loyalty. Sun Country is a strong #3, with a 20% share of passengers leaking to MSP. Additionally, not accounted for in this number are the numbers of passengers that utilize Landline bus service (1,500 passengers per month, pre-pandemic) to travel largely on Sun Country out of MSP. This shows Sun Country's long-time presence from the State of Minnesota, and likely indicates that many passengers driving to MSP are price-sensitive passengers, particularly those flying to sun destinations on a seasonal basis.

3.4.3 Air Service at DLH

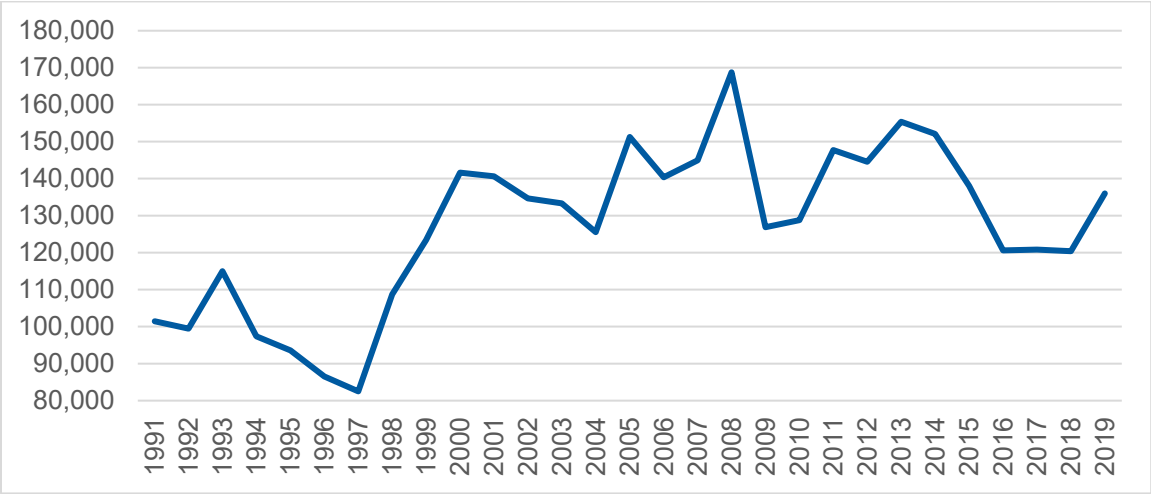
The following sections evaluate current air service capacity and operating performance for the primary passenger airlines serving the Airport. Airline performance will be evaluated from an economic perspective, or evaluating carrier revenue, yield and load factor results. The Airport's overall O&D market will also be assessed at the market level, comparing current performance with prior.

From a historical basis, DLH has always been a market dominated by Northwest, now Delta Air Lines. For many years, Northwest was the only commercial airline, offering non-stop service to MSP (and for a time, Detroit (DTW)).

When the former Northwest Airbus maintenance facility was operating, Northwest operated Airbus aircraft to DLH, cycling A320 aircraft through the DLH maintenance hangar. This was a great aircraft for DLH, although it distorted the number of seats that DLH was served with.

When Northwest Airlines (now Delta) closed the maintenance base in 2006, this was the beginning of a period when Northwest/Delta significantly reduced DLH seat capacity. At about the same time, lower cost alternative ground transportation in the form of shuttles started operating between DLH and MSP. This began an extended period where DLH experienced worsening "leakage" trends.

Chart 3-9 – DLH Enplaned Passengers (Year-ending May)



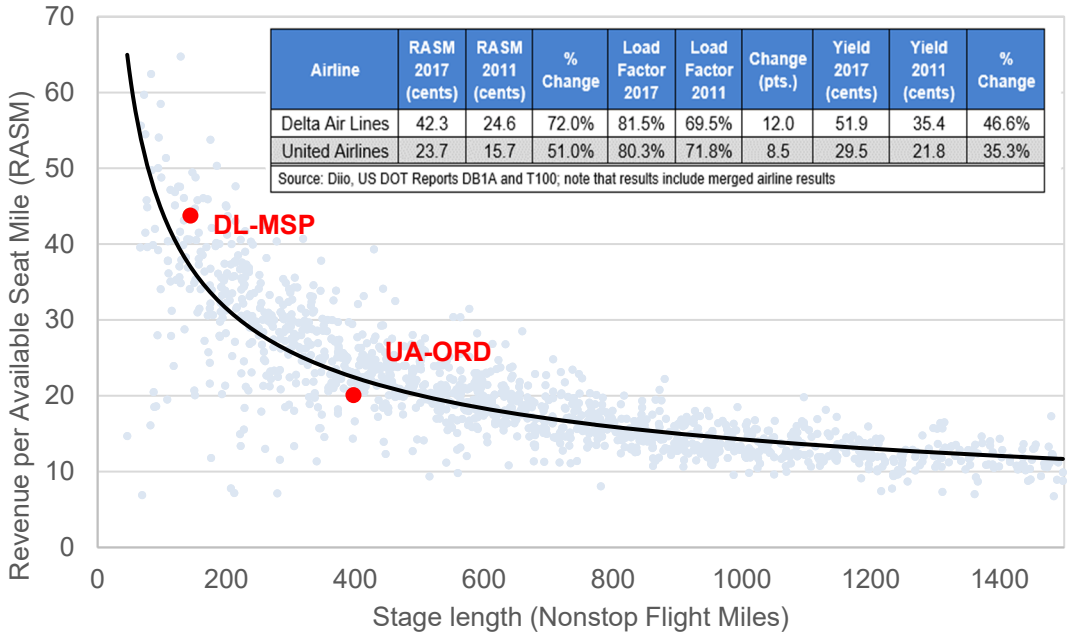
Source: Diio Mi

Chart 3-9 shows long-term enplaned passenger trends at DLH for the past twenty-eight years. There were some key changes over time:

1. Northwest (now Delta) eliminated the DLH maintenance base in 2006. In conjunction with the U.S. recession that started in 2008, Northwest/Delta reduced DLH seat capacity by 26% (CY 2010 vs CY 2006).
2. The Delta Air Lines-Northwest Airlines merger, which was announced in 2008, also heavily contributed to DLH capacity reductions. As Delta integrated Northwest into the Delta system, DLH experienced further capacity declines. From CY 2010 until CY 2017, Delta seat capacity at DLH fell a further 42% (total seat capacity fell almost 57% from 2006 until 2017).
3. In 2006, DLH was successful in recruiting Allegiant Airlines to DLH. Allegiant offered (mostly) year-round service to Las Vegas, Phoenix and seasonal service to Orlando. Allegiant served DLH from 2006 until 2015. Allegiant's DLH results started to decline in 2013, eventually resulting in Allegiant exiting the market. During this time, two events worked against the Allegiant service: a) A significant increase in ULCC service at MSP, causing more passengers to drive to MSP and b) A weakening in the Canadian dollar, which had the result of increasing U.S. air fares for Canadian travelers accustomed to driving to DLH for relatively inexpensive airfares. It was the Allegiant service that primarily contributed DLH's commercial operations and enplanements decline from 2014 to 2017.
4. United Airlines (operated by SkyWest Airlines) entered the DLH-ORD market in 2010, with 2 daily CRJ round-trip flights. This route has proven successful and United/SkyWest eventually upgraded this service to 4 daily round trips. This route has periodically seen service by larger and dual class aircraft including the A-320 family of aircraft and recently the EMB-175.

Chart 3-10 illustrates key metrics at DLH since 2011. In short, carrier results have significantly improved over this time (not including performance during the pandemic). Both DLH routes are operating near or above (mileage-adjusted) Revenue per Available Seat Mile (RASM) system averages, which is indicative of carrier relative profitability, as benchmarked against other carrier-served markets. Note: Before the A319 upgrade in 2018, UA RASMs at DLH were well above system averages.

Chart 3-10 – DLH Carrier Mileage-Adjusted RASMS & Key Metrics



Airline	RASM 2017 (cents)	RASM 2011 (cents)	% Change	Load Factor 2017	Load Factor 2011	Change (pts.)	Yield 2017 (cents)	Yield 2011 (cents)	% Change
Delta Air Lines	42.3	24.6	72.0%	81.5%	69.5%	12.0	51.9	35.4	46.6%
United Airlines	23.7	15.7	51.0%	80.3%	71.8%	8.5	29.5	21.8	35.3%

Source: Diio, US DOT Reports DB1A and T100; note that results include merged airline results

Source: Diio Mi

In addition, note the significant improvement in not only RASMs, but yields and load factors since 2011. These results are reflective of massive improvements and suggest in tandem that carrier service, at least as of year-end 2018, was much more stable than it has been historically. It should be noted that DLH airline load factors historically have run from the 50s (percentage) (until 2003), rising to 65% in the late 2000s, to today's 80%+ levels. Again, it would appear as of year-end 2018 that DLH air service was likely more stable than it had ever been.

Table 3-10 is a snap-shot of carrier results at DLH. DLH experienced a nearly 13% increase in passenger volumes in 2018. The key driver of this was again the MRO maintenance base. United Airlines decided to begin maintaining their A319 fleet at the AAR facility. Subsequently, beginning in March 2018, United scheduled an overnight A319 flight into their DLH-ORD schedule.

Table 3-10 – Overview of Carrier Traffic & Loads (Year-end March 2019)

DLH Air Service Overview: YE March 2019					
Departures					
Airline	Market	Annual	Daily	Onboards	Load Factor
DL	MSP	1,604	4.4	74,435	85
UA	ORD	1,067	2.9	59,436	76
Total		**2,670**	**7.3**	**133,871**	**78**

Source: Diio Mi

The effect of what appeared to be a minor schedule change to the DLH air service market was significant, as shown in **Table 3-11**.

Table 3-11 – Top DLH O&D Markets

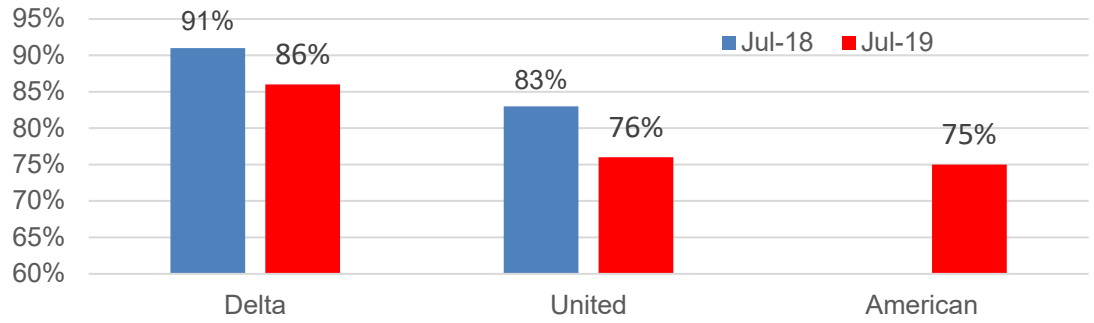
Rank	Destination	O&D Passengers	O&D Revenue ($)	Average Fare ($)	YOY % Change		
					Pax	Rev	Fare
1	Chicago-O'Hare, IL (ORD)	42	5,486	132	34%	31%	(3%)
2	Denver, CO	12	2,244	186	106%	61%	(22%)
3	Orlando, FL (MCO)	12	2,414	201	50%	38%	(8%)
4	Phoenix, AZ (PHX)	9	2,220	242	34%	20%	(10%)
5	Atlanta, GA	8	2,016	243	28%	31%	2%
6	New York-La Guardia, NY (LGA)	8	1,676	204	28%	19%	(8%)
7	Las Vegas, NV	8	2,114	264	(19%)	9%	35%
8	Boston, MA	8	1,519	191	23%	(3%)	(21%)
9	Detroit, MI	8	1,660	219	35%	28%	(5%)
10	Dallas-Fort Worth, TX (DFW)	7	1,368	193	52%	37%	(10%)
11	Seattle, WA	7	1,565	238	13%	(1%)	(12%)
12	Los Angeles, CA	6	1,467	236	(7%)	(16%)	(10%)
13	Minneapolis-St. Paul, MN	6	706	114	85%	57%	(15%)
14	Ft.Myers, FL	6	1,364	231	130%	113%	(7%)
15	Houston-Intercontinental, TX IAH)	6	1,565	269	14%	10%	(4%)
16	St. Louis, MO	6	1,195	208	82%	79%	(2%)
17	Tampa, FL	5	1,078	206	65%	71%	3%
18	San Francisco, CA	5	1,332	261	53%	73%	13%
19	Portland, OR	5	1,014	209	1%	(15%)	(16%)
20	Washington-National, D.C.	5	1,210	258	(22%)	(12%)	13%
Total All Markets		360	86,992	242	24%	15%	(8%)

Source: Diio Mi; passengers & revenue figures are daily/directional; avg fare paid is one-way

What occurred was that the added United seats created additional discounted seat inventory at DLH. In other words, cheaper fares. The result was a moderate decline in DLH air fares and a significant increase in air travel demand, specifically to high demand markets. Note the increase in passenger volume to markets like Denver (DEN), Orlando (MCO) and Phoenix (PHX). Most markets have experienced double-digit traffic increases since United added the Airbus to the overnight flight pattern.

The strong United and Delta Air Lines results got the attention of other airlines. First, American Airlines added 2 daily flights (50-seat regional jets) to ORD, starting in late May 2019, ultimately exiting the market in early 2020 (exit decision was made prior to the pandemic and was unrelated).

Chart 3-11 – DLH Carrier Load Factors (July 2019 vs July 2018)



Source: Diio Mi

In addition to American Airlines adding service to DLH in the summer of 2019, Delta Air Lines added significant capacity to DLH in the fall of 2019. **Table 3-12** below illustrates seat capacity growth by airline. As can be seen, DLH experienced approximately 38% growth in August and September, 28% in October, almost 33% growth in November and 46% growth in December 2019. Most of growth came from American and Delta, after United Airlines generated the majority of DLH's growth in 2018 and early 2019.

Table 3-12 – DLH Seat Capacity Growth: August-December 2019

Destination	Airline	YOY % Change – Monthly Seats (2019)				
		Aug	Sep	Oct	Nov	Dec
Percent Difference						
Chicago-O'Hare, IL (ORD)	American	NEW	NEW	NEW	NEW	NEW
Minneapolis/St. Paul, MN	Delta	21.7%	34.7%	16.4%	25.8%	37.2%
Chicago-O'Hare, IL (ORD)	United	14.8%	3.2%	1.3%	(4.0%)	7.9%
Total		**38.4%**	**38.2%**	**28.2%**	**32.7%**	**46.5%**

Source: Diio Mi

For all of 2019, DLH's scheduled seat capacity increased from about 169,000 one-way seats to 207,000, or an increase of about 39,000 one-way seats (or about 22%). If DLH passenger volumes were to grow 22% in 2019, enplaned passengers would increase to approximately 171,000. Even if load factors declined sharply and traffic increased "only" 15%, this would bring enplaned passenger volumes to approximately 162,000 for CY 2019.

3.4.4 Commercial Air Traffic Activity Trends

This section will analyze historical trends in air traffic activity at the Airport. It will also discuss the primary factors affecting these trends.

Table 3-13 below presents the most current DLH TAF, illustrating historical enplaned passenger trends at the Airport between CY 2000 and CY 2017. For 2018, DLH Airport results were used. It also presents enplaned passenger activity for overall U.S. domestic activity on a federal fiscal year basis (years ending September 30) for 2000 through 2017 and presents the Airport's share of overall U.S. activity.

Table 3-13 – Historical Commercial Service Operations and Enplaned Passenger Trends at the Airport and the U.S.

Fiscal Year	Air Carrier	Air Taxi & Commuter	Enplaned Passengers	% Change	Federal Fiscal Year	U.S. Domestic Enplaned Passengers	% Change	Airport Share of U.S. Domestic
2000	49,832	91,581	141,413	-	2000	641,200	-	0.022%
2001	47,849	89,404	137,253	(2.9%)	2001	625,000	(2.5%)	0.022%
2002	51,249	88,782	140,031	2.0%	2002	626,800	0.3%	0.022%
2003	63,750	59,311	123,061	(12.1%)	2003	574,500	(8.3%)	0.021%
2004	55,387	89,354	144,741	17.6%	2004	628,500	9.1%	0.023%
2005	80,531	68,442	148,973	2.9%	2005	669,500	6.5%	0.022%
2006	84,210	53,448	137,658	(7.6%)	2006	668,400	(0.2%)	0.021%
2007	102,286	59,100	161,386	17.2%	2007	690,100	3.2%	0.023%
2008	105,931	53,248	159,179	(1.4%)	2008	680,700	(1.4%)	0.023%
2009	63,588	63,086	126,674	(20.4%)	2009	630,800	(7.3%)	0.020%
2010	34,709	108,210	142,919	12.8%	2010	635,200	0.7%	0.022%
2011	24,648	122,987	147,635	3.3%	2011	650,100	2.3%	0.023%
2012	38,828	117,616	156,444	6.0%	2012	653,800	0.6%	0.024%
2013	33,651	122,087	155,738	(0.5%)	2013	654,300	0.1%	0.024%
2014	36,638	118,394	155,032	(0.5%)	2014	669,000	2.2%	0.023%
2015	29,333	106,439	135,772	(12.4%)	2015	696,000	4.0%	0.020%
2016	18,120	105,195	123,315	(9.2%)	2016	726,000	4.3%	0.017%
2017	4,811	118,552	123,363	0.0%	2017	744,000	2.48%	0.017%
2018	46,177	94,308	140,485	12.1%	2018E	781,000	4.97%	0.018%
CAGR[1]					CAGR[1]			
2000-18			(0.04%)		2000-18	1.10%		
2000-02			(0.49%)		2000-02	(1.13%)		
2002-08			2.16%		2002-08	1.38%		
2008-10			(5.25%)		2008-10	(3.40%)		
2010-15			(1.02%)		2010-15	1.85%		
2015-18			1.14%		2015-18	3.92%		

[1]CAGR = Compounded annual growth rate

Source: FAA TAF, FAA Aerospace Forecasts; 2018 source for DLH: Airport records

While the prior section addressed historical DLH passenger volume trends, the following will refer to **Table 3-13** directly above. DLH passenger traffic has been relatively stable-to-flat over the past nearly twenty years, despite economic trends. This is indicative of capacity reductions over time, mostly from regionally dominant Delta Air Lines, which resulted in greater DLH demand "leaking" to MSP. Some specific time periods with relatively larger traffic changes:

- **2002-2008.** Traffic increased at a Compounded Annual Growth Rate (CAGR) of 2.16% during this period. During this period, Delta Air Lines added significant capacity into the market, almost doubling daily departure frequencies from 5 in 2002 to as high as 9.3 in 2004. Delta's seat capacity almost

doubled during this same time period. In addition, Allegiant entered the market in 2006 which also contributed to traffic growth.

- **2008-2010.** During the U.S. economic recession, DLH, like most markets across the country, experienced reductions in air service, resulting in a 5.25% CAGR traffic decline during this period. Most of these declines were driven by Delta reductions in service largely due to relatively low DLH load factors, which were typically in the 50% range. To some degree, United Airlines offset these declines, by adding DLH-ORD service in late 2009, along with continued growth in Allegiant Airlines service.
- **2010-2018.** Delta continued to steadily reduce service at DLH during this period, with seat capacity being reduced by approximately 40%. This was driven by the Northwest Airlines-Delta Air Lines merger integration and continued sub-par Delta load factors at DLH. Somewhat offsetting Delta's declines was the steady growth of United Airlines, who increased enplaned passenger volume from approximately 21,000 in 2010 to almost 58,000 in 2018. Finally, Allegiant Airlines exited DLH in early 2015. Allegiant's traffic peaked at about 36,000 enplanements in 2012.

DLH's air traffic trends since 2000 have largely been a function of Delta steadily reducing service, with other airlines, mostly United and for a period, Allegiant, offsetting some of those declines.

The effect of these capacity declines, in conjunction with moderately higher economic growth from the region has been sharply high load factors and airline profitability, as was noted earlier.

As of year-end 2018, carrier load factors were averaging close to 80%, as compared to load factors in the 50%-60% range in the 2000s. Specifically, Delta generated an 85% load factor for CY 2018 and was even above 80% during the seasonally slower first quarter.

To summarize DLH's current air service situation, prior to the onset of the pandemic DLH was positioned better than likely anytime over the past 25+ years. This was due to: 1) Load factor increases from the 50s earlier this decade to the 80s currently. In other words, planes were full. Once load factors begin ranging from 85%-90%, carriers look at adding more capacity; 2) Mileage-adjusted RASMs are well above system averages – indicative of relative profitability and 3) Finally, there was more demand than is currently flying out of DLH, due to significant leakage to MSP.

3.4.5 DLH Commercial Aircraft Operations

Commercial operations (takeoffs and landings) at DLH have declined by approximately 33% since 2000, as noted in **Table 3-14** below. But, when excluding CY 2000, the Commercial Operations decline has been more moderate, having declined 13.7% over the past seventeen years.

Most of the declines have been due to Delta Air Lines cutting mainline flights as discussed earlier. Most of the reduced operations were on larger Airbus 319/320 and McDonnel Douglas DC9-30/50 aircraft. These larger aircraft were then replaced with smaller regional jet aircraft, primarily the 50-seat CRJ aircraft. From 2013-2017, Delta did seasonally increase the gauge during the peak season (summer) travel period, operating an Airbus 320 aircraft.

In 2018, United began flying an A319 into DLH on their overnight pattern. This was due to United's Airbus Maintenance base being located at DLH. This service pattern continued until AAR exited Duluth in mid-2020.

In May, 2019, American Airlines started 2x daily service between DLH-ORD, operating 50-seat regional jets. In addition, Delta upgraded and added frequency in the fall of 2019.

Table 3-14 – DLH Historical Commercial Aircraft Operations

Fiscal Year	Air Carrier	Air Taxi & Commuter	Total	% Change
2000	8,132	5,909	14,041	-
2001	6,117	4,749	10,866	(22.6%)
2002	5,292	6,172	11,464	5.5%
2003	5,737	3,338	9,075	(20.8%)
2004	5,266	5,795	11,061	21.9%
2005	4,554	4,921	9,475	(14.3%)
2006	3,953	4,936	8,889	(6.2%)
2007	4,480	5,431	9,911	11.5%
2008	4,518	5,055	9,573	(3.4%)
2009	3,354	5,750	9,104	(4.9%)
2010	1,412	9,525	10,937	20.1%
2011	534	10,302	10,836	(0.9%)
2012	810	10,597	11,407	5.3%
2013	755	11,247	12,002	5.2%
2014	1,215	9,891	11,106	(7.5%)
2015	1,712	8,485	10,197	(8.2%)
2016	1,283	7,765	9,048	(11.3%)
2017	1,154	8,190	9,344	3.3%
2018E	1,594	7,793	9,387	0.5%

Source: August 2019 DLH Terminal Area Forecast (TAF). Air Carrier: 60 seats or greater, Commuter <60 seats

3.4.5.2 Aircraft Fleet Mix: Passenger Aircraft Operations

Scheduled departure data was further analyzed for operational trends over the past seven years in **Table 3-15**. As noted previously, there has been a shift toward larger aircraft in the industry, particularly due to the large reduction in 50-seat flying across the industry in favor of larger 64-76 seat regional jets. These trends have been slower in coming to DLH but are expected to impact the airport in the coming years.

Table 3-15 – Historical Operations by Aircraft Type

Seating Capacity	2013	2014	2015	2016	2017	2018
Commuter						
40-60 Seats	94.1%	83.2%	77.4%	81.9%	82.7%	76.0%
Air Carrier						
61-99 Seats	0.7%	7.0%	12.8%	12.0%	17.3%	14.8%
100-120 Seats	-	-	2.8%	2.1%	-	-
121-150 Seats	-	3.8%	3.6%	2.6%	-	9.1%
151+ Seats	5.1%	6.0%	3.3%	1.4%	-	0.1%

Source: BTS Report T-100 for 2013-18; (source: Innovata)

3.5 Passenger Air Traffic Activity Forecasts

L&B reviewed past activity and related forecasts for DLH. The upcoming section forecasts DLH enplaned passenger activity for the 5, 10 and 20-year time periods. The forecast will consist of two primary steps: a short-term review and a long-term forecast as is described in the sections below. Additionally, a forecast of commercial aircraft operations, including by aircraft, type was prepared.

3.5.1 Base Year Enplanements

The Airport reported that enplaned passengers for CY 2018 were 140,485, which represented a 12.1% increase versus 2017. It was also 8.7% higher than the latest FAA TAF estimate of 129,282. CY 2019 enplanements were 155,531, a 13.69% increase over 2018.

This forecasting effort was completed prior to 2019 enplanement data being officially available. CY 2018 enplanements were used for the baseline for this forecasting effort. Although 2019 enplanement data became available during the Master Plan process, it was determined that 2018 represented a more accurate base year as it reflected a better picture of a baseline since the 2019 enplanements were inflated due to a short-term introduction of American service and additional capacity by both Delta and United.

3.5.2 Long-term Forecast Review

The long-term forecast at Duluth will be done for 5, 10 and 20-year time periods, using 2018 estimates as the baseline. The enplaned passenger forecast below, will be done using a variety of forecast methodologies: 1) Historical Trends, 2) FAA Forecasts, 3) DLH market shares of industry projections and 4) Regression analysis of the Air Service Area's economic metrics.

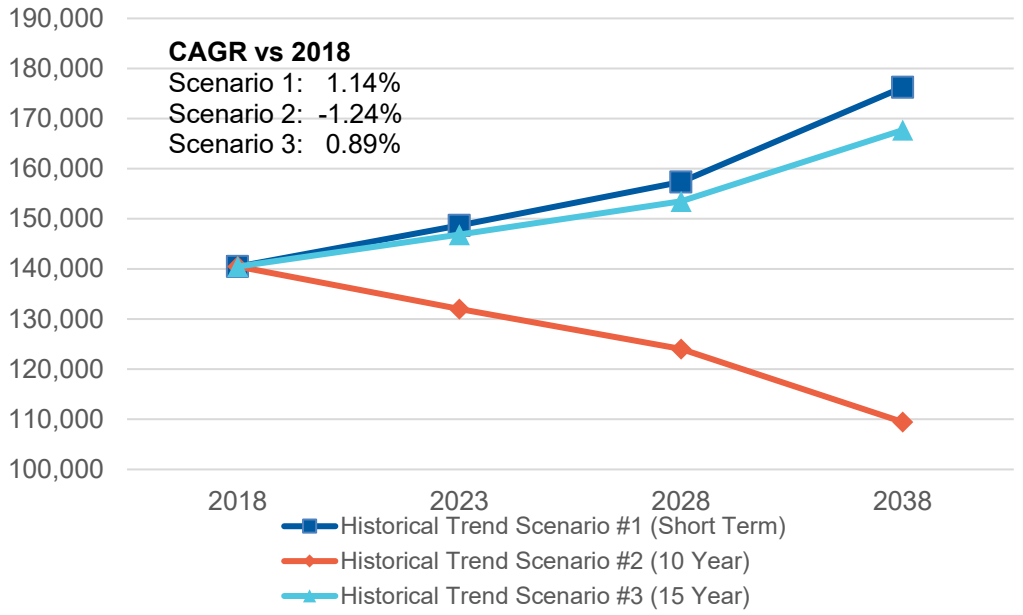
3.5.2.1 Historical Trend Analysis

Three historical trends have been considered for future projections:

- **Historical Trend Scenario #1 (Short-term trend):** The first historical trend emulates the past five years (2013-2018) at DLH, using 2018 enplaned passengers as the baseline. The past five years was a time-period when the area saw moderate economic growth and increased United seat capacity in 2018. The CAGR in enplaned passenger traffic during this five-year period was 1.14%. This is **Historical Trend Scenario #1**.
- **Historical Trend Scenario #2 (10-Year Trend):** The second trend uses data from the ten-year period of 2008-2018, reflecting a CAGR of (-1.24%). This period incorporated the significant recession and subsequent economic climb back. This projection will serve as the basis for **Historical Trend Scenario #2**.
- **Historical Trend Scenario #3 (15-year Trend):** The third historical trend uses a 15-year period of historical data (2003-2018) and reflects a CAGR of 0.89%. This projection will be the basis for **Historical Trend Scenario #3**.

Chart 3-12 illustrates the results of applying these trends to 2018 actuals of 140,485 passenger enplanements. It should be noted that in both of the positive growth scenarios (Scenarios 1 and 3), the 2023 enplanement levels do not reach 2019 levels until around 2027 in both scenarios.

Chart 3-12 – DLH Enplanement Projections (Historical)



Source: Landrum & Brown Analysis

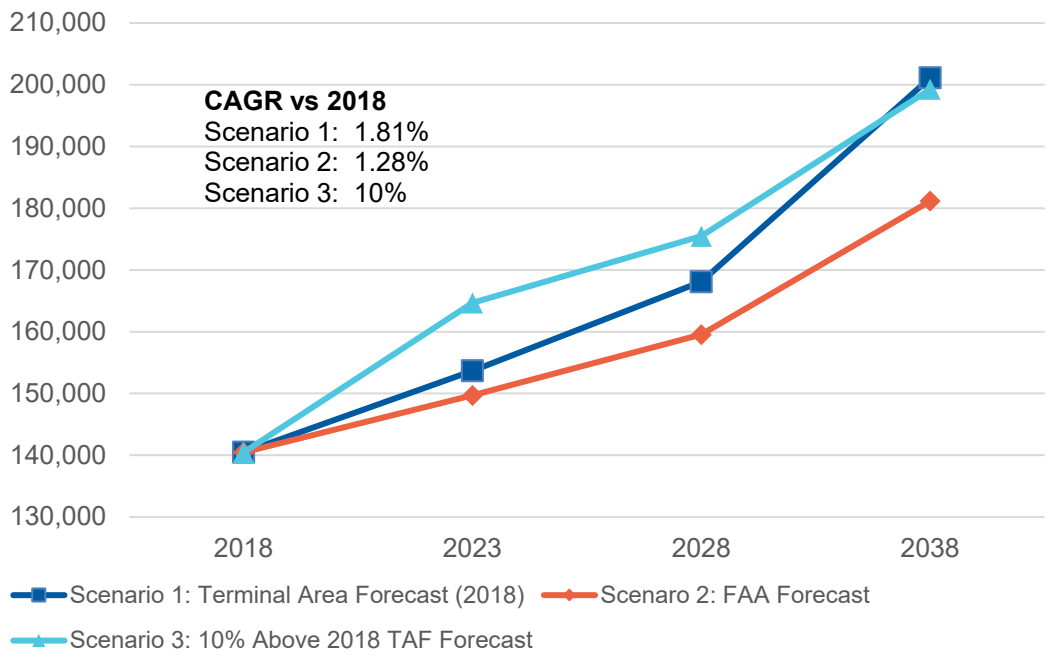
3.5.2.2 FAA Forecast Sources and Scenarios

The FAA presents aviation activity forecasts in several different sources, including the following two sources to be considered in this forecast analysis:

- **FAA Forecast Scenario #1 (FAA Aerospace Forecasts):** This document provides growth projections for the entire aviation industry in fiscal years, as described earlier. In this document, the FAA predicts that annual total enplanements for U.S. domestic air carriers will increase at a CAGR of approximately of 1.81% annually between 2018 and 2038. This growth rate, applied to the 2018 baseline DLH enplanements, will serve as the basis for **FAA Forecast Scenario #1.**
- **FAA Forecast Scenario #2 (2017 FAA Terminal Area Forecast):** The TAF utilizes national growth trends, coupled with historical local growth trends, to develop airport-specific activity forecasts on a fiscal year basis (October-September). The most recent TAF enplanement projections include a compound growth rate of approximately 1.28% annually for DLH between 2018 and 2038. This will serve as the basis for **FAA Forecast Scenario #2** (using baseline enplaned passengers of 140,485 for 2018).

Chart 3-13 illustrates the results of applying these scenarios based upon FAA Forecast documentation to the baseline 2018 forecast of 140,485 enplanements. The figure also depicts **FAA Forecast Scenario #3**, an enplanement level at 10% above the TAF of the forecast period, typically viewed by the FAA as the level of variation from the TAF that is deemed acceptable before additional justification is required to support higher forecasted activity levels.

Chart 3-13 – DLH Enplanement Projections (FAA Forecasts)



Source: Landrum & Brown Analysis

3.5.2.3 Market Share Analysis

Market share analysis for airports can provide a valid benchmark from which to access future activity. This approach compares activity at a specific airport with a larger aviation market, such as total U.S. domestic enplanements, to develop a ratio of activity.

Applied to historical national enplanements as reported in the FAA Terminal Area Forecast (TAF), DLH's annual market share between 2000 and 2017 ranged between a low of 0.0166% of national enplanements in 2017 to a high of 0.0239% of national enplanements in 2012. In 2018, based upon Airport actuals, DLH's % of national enplanements was .018%. **Table 3-16** illustrates DLH's historical market share of national enplanements between 2000 and 2018.

Table 3-16 – Historical Market Share

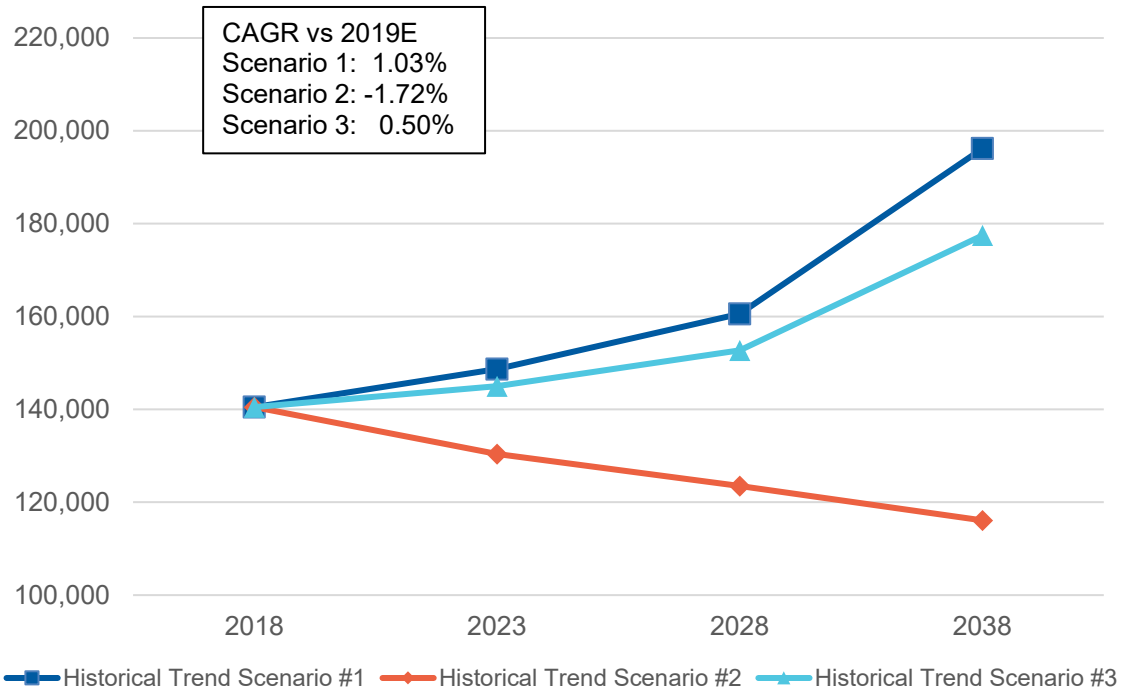
Fiscal Year	Enplaned Passengers	U.S. Domestic Enplaned Passengers (000s)	Airport Share of U.S. Domestic
2000	141,413	641,200	0.0221%
2001	137,253	625000	0.0220%
2002	140,031	626800	0.0223%
2003	123,061	574500	0.0214%
2004	144,741	628,500	0.0230%
2005	148,973	669,500	0.0223%
2006	137,658	668,400	0.0206%
2007	161,386	690,100	0.0234%
2008	159,179	680,700	0.0234%
2009	126,674	630,800	0.0201%
2010	142,919	635,200	0.0225%
2011	147,635	650,100	0.0227%
2012	156,444	653,800	0.0239%
2013	155,738	654,300	0.0238%
2014	155,032	669,000	0.0232%
2015	135,772	696,000	0.0195%
2016	123,315	726,000	0.0170%
2017	123,363	744,000	0.0166%
2018	140,485	781,000	0.0180%

Source: FAA TAF, DLH Airport Authority (2018 only for DLH)

Projections of future enplanement activity based upon market share analysis were conducted using the following scenarios:

- **Market Share Scenario #1 (Constant Market Share):** DLH market share will remain constant at 2018 level of 0.0180% of national enplanements through 2038 (using FAA's TAF Forecast of national enplaned passengers). This projection will serve as the basis for **Market Share Scenario #1**.
- **Market Share Scenario #2 (Market Share Change I):** DLH market share will change at the CAGR experienced between 2008-2018 (CAGR of -2.59%) through 2038, starting with the 2018 share of 0.018% and then declining at the -2.59% rate. This projection will serve as the basis for **Market Share Scenario #2**.
- **Market Share Scenario #3 (Market Share Change II):** DLH market share will change at the CAGR experienced between 2009-2015 (CAGR of -0.5%) through 2038, starting with the 2018 share of 0.018% and then decline at the 0.5% rate. This projection will serve as the basis for **Market Share Scenario #3**.

Chart 3-14 – DLH Enplanement Projections (Market Share)



Source: Landrum & Brown Analysis

3.5.2.4 Regression Analysis Projections

Regression analysis, which projects values for a dependent variable based on establishing a statistical relationship between one or more other independent variables, was utilized to determine if a statistically reliable relationship exists between historical passenger enplanements at DLH (dependent variable) and several local socioeconomic indicators (independent variable(s)).

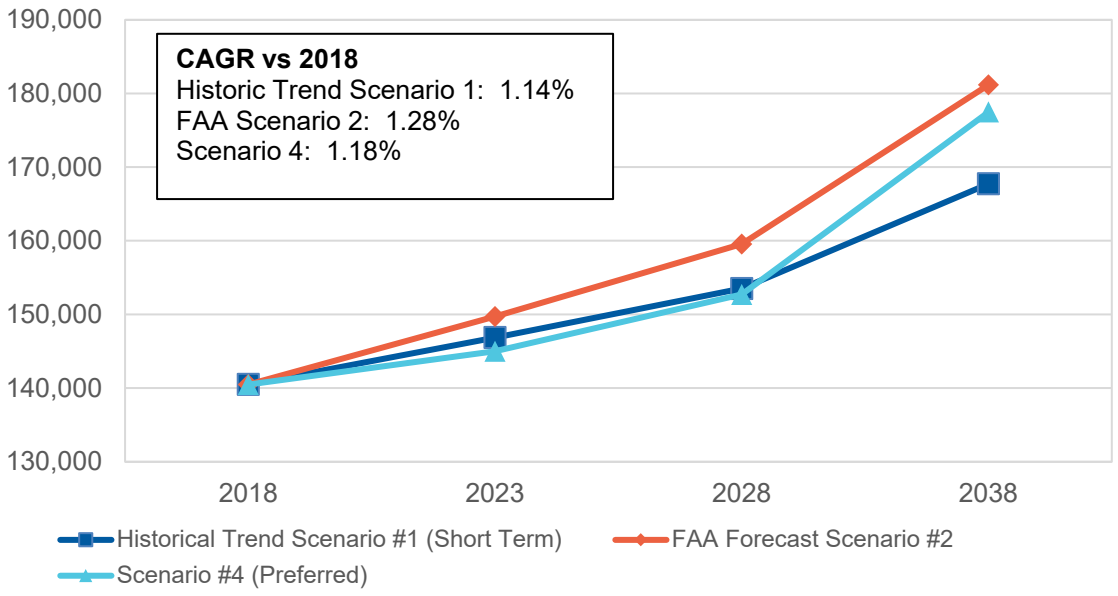
The socioeconomic indicators that were evaluated as independent variables in the projection of future passenger enplanements at DLH include MSA population, per capita personal income, total earnings, gross regional product, retail sales, median household income and non-farm payrolls. Finally, a multiple-regression analysis was performed combining all seven independent variables.

The statistical reliability of projections made to the dependent variable through a regression analysis is evaluated using the coefficient of determination, or R-squared value. Technically, the R-squared value explains the relative accuracy of the association between the dependent and independent variables. An R-squared value of 1.0 indicates a perfect correlation between variables; R-square values of less than 0.70 typically indicate that there is less correlation. An R-squared value of 0.90 is generally used as a threshold to depict a high level of statistical reliability. None of the studied socioeconomic factors studied resulted in an R-squared greater than 0.25, indicating little correlation between historical enplaned passenger volume and socioeconomic factors. Hence, these should not be considered reasonably reliable for planning/forecasting purposes.

3.5.2.5 Selection of the Preferred Forecast Range

The preceding sections have presented enplanement projections from several analytical sources. From these sources, a range of potential future enplanement activity can be established. Historical Trend Scenario #1, FAA Forecast Scenario #2 and a merged Scenario #4 were chosen. Those are shown below in **Chart 3-15**.

Chart 3-15 – DLH Preferred Passenger Enplanement Forecast Range



Source: Landrum & Brown Analysis

For the 20-year forecast period, the preferred forecast CAGR is 1.18% (Scenario #4). This compares to the FAA's U.S. CAGR of 1.81% for all U.S. airports and is also below the latest TAF CAGR of 1.28% during this same time-period. The 2038 forecast of 177,485 is 6.4% above the TAF forecast, due to the actual 2018 enplaned passengers exceeding the latest TAF estimate by 8.9%.

The preferred forecast 5-year CAGR is 0.63% and the 10-year CAGR is also 0.84%. The TAF CAGR for this same 5-year time period is 1.28% and the 10-year CAGR is 1.28%.

3.5.3 Evaluation of Preferred Forecast Against the Impacts of the Coronavirus Pandemic

The established forecast was developed prior to the full extent and duration of the Coronavirus pandemic being known. The forecast was re-evaluated in fall 2020 and it was determined that the 5 and 10-year projected activity levels represented an accurate projection of likely future air service activity levels. With the selected enplanement forecast (Scenario #4), the enplanement levels surpass 2018 in 2023 but do not reach 2019 levels (when American served DLH and additional Delta and United capacity was added) until after 2028.

The ongoing impacts of the Coronavirus pandemic are still unknown. However, with the introduction of a vaccine in 2020, travel is expected to rebound in the coming years. Air service is forecasted to return to pre-pandemic levels in many markets by 2023. Domestic air travel is expected to reach pre-pandemic levels prior to international travel.

3.5.4 Alternative, Unconstrained Enplaned Passenger Forecast(s)

The above forecasts are considered the most likely as it pertains to the Master Plan Forecast given information available today on the potential for new or increased capacity or service. These forecasts generally assume that after DLH's extreme growth over the past two years, that in addition to pandemic recovery there will be a relatively long "digestion" period, where the market over time grows back into capacity as it is reintroduced and business travel returns.

The proposed Master Plan Forecast could be conservative, given that DLH enplaned around 155,000 passengers in 2019.

In addition to what could be a conservative, baseline forecast, DLH has further upside based upon recent air service initiatives and carrier feedback. Additional "unconstrained" passenger forecast scenarios were developed to account for potential growth beyond the selected forecast. These scenarios and the rationale for these is summarized below:

- **Alternative Scenario 1:** Potential nonstop service on United Express to Denver. United Express (SkyWest Airlines) has supported a DLH Small Community Air Service Development Grant (SCASDG) application, indicating their intent to serve the DLH-DEN market should DLH be awarded the SCASDG. DLH has applied previously for a SCASDG grant and has applied again in early 2021. The route would operate daily on a CRJ-700 aircraft.
- **Alternative Scenario 2:** Seasonal, less-than-daily nonstop service to a leisure destination. Markets deemed most likely are Fort Myers, Orlando, Phoenix and Cancun. Sun Country Airlines expressed interest prior to the pandemic and would fly a 737-800 aircraft. Tied to this, Landline, a van/shuttle operator is operating between DLH and MSP since 2019, generating approximately 1,500 one-way passengers per month (pre-pandemic). As Sun Country was the initial backer of this operation and passenger bags can be directly transferred at MSP, many of the passengers (although not all) are ultimately flying Sun Country out of MSP. Furthermore, Sun Country indicated initially that the success of Landline would likely influence the likelihood of future Sun Country service to DLH.

An overview of these scenarios is included in **Table 3-17**.

Table 3-17 – Alternative Forecast Scenario Summary

Passenger Forecast Summary Realistic Alternatives at DLH			
	2023	2028	2038
Baseline Enplaned Passenger Forecast	145,000	152,710	177,720
Alternative 1: DEN – DLH Service			
Enplaned Passengers	14,906	17,428	17,428
Load Factor	75%	75%	75%
Annual Departing Seats	19,874	23,238	23,238
Annual Departures	306	306	306
Alternative 2: Seasonal SY Service			
Enplaned Passengers	10,150	15,226	15,226
Load Factor	80%	80%	80%
Annual Departing Seats	12,688	19,032	19,032
Annual Departures	69	104	104
Baseline Forecast + Alternative 1	159,906	170,138	195,148
Baseline Forecast + Alternative 2	155,150	167,936	192,946
Baseline Forecast + Both Alternatives	177,562	194,980	219,990
DLH-DEN Key Assumptions: CRJ-00 flown in 2023, upgraded to CRJ-900 in 2028; assumes service is flown 6x weekly with a 98% completion factor. DLH Seasonal Sun Country Service Assumptions: Assumes 2x weekly service from mid-December through mid-April; service to RSW & MCO in 2023, with CUN added beginning in 2028.			

As can be seen in Scenario 1, the DLH-DEN forecast adds an additional 14,906 enplaned passengers in 2023, assuming a CRJ-700 is operated on this route. In this scenario, it is assumed that this route is upgraded to a 76-seat CRJ-900 aircraft in 2028, increasing the enplaned passenger forecast by 17,428 for both 2028 and 2038. This forecast could be conservative, as if the route proves successful, it is likely that United would add additional frequencies on this route further increasing enplanements.

In Scenario 2, the addition of Sun Country service adds 10,150 enplaned passengers in 2023 with the addition of a domestic route and increases to 15,226 in 2028 and 2038 with the addition of Cancun service. It is expected that the service in this scenario would capture passengers that are currently driving to MSP, thus creating a true increase in the total passengers and not a redistribution of DLH passengers from one airline (Delta or United) to another (Sun Country). Given historical Allegiant Airlines service in this market and what was generally successful until late (especially during peak season), it is very realistic for this service to occur.

Overall, it is feasible that enplaned passenger volumes could exceed 177,000 by 2023, eventually reaching almost 220,000 by 2038. Even if just one of the alternatives would occur, this could result in enplaned passenger volumes approximating 170,000 by 2028 and 195,000 by 2038. At these higher forecasted passenger levels, DLH “leakage” is still estimated to be around 30%.

These alternative forecasts will be considered in the facility recommendations chapter, particularly as it relates to the terminal. During 2019, all four gates at DLH were in use overnight. An increase in service to 2019 levels with all four gates used concurrently for periods of the day could create congestion in the terminal or gate use.

3.6 Passenger Aircraft Operations & Fleet Mix Forecast

The following forecasts include air carrier operations and fleet mix. This forecast was done at a macro-level and ties to earlier enplaned passenger forecast. It follows expected industry trends, of less 50-seat regional jet flying and increased larger RJ flying (64-76 seat jets).

3.6.1 Airline Fleet Mix

The type of passenger service aircraft that utilize the airport defines the operations needed to serve the forecasted enplanements. Flight schedules for calendar years 2015-2019 were reviewed to develop an annual schedule and current aircraft fleet mix. Projected fleet mix is developed based on known industry trends. The eventual phase-out of the 50-seat regional jet is significant to the overall fleet mix at DLH as this has historically been the predominant aircraft serving DLH. This fleet mix is expected to begin being phased out of U.S. airline fleets starting in the early 2030's.

Table 3-18 shows forecasted aircraft fleet mix details by number of seats (considering aircraft operations and operating seats) from 2018 through 2038. As indicated earlier, there will be an overall trend toward larger aircraft, less operations and moderate overall seat capacity growth during the forecast period.

Table 3-18 – Airline Fleet Mix by Number of Seats

Seating	2018	2023	2028	2038
Less Than 40 Seats	-	-	-	-
40-60 Seats	76.0%	83.2%	75.3%	-
61-99 Seats	14.8%	7.9%	15.6%	90.0%
100-120 Seats	-	-	-	-
121-150 Seats	9.1%	8.6%	8.9%	9.7%
151+ Seats	0.1%	0.3%	0.3%	0.3%

Source: Published Flight Schedules (Innovata) for 2017; Landrum and Brown analysis

The 50-seat Embraer/Canadair regional jets are assumed to be partially phased out by 2028 and entirely phased out by 2038. While Canadair CRJ-700/900 (or comparable 76-seat jet such as the EMB 175) will backfill much of these reductions, it will not be a one for one trade off. The net result will be less operations from these aircraft types but at higher overall seat capacity levels as compared to today when much more 50-seat regional jet frequency exists.

The key operations assumptions are that 83.2% of 2023 operations will be on 50-seat regional jets, with 15.6% on (mostly) CRJ-700s and 7.9% on A319/A320 aircraft or similar. The increase in 50-seat jet flying is driven by recent American Airlines additions to the market and increased Delta frequency. The shift to larger regional jets starts in the years between 2023 and 2028, with the wholesale transition to larger regional jets taking place by 2038. By 2038, it is assumed that all flying in the 61-99 seat category will be 76-seat regional jets, either in the form of CRJ-900 or EMB-175 aircraft. It is also assumed that United and/or Delta will occasionally utilize A319/320 type aircraft at DLH during the 20-year forecast period. **Table 3-19** includes a forecast of passengers per departure.

Table 3-19 – Passengers per Departure

Seating Capacity	2018	2023	2028	2038
Regional (<60 seats)				
Average Seats Per Departure	50.0	50.0	50.0	-
Average Load Factor	84.8%	72.0%	75.0%	-
Enplanements Per Departure	42.4	36.0	37.5	-
Air Carrier (60+ seats)				
Average Seats Per Departure	92.5	100.9	95.6	81.0
Average Load Factor	71.2%	59.8%	63.5%	67.8%
Enplanements Per Departure	65.8	60.4	60.7	55.1
Total				
Average Seats Per Departure	60.3	58.6	61.3	81.0
Average Load Factor	77.7%	68.5%	70.6%	67.8%
Enplanements Per Departure	48.1	40.0	43.3	55.1

Source: Landrum and Brown Analysis, Diio (2018)

3.6.2 Passenger Airline Operations

Passenger airline operations are determined from the average enplanements per departure from the fleet mix determinations. An operation is considered an aircraft takeoff or landing. Forecasted operations for passenger airlines is shown in **Table 3-20**.

Table 3-20 – Passenger Airline Operations

Metric	2018	2023	2028	2038
Departures				
Regional (< 60 Seats)	2,121	3,009	2,651	'-
Air Carrier (> 60 Seats)	677	6,610	874	3,224
Operations				
Regional (< 60 Seats)	4,242	6,018	5,302	-
Air Carrier (> 60 Seats)	1,354	1,219	1,748	6,448
Total Operations	**5,596**	**7,237**	**7,050**	**6,448**

Source: Landrum and Brown Analysis, Diio (2018)

These forecasts were developed based on likely airline operations commensurate with the selected enplanement forecast. It should be noted that if either of the alternative forecast scenarios occur (United service to Denver or Sun Country service to a leisure destination), additional operations would occur. Neither of the alternative forecast scenarios are included in these operations forecasts.

3.6.3 Summary

A summary of the selected passenger activity forecast (enplanements and operations) is provided in **Table 3-21**. As noted earlier, it is expected that operations may drop over time, as larger aircraft replace 50-seat regional jets. Seat capacity is forecasted to grow over the next 20 years, although operations will decline.

Note that load factors will likely drop versus more recent levels post-pandemic and as larger aircraft begin to serve DLH.

It should be noted that the selected forecast below pertains to the selected forecast and does not include the passenger forecast scenarios noted earlier.

Table 3-21 – Preferred Passenger Airline Forecasts Summary

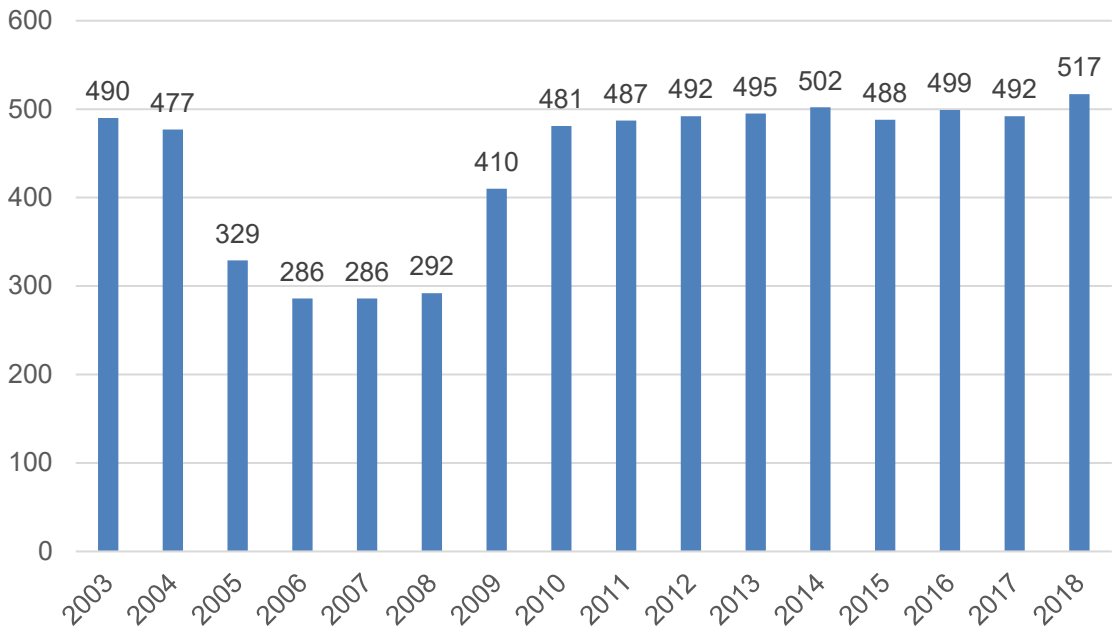
Metric	2018	2023	2028	2038
Enplanements				
Regional (< 60 Seats)	69,609	108,201	99,412	-
Air Carrier (> 60 Seats)	70,876	36,799	53,298	177,720
Total Enplaned Passengers	**140,485**	**145,000**	**152,710**	**177,720**
Avg. Seats/Departure	60.3	58.6	61.3	81.0
Avg. Load Factor	77.7%	68.5%	70.6%	67.8%
Operations				
Regional (< 60 Seats)	4,242	6,018	5,302	-
Air Carrier (> 60 Seats)	1,354	1,219	1,748	6,448
Total Operations	**5,596**	**7,237**	**7,050**	**6,448**

Source: Landrum and Brown Analysis

3.7 Cargo Activity

Chart 3-16 below illustrates historic cargo operations at DLH since 2003. While DLH cargo operations dropped preceding and during the U.S. recession in the late 2000s, they have been very stable since 2010, exhibiting a small increase in 2018. Over the 8-year period (2018 vs 2010), cargo operations grew at a CAGR of 0.91%, which is somewhat consistent with economic growth in Duluth.

Chart 3-16 – DLH Air Cargo Operations



Source: Landrum & Brown Analysis

The fleet mix of these operations has shifted materially over time. Through 2009, Federal Express (FedEx) flew a combination of larger cargo aircraft (B727s, A310s) and Cessna 208 Caravan aircraft by typically flying larger aircraft directly into their Memphis (MEM) hub, with a mix of “tag” flights into Grand Forks (GFK), Rochester (RST) and Minneapolis-St. Paul (MSP).

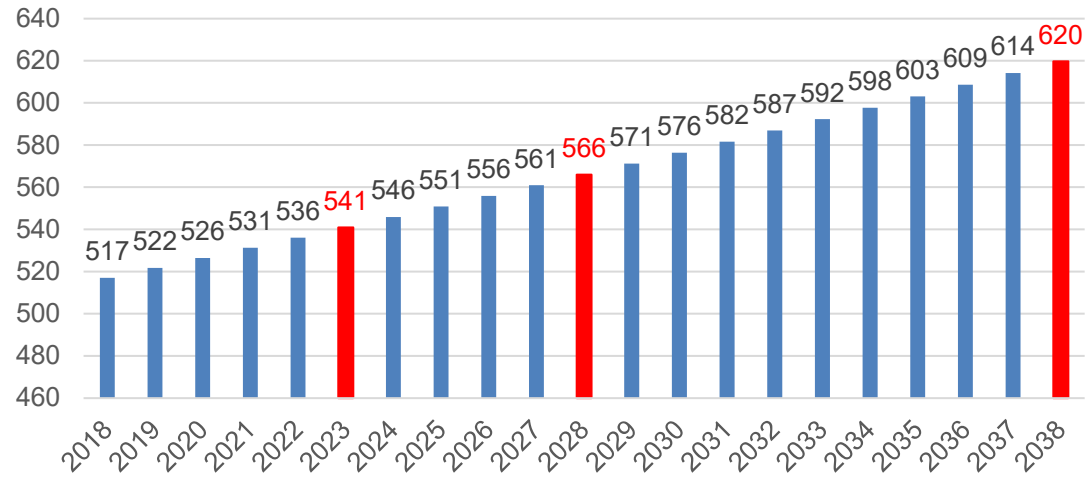
Since 2010, when operations stabilized, FedEx has served the DLH cargo market almost exclusively with Beechcraft Beech 18 C-185 and ATR-43 aircraft.

Since 2010, when FedEx’s DLH operation has stabilized, Federal Express has consistently flown directly into MSP as Federal Express has expanded at MSP. In addition to FedEx air cargo service, UPS ships air cargo in and out of DLH utilizing a Beech Queen Air operated by Bemidji Air.

3.7.2 Cargo Operations Forecast

It is anticipated that the current fleet of aircraft operating at DLH will continue to operate for the near future. It is assumed that cargo operations activity will grow at a 0.91% CAGR, which is the same rate that was generated over the past eight years. A summary of the air cargo operations forecast is provided below.

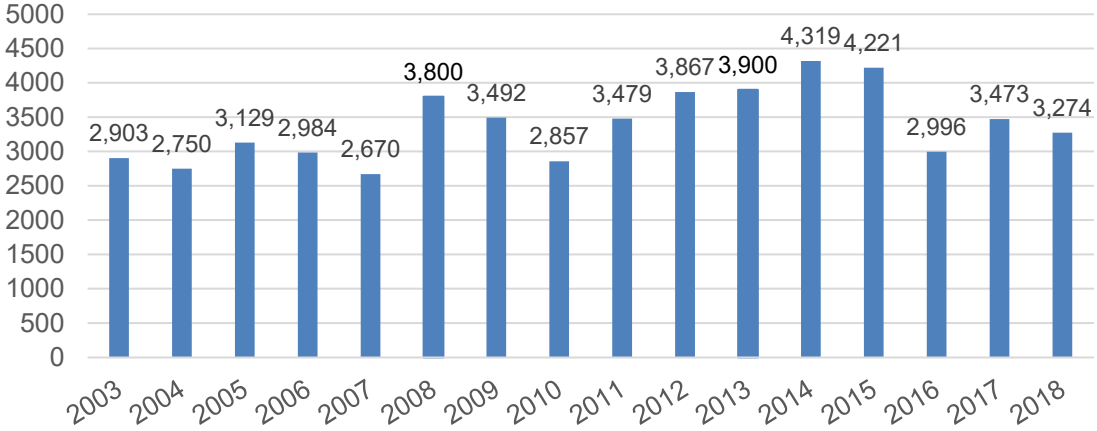
Chart 3-17 – Forecasted DLH Air Cargo Operations



3.8 Other Commercial Operations Forecast (Non-passenger/cargo - Air Taxi)

Air taxi annual operations are illustrated below in **Chart 3-18**. The Airport historically generates relatively consistent Air Taxi demand, in part driven by Duluth's being a regional "hub" for healthcare service and other business. Additionally, DLH it utilized as a stopping point for many international flights using DLH for Customs and refueling. For forecast purposes, it is assumed that operations will remain flat during the remainder of the forecast period.

Chart 3-18 – DLH Air Taxi Trends



Source: DLH TAF, T100, Landrum and Brown analysis

3.9 Commercial Forecast Summary

The selected forecast of the various types of commercial activity at DLH is summarized in **Table 3-22**.

Table 3-22 – Selected Commercial Aviation Forecasts Summary

	Metric	2018	2023	2028	2038
Enplanements	Air Carrier	70,876	36,799	53,298	177,720
	Commuter/Regional	69,609	108,201	99,412	-
	Total Enplanements	**140,485**	**145,000**	**152,710**	**177,720**
Operations	Air Carrier	1,354	1,219	1,748	6,448
	Commuter/Regional	4,242	6,018	5,302	-
	Air Cargo	517	541	566	620
	Air Taxi	3,274	3,274	3,274	3,274
Total	Total Commercial Operations	9,387	11,052	10,890	10,342
	Avg. Seats/Operation	60.3	58.6	61.3	81.0
	Average Load Factor	77.7%	68.5%	70.6%	67.8%

Source: Duluth Airport Authority, Landrum & Brown Analysis

3.10 Based Aircraft Forecast

The preceding sections focused heavily on the commercial service forecasts for DLH. The steady growth of enplaned passengers and use of larger regional jet aircraft within the planning horizon exemplifies the City's need to continue to plan for future enhancements to the facilities directly related to air service operations. However, the commercial service forecasts only partially represent the forecasted facility needs for the airport. As such, another important forecast for airports to consider is the based aircraft forecast.

The FAA's definition of a based aircraft is an aircraft that is operational and airworthy, which is based at a specific facility for most of the year. Based aircraft can include any airworthy type of aircraft, such as gliders or ultralights; however, the FAA is mainly interested in an airport's based aircraft of the following types: single-engine piston, multi-engine piston, jet (including turboprop), and helicopters.

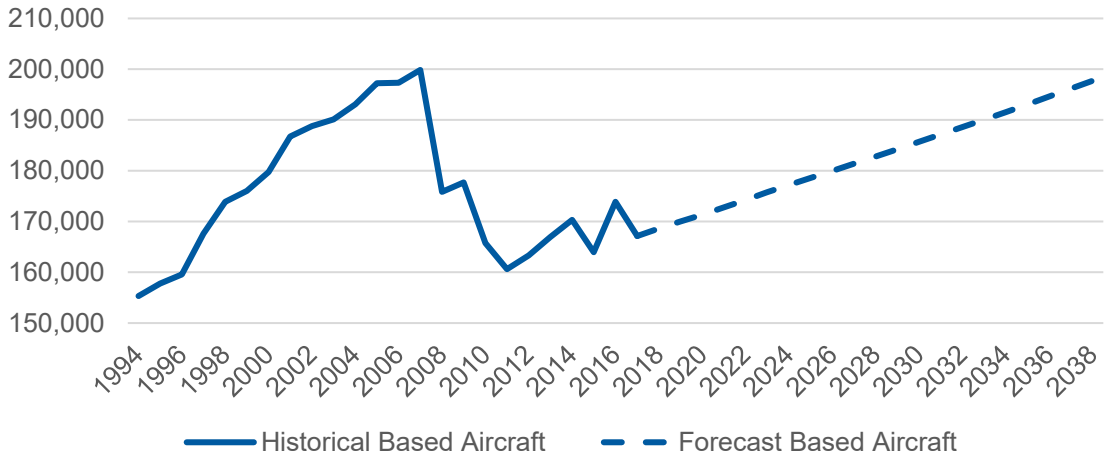
A based aircraft forecast is used to estimate the amount and types of aircraft an airport can expect to regularly use all components of the airfield, and therefore are an important aspect of planning for future development at the airport. For example, based aircraft can drive the need for hangars, additional parking apron, and even design standards of the airfield. Development of the based aircraft forecast for DLH includes the review of historical, existing, and forecasted data from the FAA and airport management records. For context, a brief discussion on based aircraft trends at the national level is also provided.

3.10.1 Based Aircraft at the National Level

On the national level, the *FAA Aerospace Forecast* provides an overview of aviation industry trends and expected growth rates for commercial passenger carrier, cargo carrier, and GA activity segments. National growth rates in enplanements, operations, fleet growth and mix for commercial fleets, and the GA fleet are provided over a 20-year forecast period. Using the published report for fiscal years 2018-2038 to align with DLH's baseline year of 2018, the *FAA Aerospace Forecast* indicates based aircraft at U.S. airports hit a 15-year low in 2011 after highs were achieved in 2007. The economic recession has been attributed with the decline in the number of based aircraft, which fell nearly 20 percent between 2007 and 2011. Since the

economic recovery from that period, national forecasts show a modest growth rate in based aircraft of 0.8 percent annually over the next 20 years. The gradual increase in based aircraft nationally beginning in the early 1990s, as well as the periods of decline, followed by a return to conservative growth is illustrated in **Chart 3-19**.

Chart 3-19 – U.S. Based Aircraft



Source: FAA Terminal Area Forecast

3.10.2 Based Aircraft at Duluth International Airport (DLH)

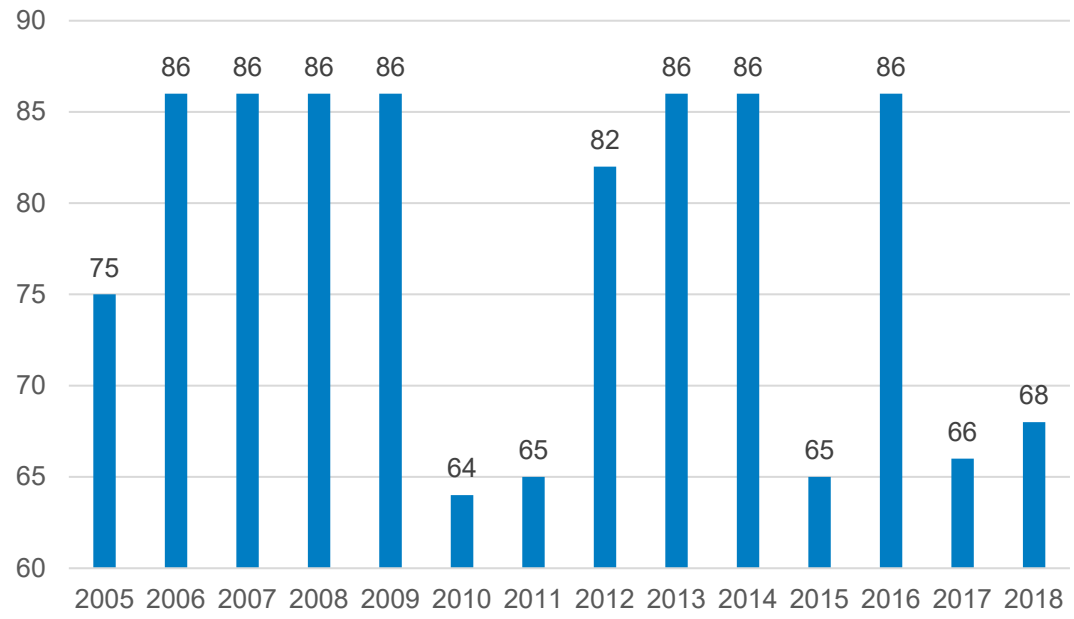
Prior to determining the forecasted based aircraft at DLH within the 20-year planning horizon, a review of historical and existing based aircraft data was necessary. Evaluating historical trends at an airport can be useful when projecting future aviation activity levels by providing insight as to what may be expected.

Sources examined for the historical and existing based aircraft figures included the FAA *Terminal Area Forecast* (TAF) and the FAA Form 5010-1, *Airport Master Record* (5010) and Airport records. The TAF is considered the official forecast of aviation activity for U.S. airports, and is often used for planning and budgeting for the implementation of capital projects. It also is a reference for historical data, as it is updated on an annual basis. Based aircraft at DLH from the last twelve years according to the most current TAF are depicted in **Chart 3-20**, except for 2018, which is from Airport Authority records.

In 2018, there were 68 DLH based aircraft. Many of these aircraft are stored in inexpensive hangars. Availability for hangar space is low in the area and this will likely limit growth in the future. The airport currently has a waiting list for hangar space and when a hangar becomes available it is typically quickly filled form a waiting user.

It should be noted that for any given year, there are approximately 20 military aircraft based at DLH. When the TAF estimates of Based Aircraft expand to the mid-80s as shown below, the incremental increase appears to be these military based aircraft at DLH being included in the total. The forecast below will focus upon GA-based aircraft. Military aircraft will be discussed later in this chapter.

Chart 3-20 – Duluth Historical Based Aircraft



Source: FAA Terminal Area Forecast for 2005-17; Airport Records for 2018

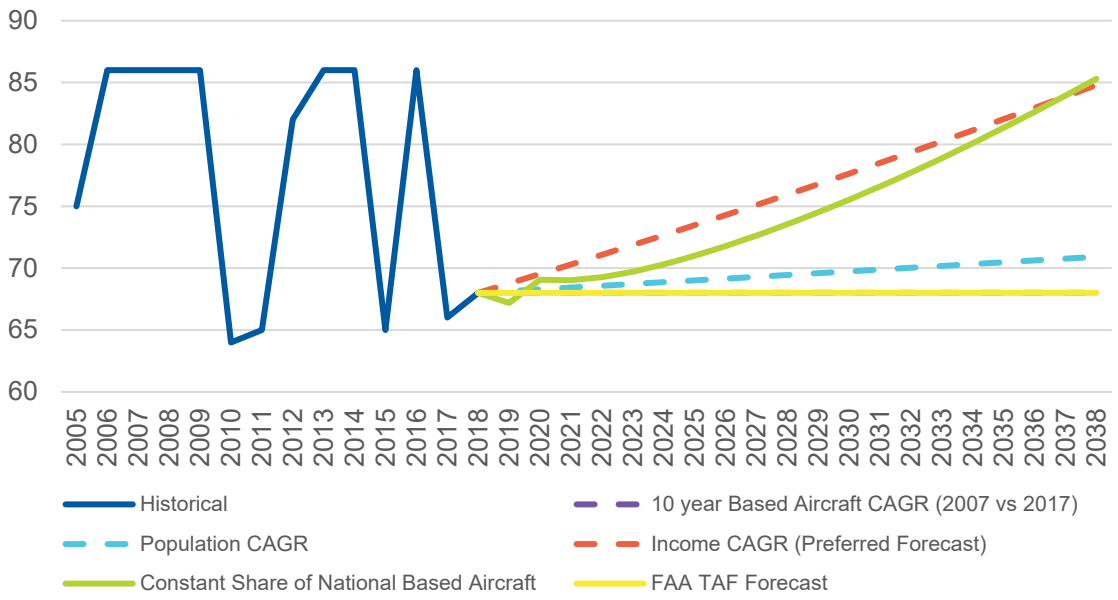
3.10.3 DLH Based Aircraft Forecast Methodologies and Analysis

Typical forecast methodologies used to predict based aircraft at airports include time series (trend), economic variables, regression, and market share analyses. These methods incorporate data from the FAA TAF and Aerospace Forecasts, airport management records, as well as other demographic and socioeconomic data. The specific forecasting methods applied to estimate based aircraft at DLH for the next 20 years included the following:

- Population CAGR (Metropolitan Statistical Area)
- 10-year DLH based aircraft CAGR
- Income CAGR (Metropolitan Statistical Area)
- DLH's constant share of the national based aircraft forecast

The outcomes produced by the forecasting methodologies listed below are illustrated in **Chart 3-21.** For comparative purposes, the historical and forecasted FAA TAF based aircraft are also included; the 2018 TAF published for DLH reports 68 based aircraft in 2018, growing to 89 based aircraft by 2038. This represents a CAGR of approximately 1.35 percent.

Chart 3-21 – Duluth Based Aircraft Forecast Methods



Source: FAA Terminal Area Forecast, Landrum & Brown Aviation Analysis

The income growth model for the Duluth metropolitan statistical area (MSA) was chosen as the preferred based aircraft forecast. As previously mentioned, airports are often influenced by fluctuations in demographic and socioeconomic factors within their surrounding communities. Although modest, increases in population for the Duluth MSA, combined with steady increases in employment and per capita income in the same MSA, have the potential to increase the Airport's aviation activity. The logic being that with these increases, there will be an increase in the economic base that may use general aviation aircraft for recreational or business purposes, and therefore be inclined to either build or lease a hangar and base an aircraft or fly to/from the Airport (or both) on a regular basis. This positive growth rate is supported by the ongoing waiting list for hangars at the airport. The selected based aircraft forecast is shown in **Table 3-23**.

Table 3-23 – Based Aircraft Forecast at the Airport

Metric	2018	2023	2028	2038	CAGR
Total Based Aircraft	68	72	76	85	1.12%

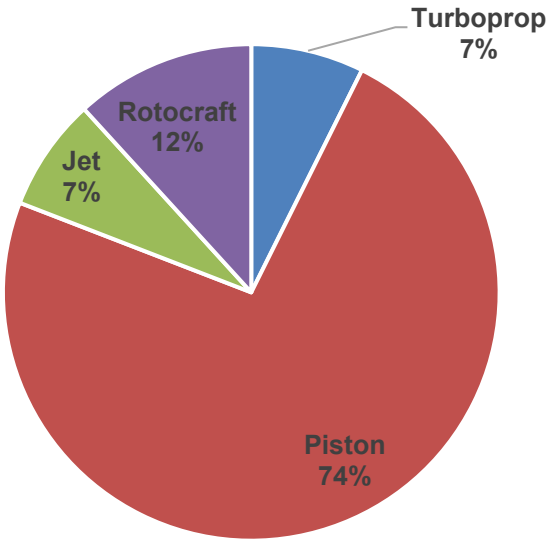
Source: Landrum & Brown Analysis

3.10.4 DLH Based Aircraft Mix

The estimate of based aircraft over the 20-year planning horizon at an airport can be further broken down into an aircraft fleet mix, or the types of aircraft, expected to be based at the airport during this time period. The existing breakdown of the types of aircraft based at the airport is reviewed, and then typically the preferred based aircraft forecast growth rate is applied to the forecasted based aircraft within each planning period, which in turn determines the forecasted fleet mix of based aircraft at the airport. The results of the based aircraft fleet mix are then utilized to determine if the airport's existing facilities will be able to meet the forecasted demand. This will be addressed in the subsequent facility requirements portion of the report.

Chart 3-22 displays the breakdown of the existing aircraft fleet mix as a percentage of total based aircraft found at DLH today.

Chart 3-22 – Existing Based Aircraft Mix



Source: DLH Airport Authority records

For context, the FAA *Aerospace Forecast, Fiscal Years (FY) 2018-2038*, includes the following fleet mix projections at the national level:

- Fixed-wing piston powered aircraft are projected to decline at an average annual rate of 0.8 percent.
- Turbine-powered piston (turboprop) and rotorcraft fleets are projected to increase at an average annual rate of 1.9 percent.
- Turbine jet aircraft are projected to increase at an average annual rate of 2.3 percent.

Presently, single-engine piston aircraft comprise the majority of the based aircraft fleet mix at DLH. Multi-engine piston aircraft and rotorcraft round out the mix to a lesser extent. Although the national forecast predicts a decline in single- and multi-engine piston aircraft, it is anticipated that these aircraft types could increase by modest amounts based on historical flight training (LSC and others) and recreational activities at DLH. Additionally, it is anticipated that rotorcraft use will continue to grow at DLH and growth in based rotorcraft (LSH and others) has also been included.

Table 3-24 – Mix of Based Aircraft Forecast at the Airport

Year	Piston	Jet	Turboprop	Rotorcraft	Total
2018 (Existing baseline)	50	5	5	8	68
2023	53	5	5	9	72
2028	55	6	6	9	76
2038	63	6	6	10	85

Source: Landrum and Brown Analysis; Baseline (2018) taken from Duluth Airport records

3.11 General Aviation Operations Forecast

General aviation (GA) annual operations were also developed for the 20-year planning period. General aviation operations include all aircraft operations other than the commercial service and air taxi operations or military operations. GA operations can be broken into either itinerant or local operations.

Like the based aircraft forecast, general aviation operations forecasts provide airports with information that can be useful for future development planning. Development of the based aircraft forecast for DLH includes the review of historical, existing, and forecasted data from the FAA and airport management records. Similar to based aircraft, a brief discussion on GA operations trends at the national level is also provided.

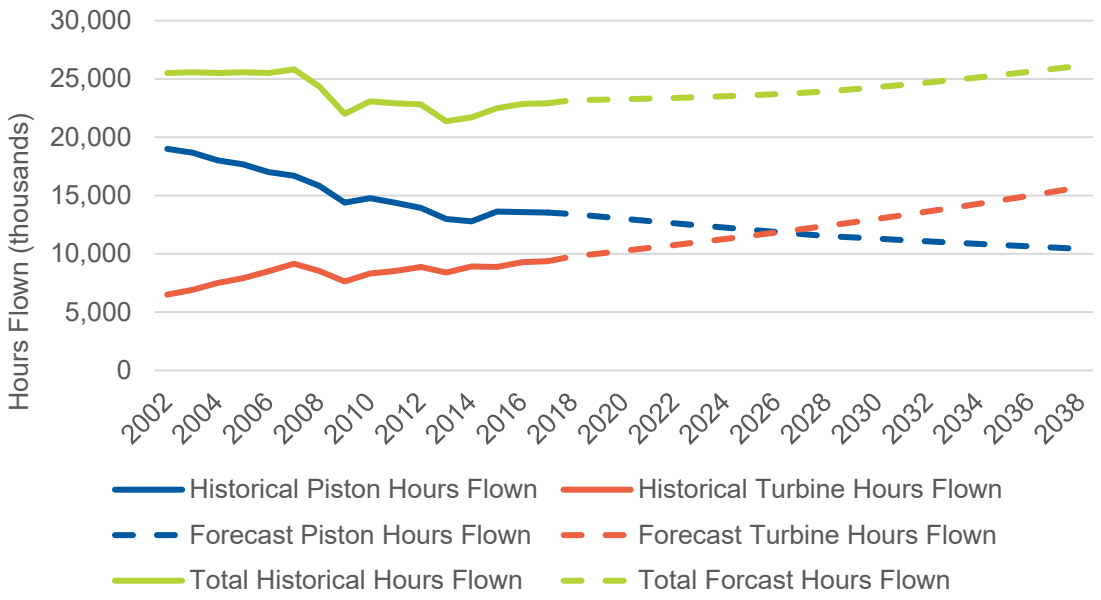
3.11.1 General Aviation Operations at the National Level

Review of the FAA Aerospace Forecast, Fiscal Years (FY) 2018-2038, reports the number of general aviation (GA) and air taxi (AT) hours flown nationally has decreased by 11 percent since 2001. According to the report, this decline can be attributed to the economic downturn of the early 2000s, the recession of the late 2000s, and increasing operating costs driven by fuel prices. Total GA and AT hours have been steadily increasing since 2012, and ultimately could reach slightly just above the flight hours flown in 2002 by 2038.

Within the overall GA and AT activity category, piston-powered and turbine-powered aircraft have seen a reversal in their activity starting in 2001. Since this time, there has been increased demand for the use of turbine-powered aircraft, and as such, active turbine hours have increased steadily since 2001 (except for the economic recession years from 2008-2011). These aircraft include turboprop and turbojet aircraft primarily used for corporate business travel. More corporate and business operators, large and small, are using GA aircraft for their transportation needs to save time and reduces costs. The number of turbine aircraft hours flown has increased an average of 3.1 percent annually. Helicopters, which are also used by corporations, have also seen steady increases in hours flown. Conversely, the number of piston-powered aircraft hours flown has decreased 0.89 percent annually. Although these types of aircraft still comprise most general aviation aircraft in the U.S., they are used primarily for recreational and flight training purposes. According to the *Aerospace Forecast*, decreases can be attributed to higher ownership costs, increased fuel prices, economic downturn, and a decreasing pilot population. Multi-engine piston aircraft have particularly seen a reduction with decreases of 2.0 percent annually. These aircraft types are being replaced by newer, more efficient turboprop aircraft for business travel.

The trend of strong growth in corporate aircraft, and steady or decreased use of piston aircraft, is expected to continue over the planning period. This forecast may fluctuate with new unleaded fuel engines potentially reducing the cost of flying. The number of turbine aircraft hours flown (including rotorcraft) is expected to increase 2.4 percent annually. The largest segment of the turbine aircraft increase in flight hours will be attributed to jet aircraft, particularly the larger corporate GA aircraft types; hours flown are anticipated to increase at 3 percent annually. Piston aircraft hours flown are expected to decrease at a rate of 0.8 percent annually (similar to the fleet reduction rate). Again, this decrease can be attributed in part to upgrades to newer turbine-powered aircraft types, but also in part due to the increased cost of flying and activity sensitivity to economic conditions. The historical and projected general aviation and air taxi active hours flown at the national level are depicted in **Chart 3-23**.

Chart 3-23 – U.S. General Aviation and Air Taxi Hours Flown



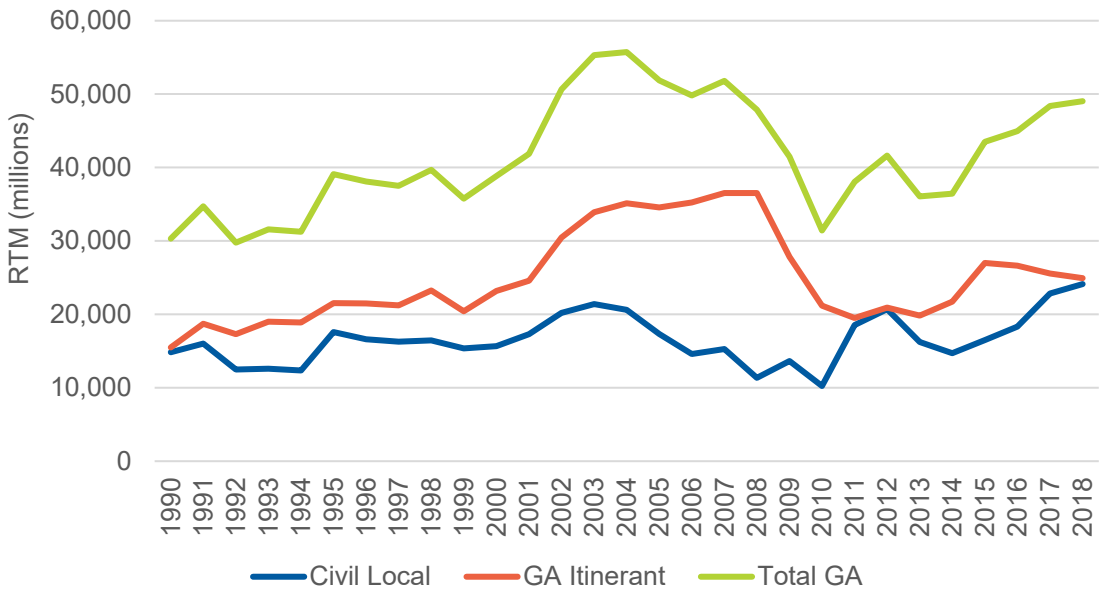
Source: FAA Aerospace Forecast (2018-2038)

3.11.2 General Aviation Annual Operations at DLH

As previously mentioned in the preceding sections, many factors have the potential to affect general aviation activity at airports, most notably those related to local and regional socioeconomic and demographic factors. Furthermore, GA activities at an airport vary depending on its pilot base, geographic location, and services offered, just to name a few. DLH is no exception to this generality, as the Airport has experienced fluctuations in its overall GA operations, with an overall long-term moderate increase over the past 28 years. Most notably, DLH's GA operations have experienced healthy overall growth since the end of the U.S. recession in the late 2000s, driven by strong growth in civil local operations. It should be noted that DLH's GA trends far outpaced U.S. trends that have seen large declines in GA activity.

This can be attributed to the growing aviation sector in Duluth including Cirrus Aircraft, Lake Superior Helicopters, Lake Superior College, Monaco Air and others. Historical operations for DLH from 1990-2018 are illustrated in **Chart 3-24**.

Chart 3-24 – Duluth General Aviation Operations Breakdown



Source: DLH TAF

For the purposes of generating general aviation operations forecasts for DLH within the 20-year planning horizon, the local and itinerant operations data as reported on the most current TAF is illustrated on **Chart 3-25**. This data reports 24,122 local and 24,917 itinerant operations performed at the Airport, totaling 49,039 annual GA operations in 2018.

3.11.3 DLH General Aviation Operations Forecast Methodologies and Analysis

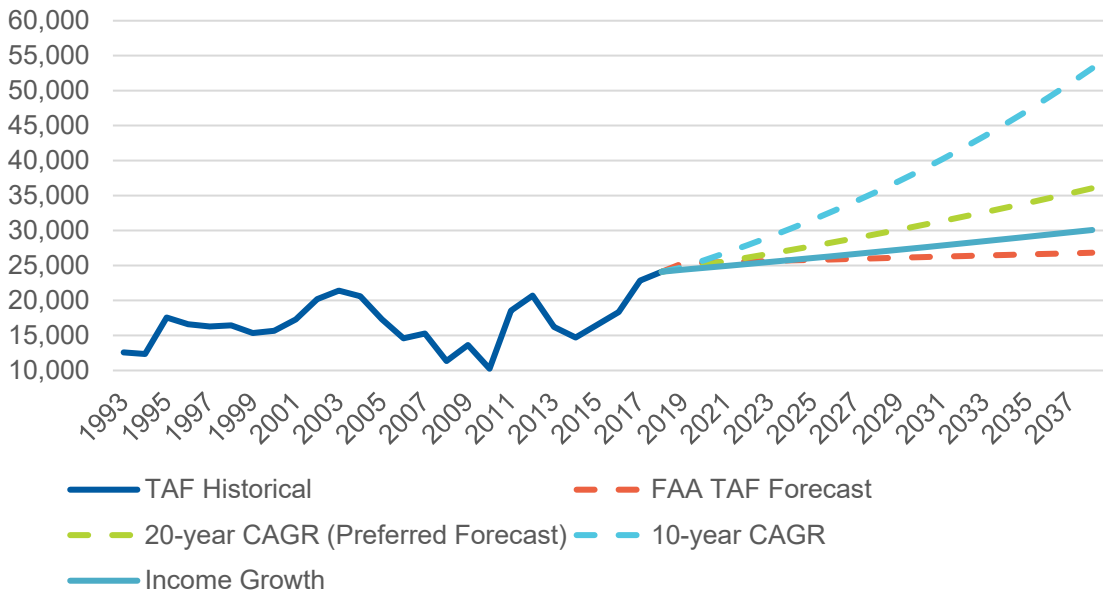
3.11.3.1 Local (Civil) Operations Forecast

A local operation is defined as operations that are performed by aircraft that remain within the local traffic pattern. These operations typically include practice landings, touch-and-go's, practice approaches and maneuvering in the local area. Civil local operations are usually conducted by recreational and flight training aircraft.

DLH is unique in that many military local operations are performed at the Airport each year due to it being the home of the Duluth Air National Guard Base. It is home to the 148th Fighter Wing. A more detailed discussion of projected military operations, both local and itinerant, is provided in a subsequent portion of this chapter. As such, the general aviation local forecasts only include operations within the civil category.

According to the January 2018 FAA TAF, local civil operations at DLH have varied, but generally trended higher over the past (nearly) 30 years. Note that these trends have been relatively stronger as compared to general U.S. civil operations trends, in large part due to the growth of LSC and Cirrus at the airport.

Chart 3-25 – Duluth Civil Local Operations Forecast Methods



Source: FAA Terminal Area Forecast, Landrum and Brown Analysis

Chart 3-26 illustrates both long-term trends and various forecasts for local civil operations at DLH. Over the prior 10 years (2018 vs 2008), DLH civil local operations grew at an 8.04% CAGR. Over the past 20 years, the CAGR was 2.03%. Much of DLH's GA out-performance has occurred over the past few years. This was at a time when LSC and other aviation-related business have been growing.

Several forecasting methods were utilized to estimate local civil operations at DLH for the next 20 years. This included the following:

- FAA TAF Forecast. CAGR: 0.53%
- 20-year CAGR of 2.03%
- 10-year CAGR 8.04%
- Forecasted Duluth-area income growth of 1.1%

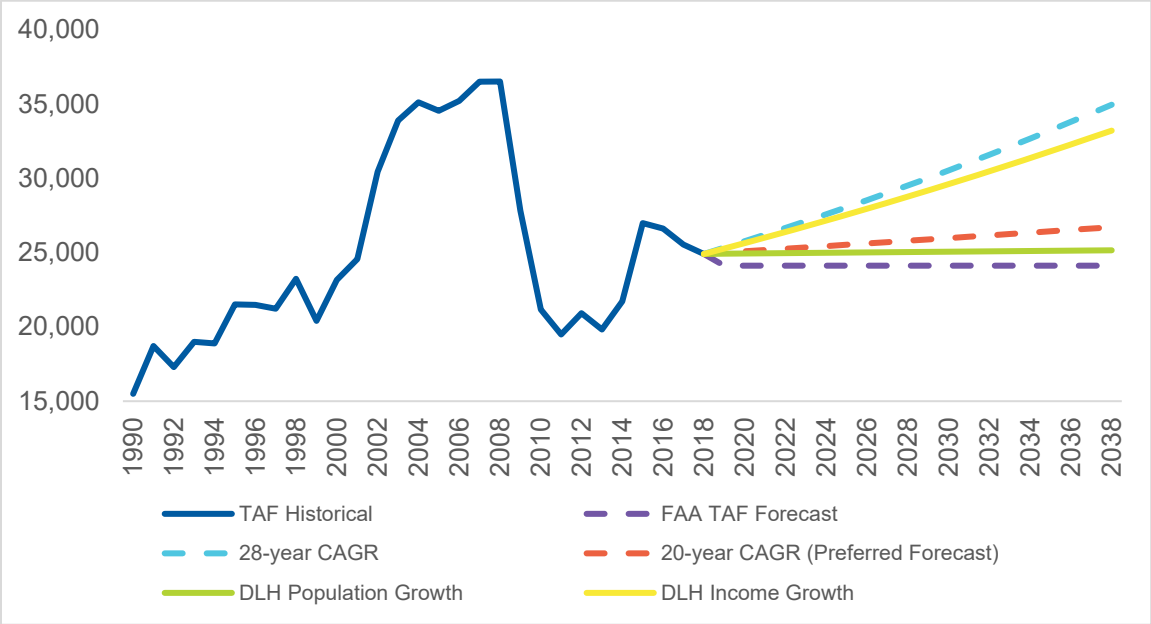
Each of these methodologies considered a longer-term perspective that reflects different economic scenarios, as opposed to a shorter-term period that would not be as reflective of longer-term trends. Based on the analysis of these methodologies, the preferred forecast method is identified as the Local Operations 20-year CAGR forecast. This forecast assumes that DLH is at a similar point in the economic cycle, growing to the mid-range of prior year's results. It is believed that this time 20-year period is a good reflection of longer-term trends. Consequently, this forecast projects that local civil operations will increase at a rate of 2.03 percent per year. This ultimately results in a forecast of 36,055 local civil operations by 2038.

3.11.3.2 Itinerant Operations Forecast

An itinerant operation is defined as a landing or departure from an airport. GA itinerant operations are conducted by all types of aircraft. Again, there are several categories of itinerant operations that the FAA records; itinerant operations by air carrier, air taxi, and commuter aircraft were captured within the commercial service forecast section, and itinerant military operations are also included in a subsequent section. The forecast presented here only reflects itinerant operations projections for GA aircraft at DLH.

According to the most recent DLH TAF, GA itinerant operations at DLH increased at a 4.88% CAGR over the 18-year period from 1990 until 2008. Starting in 2009, at the depths of the U.S. economic recession, DLH's itinerant GA operations declined sharply until 2010, then stabilizing from 2010 until 2014. Between 2014 and 2015, DLH experienced sharp growth in GA itinerant operations, and have stabilized at these higher levels since. Over the entire 28-year period, DLH's itinerant GA operations have increased at a 1.71% CAGR.

Chart 3-26 – Duluth General Aviation Itinerant Operations Forecast Methods



Source: FAA Terminal Area Forecast, Landrum & Brown Aviation Analysis

Several forecasting methods were utilized to estimate local civil operations at DLH for the next 20 years. This included the following:

- FAA TAF Forecast. CAGR: 0%
- 28-year CAGR of 1.71%
- 20-year CAGR 0.35%
- Forecasted Duluth population growth: 0.05%
- Forecasted Duluth-area income growth of 1.1%

The 20-year CAGR was selected as the preferred forecast resulting in 26,720 operations in 2038.

3.11.3.3 General Aviation Operations Forecast Summary

A summary of the local civil and itinerant GA operations forecasts for DLH is included in **Table 3-25**. It is expected that overall GA operations will grow at a 1.24% CAGR over the next 20 years. This is in line with overall expected economic growth from the region.

Table 3-25 – General Aviation Forecast Summary

Metric	2018	2023	2028	2038	CAGR
Local Operations	24,122	26,141	29,491	36,055	2.03%
Itinerant Operations	24,917	25,336	25,803	26,720	0.04%
Total Operations	**49,039**	**51,477**	**55,294**	**62,775**	**1.24%**
Local Share	49%	51%	53%	57%	
Itinerant Share	51%	49%	47%	43%	

Source: Landrum and Brown Analysis

Key drivers for increased GA activity will be dictated by continued growth from both LSC and Cirrus Aircraft as well as growth in Monaco Air's Tech Stop business. These entities are likely to outpace general GA trends in the U.S.

The share of local operations (of total GA) is forecasted to grow from 49% today to approximately 57% in 2038.

3.12 Military Operations

There are 21 military aircraft based at DLH as part of the 148th Fighter Wing of the Air National Guard. 2017 military operations totaled 4,174.

Interviews were conducted with the Air National Guard based at DLH. From these interviews, the ANG supplied their internal forecasts for operations at DLH. Based upon these interviews, the ANG is forecasting 1.5% annual growth at DLH over the next 20 years.

3.13 Annual Instrument Approaches

Annual instrument approaches (AIAs) are defined as an approach to an airport conducted in actual instrument meteorological conditions. For purposes of this definition, an approach initiated when the observed visibility is less than 3 miles, or the cloud ceiling is less than the decision altitude over the final approach fix is considered an instrument approach. AIA figures for DLH are no longer tracked by the local Air Traffic Control Tower but are a required element to an FAA forecast.

To determine AIAs, the number of itinerant operations are totaled from earlier estimates and compared to annual operations. The number of instrument flights will then be determined. Approximately 73% of all DLH itinerant flight operations are conducted under instrument flight rules (IFR) according to FAA records. Local weather conditions are then reviewed. A total of 15% of the hourly weather observations are in instrument conditions for an instrument approach. Total AIAs for DLH are forecast to increase from 1,364 currently to an estimated 1,463 at the end of the planning period as shown in **Table 3-26**.

Table 3-26 – General Aviation Forecast Summary

Metric	2018	2023	2028	2038	CAGR
Annual Operations	49,039	51,477	55,294	62,775	1.24%
Itinerant Operations	24,917	25,336	25,803	26,720	0.04%
% IFR Itinerant Operations	73%	73%	73%	73%	
IFR Itinerant Operations	18,189	18,495	18,836	19,506	.0.04%
IFR Approaches	9,095	9,248	9,418	9,753	0.04%
Instrument Approach Weather					
Annual Instrument Approaches	1,364	1,387	1,413	1,463	0.04%
AIA as % of Itinerant	5.5%	5.5%	5.5%	5.5%	

Source: National Climatic Data Center, FAA Air Traffic Activity Data System (ATADS), Landrum and Brown Analysis

3.14 Peak Activity

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

3.14.1 Commercial Passenger Airlines

3.14.1.1 Peak Month

The peak month of passenger airline activity was determined by reviewing the prior year of monthly passenger enplanement figures for the airport. This method evaluates historic patterns of passenger activity to identify the peak month. The peak month was determined to be August 2017 with 10.20% of the annual enplanements for Calendar Year 2017, which is generally consistent with other calendar years reviewed (2018 was not used, due to United adding A319 capacity starting in March, hence months weren't equal in 2018).

Table 3-27 – Peak Month Commercial Airline Activity Forecast

Metric	2018	2023	2028	2038
Annual Enplanements	140,495	145,000	152,710	177,720
Peak Month Enplanements (10.20%)	14,359	14,819	15,607	18,186
Annual Operations	5.596	7,237	7,050	6,448
Peak Month Operations (9.82%)	550	711	692	633

Source: Landrum and Brown Analysis, BTS Report T100, and Innovata (via Diio)

The peak month of commercial passenger airport operations was determined by reviewing the prior year (2017) of commercial monthly airport operations. This method evaluates historic patterns of airport operations activity to identify the peak month. The peak month was determined to be August 2017 with 9.82% of operations.

3.14.1.2 Design Day

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

To estimate design day passenger volume, scheduled passenger departing seat schedules were analyzed. For the peak enplaned passenger month (August 2017), there were 13,983 departing seats scheduled on passenger airlines during the month. The average week during this peak month was 3,227 departing seats. The peak day during this month was 224 departing seats. The peak design day is calculated at 14.29% of the average week.

The enplanements and operations forecast for the design day is summarized below.

Table 3-28 – Design Day Commercial Airline Activity Forecast

Metric	2018	2023	2028	2038
Peak Month Enplanements	14,359	14,819	15,607	18,186
Avg. Week Peak Month Enplanements	3,316	3,422	3,604	4,159
Design Day (14.54%) Enplanements	482	498	524	610
Peak Month Operations	550	711	692	633
Avg. Week Peak Month Operations	127	164	160	146
Design Day (14.29%) Operations	18	23	23	21

Source: Landrum and Brown Analysis

3.14.1.3 Design Hour

The design hour is based on the flight schedules during a design day. Using the terminal planning guidance from *ACRP Report 25*, peak hour assumes passengers arrive to the airport 60 minutes prior to departure and remain at the airport up to 60 minutes after arrival. The December 2017 flight schedule was used to review a rolling peak in 10-minute intervals.

Table 3-29 – Design Hour Commercial Activity

Metric	2018	2023	2028	2038
Peak Month Design Day Enplanements	482	498	524	610
Design Hour Enplanements (17.3%)	83	86	91	106
Design Hour Deplanements (17.3%)	83	86	91	106
Design Day Operations	18	23	23	21
Design Hour Operations (17.3%)	3	4	4	4

Source: Landrum and Brown Analysis

3.15 Determination of Critical Aircraft

The FAA classifies airports by the type of aircraft traffic they experience, this classification is known as the Runway Design Code (RDC). This classification is based on two components: approach speed and wingspan or tail height of the aircraft. The Aircraft Approach Category, approach speed, is an alphabetical classification, denoted with letters A through E (A being the slowest and E being the fastest). While the Airport Design Group (ADG), wingspan or tail height, is a numerical classification, denoted with roman numerals I through VI (I being the smallest and VI being the largest). The RDC classification of a specific airport and its facilities is based on the RDC of its Critical Aircraft. Critical Aircraft is defined as the most demanding airplane, or family of airplanes, that have a minimum of 500 annual operations currently using or forecasted to use the airport. Existing aviation activity at DLH and consultant analysis were used to determine the distribution of RDC aircraft type.

Table 3-30 shows the average annual fleet mix from the data gathered from IFR Flight Plans filed from 2013 to 2018. The data below excludes designated military operations as those operations do not count towards civilian critical aircraft.

Table 3-30 – IFR Flight Plan Fleet Mix

RDC	Flight Plans Filed						Average Annual Fleet Mix (2016-2018)
	20131	20141	20151	2016	2017	2018	
A-I	3,595	3,725	4,245	4,673	4,368	4,444	30.27%
A-II	310	313	246	321	481	476	2.87%
A-III		2					0.00%
B-I	1,243	1,197	1,089	1,061	1,045	1,158	7.33%
B-II	1,638	1,672	1,739	1,728	1,624	1,490	10.87%
B-III	534	528	557	544	541	542	3.65%
C-I	517	516	480	401	385	260	2.35%
C-II	7,351	5,472	4,421	4,716	5,167	4,991	33.39%
C-III	**381**	**1,064**	**1,257**	**1,238**	**678**	**967**	6.47%
C-IV	7	6	6	12	2	11	0.06%
C-V				2		4	0.01%
C-VI			2	2			0.00%
D-I	39	28	48	32	31	26	0.20%
D-II	75	79	99	87	56	62	0.46%
D-III	467	410	287	92	44	97	0.52%
D-IV	2	2	1	5		2	0.02%
D-V	1			2		4	0.01%
Unknown	86	175	126	146	169	148	1.04%
Helicopter	76	54	58	75	69	67	0.47%
Total	**16,322**	**15,243**	**14,661**	**15,137**	**14,660**	**14,749**	

Notes: 2013-2015 data is provided as a reference. The average annual fleet mix is calculated used 2016-2018, which is more representative of current operations that occur at DLH

Source: FAA TFMSC 2013-2018; SEH

Table 3-31 shows the average annual fleet mix by TDG from the data gathered from IFR Flight Plans filed from 2013 to 2018.

Table 3-31 – IFR Flight Plans: TDG Fleet Mix

TDG	Flight Plans Filed						Average Annual Fleet Mix
	2013	2014	2015	2016	2017	2018	
1A	4,916	4,962	5,326	5,720	5,467	5,668	35.32%
1B	7,851	5,942	4,941	5,224	5,161	4,867	37.44%
2	2,252	2,717	3,081	3,014	3,077	2,972	18.85%
3	291	601	537	521	293	732	3.28%
4	410	335	145	34	7	21	1.05%
5	8	6	2	12	16	14	0.06%
6						2	0.00%
Helicopter	86	175	126	146	169	148	0.94%
Unknown	508	505	503	466	470	325	3.06%
Total	**4,860**	**5,952**	**6,032**	**7,128**	**7,876**	**8,620**	100%

Source: FAA TFMSC 2014-2019; SEH

The Critical Aircraft operations forecast by RDC type are shown in **Table 3-30**. The RDC and TDG forecast reflect the chosen operations forecasts as presented in **Section 3.9 and Section 3.11** and are reflective of the historical IFR Flight Plans filed at DLH. The existing Critical Aircraft using DLH is a C-III aircraft with a gear configuration of TDG 3, and the future Critical Aircraft is a C-III and TDG 3 aircraft, as shown in **Table 3-34** and **Table 3-35**. This aircraft can be described as having a wingspan greater than 49 feet up to 79 feet and an approach speed of 121 knots but not more than 141 knots.

The key airline aircraft operations assumptions are that 83.2% of 2023 commercial service operations will be on 50-seat regional jets, with 15.6% on (mostly) CRJ-700s and 7.9% on A319/A320 aircraft or similar. The shift to larger regional jets starts in the years between 2023 and 2028, with the wholesale transition to larger regional jets taking place by 2038. By 2038, it is assumed that all flying in the 61-99 seat category will be 76-seat regional jets, either in the form of CRJ-900 or EMB-175 aircraft. It is also assumed that United and/or Delta will occasionally utilize A319/320 type aircraft at DLH during the 20-year forecast period. **Section 3.6** discusses the airline operations forecast more in depth.

Table 3-32 shows forecasted airline aircraft fleet mix by the number of seats (considering aircraft operations and operating seats) from 2018 through 2038. As indicated earlier, there will be an overall trend toward larger aircraft, fewer operations, and moderate overall seat capacity growth during the forecast period.

Table 3-32 – Airline Fleet Mix by Number of Seats

Seating	2018	2023	2028	2038
Less Than 40 Seats	-	-	-	-
40-60 Seats	76.0%	83.2%	75.3%	-
61-99 Seats	14.8%	7.9%	15.6%	90.0%
100-120 Seats	-	-	-	-
121-150 Seats	9.1%	8.6%	8.9%	9.7%
151+ Seats	0.1%	0.3%	0.3%	0.3%

Source: Published Flight Schedules (Innovata) for 2017; Landrum and Brown analysis

Table 3-33 shows the RDC of airline operations through the forecast period using the assumptions as shown above and other types of operations, excluding military operations.

Table 3-33 – Airline Fleet Mix by Number of Seats

	2018	2023	2028	2038
C-II Operations	4,253	6,021	5,307	0
C-III Operations	1,343	1,216	1,741	6,448
Total Airline Operations	**5,596**	**7,237**	**7,048**	**6,448**

Source: TFMSC, 2016-2018; SEH; Landrum and Brown analysis

It is important to note that B-II or larger aircraft tend to file IFR Flight Plans more often than A/B-I type aircraft. This is because these larger aircraft are commonly pressurized and realize maximum fuel efficiency at higher altitudes. Flights in Class A airspace (above 18,000 feet) are required to operate under IFR. Additionally, most Part 135 operators require flights to fly under IFR conditions[3]. Therefore, it can be assumed that the vast majority of B-II and larger operations at DLH are captured in the IFR flight plan data.

The Critical Aircraft operations forecast by RDC type are shown in **Table 3-34**, excluding military operations.

Table 3-34 – RDC Forecast (Operations per Year)

RDC	2018	2023	2028	2038
A-I	18,815	19,699	21,060	23,744
A-II	1,650	1,727	1,847	2,082
A-III	26	28	30	33
B-I	4,367	4,573	4,889	5,512
B-II	5,363	5,615	6,003	6,767
B-III	2,302	2,410	2,576	2,904
C-I	1,186	1,242	1,328	1,497
C-II	22,053	24,658	25,232	22,463
C-III	2,310	2,228	2,823	7,668
C-IV	11	12	12	14
C-V	4	4	4	5
C-VI	53	55	59	67
D-I	21	22	23	26
D-II	62	65	69	78
D-III	81	85	91	102
D-IV	2	2	2	3
D-V	4	4	4	5
Helicopter	116	121	130	146
TOTAL	**58,426**	**62,549**	**66,182**	**73,117**

Source: FAA TFMSC 2013-2018; SEH, Landrum & Brown

The Critical Aircraft forecast was also broken down by TDG type. The forecasted operations by TDG are shown in **Table 3-35**.

[3]14 Code of Federal Regulation (CFR) Part 135, and as such must adhere to strict operating, maintenance, and training requirements. Part 135, *Operating Requirements: Commuter and On Demand Operations and Rules Governing Persons on Board Such Aircraft* is the regulatory guidance for any person or business that provides air transportation of person or property for compensation or hire. Any entity that wishes to conduct operations for compensation or hire are required to hold a certification under 14 CFR Part 135 and must comply with a number of FAA standards.

Table 3-35 – TDG Forecast (Operations per Year)

TDG	2018	2023	2028	2038
1A	21,047	22,035	23,558	26,560
1B	19,145	20,044	21,429	24,160
2	16,047	18,369	18,508	14,883
3	2,036	1,941	2,516	7,322
4	20	21	23	26
5	14	14	15	17
6	2	2	2	2
Helicopter	116	121	130	146
Total	**58,426**	**62,549**	**66,182**	**73,117**

The existing Critical Aircraft using DLH is a C-III aircraft with a gear configuration of TDG 3. The future Critical Aircraft is forecasted to be a C-III aircraft with a gear configuration of TDG 3, as shown in **Table 3-35** and **Table 3-36**. This aircraft can be described as having a wingspan of 79 feet and less than 118 feet and an approach speed of 121 knots but not more than 141 knots.

3.15.2 Military Critical Aircraft

There are 21 military aircraft based at DLH as part of the 148th Fighter Wing of the Air National Guard. Interviews were conducted with the Air National Guard based at DLH. From these interviews, the ANG supplied their internal forecasts for operations at DLH. Based upon these interviews, the ANG is forecasting 1.5% annual growth at DLH over the next 20 years. **Table 3-36** shows the total military operations through the forecast period.

Table 3-36 – Military Operations Per Year

	2018	2023	2028	2038
Military Operations	4,174	4,497	4,844	5,622

The 148th Fighter Wing of the Air National Guard currently operates the F-16 Fighting Falcon. The military often sees larger transport type aircraft at DLH however, for this forecast, the F-16 will be used as the military critical aircraft.

3.15.3 Summary of Critical Aircraft

As discussed above, the civilian critical aircraft for DLH will be C-III through the 20-year planning period, represented by the Airbus A319. The military critical aircraft will be D-I, represented by the F-16 Fighting Falcon.

Table 3-37 – Future Airport Critical Aircraft

	Aircraft	AAC	ADG	TDG	Wingpsan	Tail Height	CMG	WheelBase	MGW	MTWO	Approach Speed (Knots)
Civilian	Airbus A319	C	III	3	111.9	39.7’	50.2’	36.2’	29.4’	166,449	138
Military	F-16 Falcon	D	I	1A	32.6’	16’		13.75’	7.75’	42,300	141-166

Stakeholder input will ultimately identify facility needs. The Critical Aircraft outlined in **Table 3-37** will guide the facility recommendations and facility needs and design will be discussed in greater detail in Chapter 4, Facility Recommendations. This chapter will discuss the critical aircraft for specific facilities including runways and taxiways. The alternatives analysis will also highlight Airport Improvement Program (AIP) funding requirements if facility needs exceed the civilian critical aircraft design standards.

3.16 Forecast Summary

The FAA templates to compare the proposed forecasts to the 2018 published FAA Terminal Area Forecast follow. The FAA approved the Master Plan forecasts on June 8, 2021 (see **Appendix H**).

Table 3-38 – Airport Master Plan Forecast Summary

	2018	2023	2028	2038	CAGR*		
					2023	2028	2038
Passenger Enplanements							
Air Carrier	70,876	36,799	53,298	177,720	-12.3%	-2.8%	4.7%
Commuter	69,609	108,201	99,412	---	9.2%	3.6%	---
Total	**140,485**	**145,000**	**152,710**	**177,720**	**0.6%**	**0.8%**	**1.2%**
Operations							
Itinerant							
Air Carrier	1,354	1,219	1,746	6,448	-2.1%	2.6%	8.1%
Commuter	4,242	6,018	5,302	---	7.2%	2.3%	---
Air Cargo	517	541	566	620	0.9%	0.9%	0.9%
Air Taxi	3,274	3,274	3,274	3,274	0.0%	0.0%	0.0%
Total Commercial	**9,387**	**11,052**	**10,888**	**10,342**	**3.3%**	**1.5%**	**0.5%**
General Aviation	24,917	25,356	25,803	26,720	0.3%	0.4%	0.3%
Total Itinerant	**34,304**	**36,408**	**36,691**	**37,062**	**1.2%**	**0.7%**	**0.4%**
Local							
General Aviation	24,122	26,141	29,491	36,055	1.6%	2.0%	2.0%
Military	4,174	4,497	4,844	5,622	1.5%	1.5%	1.5%
Total Operations	**62,600**	**67,046**	**71,026**	**78,739**	**1.4%**	**1.3%**	**1.2%**
Annual Instrument Approaches	1,364	1,387	1,413	1,463	0.3%	0.4%	0.4%
Peak Hour Operations	3	4	4	4	5.9%	2.9%	1.4%
Enplaned Air Freight (tons)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Based Aircraft	68	72	76	85	1.1%	1.1%	1.1%
Operational Factors							
Average Aircraft Size							
Air Carrier	93	101	96	81	1.8%	0.3%	-0.7%
Commuter	50	50	50	---	0.0%	0.0%	---
Total	**60**	**59**	**61**	**81**	**-0.6%**	**0.2%**	**1.5%**
Enplaned Load Factor							
Air Carrier	71.2%	59.8%	63.5%	67.8%	-3.4%	-1.1%	-0.2%
Commuter	84.8%	72.0%	75.0%	---	-3.2%	-1.2%	---
Total	**77.7%**	**68.5%**	**70.6%**	**67.8%**	**-2.5%**	**-1.0%**	**-0.7%**
GA operations per based aircraft	721	715	728	739	-0.2%	0.1%	0.1%

Table 3-39 – Airport Master Plan Forecast Comparison

	Year	Airport Forecast	2016 FAA Terminal Area Forecast (TAF)	AF/TAF % Difference
Passenger Enplanements				
Base Yr.	2018	140,485	129,282	8.7%
Base Yr. + 5 Years	2023	145,000	135,261	7.2%
Base Yr. + 10 Years	2028	152,710	143,375	6.5%
Base Yr. + 20 Years	2038	177,720	166,790	6.6%
Total Operations				
Base Yr.	2018	62,600	62,824	-0.4%
Base Yr. + 5 Years	2023	67,046	62,478	7.3%
Base Yr. + 10 Years	2028	71,026	63,285	12.2%
Base Yr. + 20 Years	2038	78,739	65,400	20.4%
Base Aircraft				
Base Yr.	2018	68	67	1.5%
Base Yr. + 5 Years	2023	72	74	-2.7%
Base Yr. + 10 Years	2028	76	79	-3.8%
Base Yr. + 20 Years	2038	85	89	-4.5%