2. Forecasts

2.1. INTRODUCTION

The purpose of the aviation activity forecast is to outline the growth in several key areas anticipated over a 20-year period at the airport. The Federal Aviation Administration (FAA) requires that all airport planning efforts be based upon an approved forecast methodology. This assists in determining the facility needs of the airport in order to meet the future growth demand.

For most U.S. airports today, forecasting growth is heavily influenced by events, strategies, and trends in the airline industry. Within a much-consolidated airline industry, schedules, capacity, and fleet decisions in regard to service at a given airport often have little relationship with the economic and demographic factors in the local airport economy. Airline service and marketing decisions are heavily influenced by each carrier's market strategy and hub location, and the need to produce a profit.

This results in a challenging situation in forecasting airline passengers and operations. As noted, the historical assumptions that local air service and passenger volume will follow economic and demographic trends no longer hold true. Also, changes in airline fleets – such as retirement of 50-seat jets – materially affect both passenger traffic and air operations at small and mid-size airports.

This is particularly the case at Erie International Airport Tom Ridge Field (ERI). The airport's service area has over the years experienced periods of economic decline, followed by some level of economic recovery. Currently the economy remains relatively stable and is positioned for moderate growth. This level of growth is expected to continue throughout the 20-year forecast period.

The key elements of a master plan forecast must include reviews of:

- Socioeconomic Trends
- External Demand Factors
- Aviation Forecast Summary
- Comparison with Other Forecast
- Future Design Aircraft

Key metrics of the master plan demand forecast and their focus include the following:

Annual Passenger Enplanements – Number of people boarding aircraft at ERI each year used to identify the need for future passenger terminal area, parking facilities, and airport access. As noted above, the methodology in forecasting this metric is no longer a simple mathematical exercise, assuming a trend-lined and concrete relationship between air service demand and economic factors.

Aircraft Operations – Number of takeoffs and landings at ERI each year to determine the necessary capacity of the airfield and aircraft operating area.

Based Aircraft by Type – The number and type of general aviation aircraft maintained at the airport on a permanent basis used to identify the needed size of future facilities.

Air Cargo Activity – Weight, in pounds, of air freight and air express shipments from ERI annually used to determine the size of future cargo facilities.

General Aviation – Estimated number of general aviation takeoffs and landings at ERI used to determine the necessary capacity of the airfield and GA support facilities.

As will be covered in this forecast, each of these areas is affected by factors specific to Erie.

2.2. SOCIOENOMIC TRENDS

This section examines social and economic factors to better understand how each, either separately or in combination with other factors, as they relate to and influence aviation activity within the ERI airport service area (ASA).

Certain key socioeconomic indicators such as population, unemployment, and personal income for each county within the ASA are combined and then evaluated against each indicator for the State of Pennsylvania and the United States as a whole.

2.2.1. Summary of Socioeconomic Trends

Assessing the current and future economic climate, both internal and external to the ASA, is a basic step in developing a reliable aviation demand forecast.

Reviewing the trends outlined below, it is apparent that there is very little volatility in any of the socioeconomic factors at Erie.

Local indicators of population, unemployment, and personal income were compared against historical passenger and aircraft operating data as well as with similar external data (regional, national and aviation industry) to identify a reliable base for forecasting future aviation demand at ERI. In some cases, for the reasons outlined in Section 2.4 (below), local historical enplanement and operations data showed no reasonable correlation with local economic indicators.

In these cases, external indicators need to be applied to project future aviation demand at ERI. These are essentially reviews of current and expected shifts in the airline and general aviation situation at Erie International Airport.

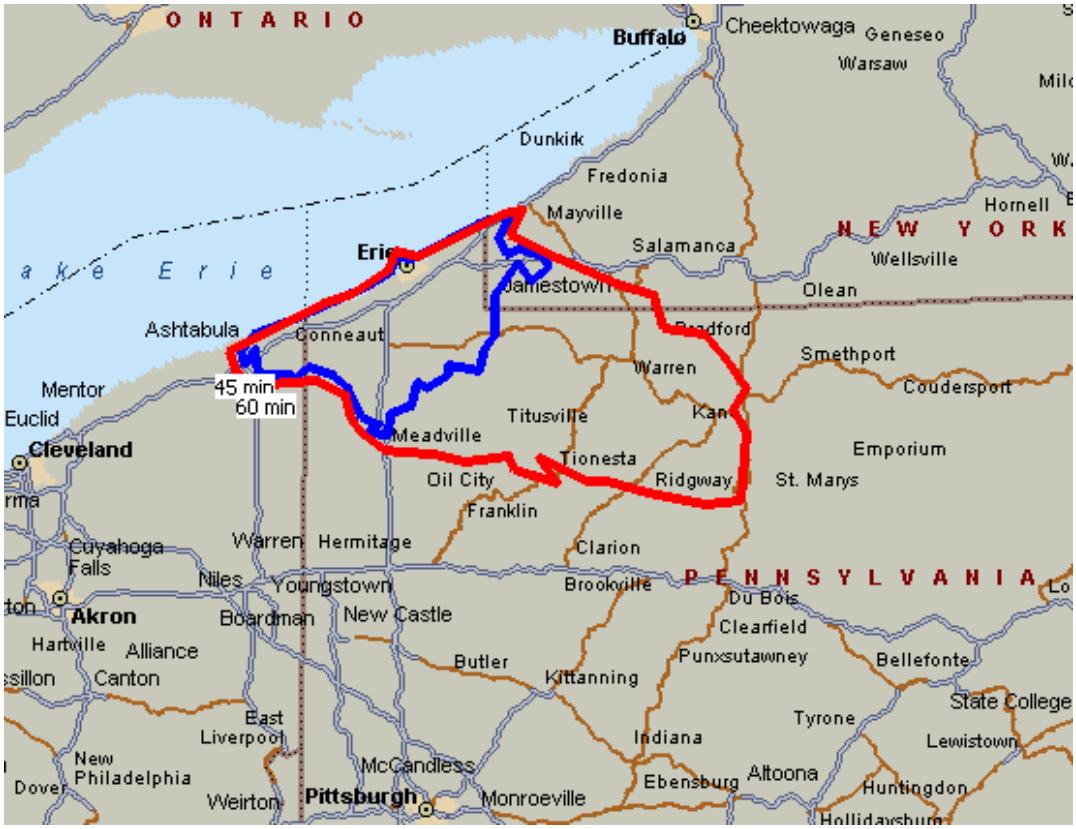
2.2.2. Population

The Erie International Airport service area encompasses Northwest Pennsylvania covering a six-county area primarily made up of Erie, Crawford, Warren, Mercer, Venango, and Forrest counties.

The airport service area is divided into sub-areas based on drive time to Erie International Airport. The primary service area covers a population of 335,000 residing within a forty-five-minute drive time of ERI. A larger secondary service area increases the total population of the airport service area to approximately 490,000, all within a one-hour drive of ERI. See Area Map in **Figure 2-1** below.

The population in Erie's ASA experienced a slight decline between 2005 and 2015 dropping at an average annual rate of less than 0.1 percent from approximately 495,000 to 490,000. During this same period the population of Erie County alone was actually increasing at an average annual rate of slightly more than 0.1 percent. Overall growth returns to the region starting in 2016 with a projected average annual rate of approximately one percent. The ERI ASA is projected to maintain this steady, yet modest, annual growth rate through the forecast period.

Figure 2-1: Erie International Airport Service Area



Source: Woods & Poole Economics and Microsoft MapPoint.

ERI's primary service area represents the population within approximately a forty-five-minute drive time from Erie International Airport. The secondary Airport service area represents approximately a one-hour drive.

As a practical matter, the majority of the consumers in the secondary service area are likely largely utilizing other airports. On the east, they have easy access to the 80+ daily flights at Buffalo. On the West, the same is true for access to the 130+ departures at Cleveland. Pittsburgh International, to the south has approximately 160 daily departing flights.

The important point to keep in mind is that Erie International Airport has a core traffic base that is the result of these alternative options. Particularly for business travelers, access and egress from ERI can be important. However, the wide range on nonstop destinations at any of the other three airports can often more than gain back the two-hour drive (or longer) to these alternatives.

This is mentioned in order to illuminate the air service realities of Erie International Airport in contemplating future traffic. While this situation will not materially change, the fact remains that there is a solid sector of the traveling public that will continue to use ERI.

2.2.3. Unemployment/Employment

Unemployment rate for the ERI ASA improved to six percent in January 2016 from a decade high of 11 percent in January 2010, which reflected an economic change that was moving closer to that of the State of Pennsylvania at 4.6 percent and the United States at 4.9 percent. This improvement indicated that Erie was making its way back to a healthier labor market and overall economy. Woods & Poole Economics projects a modest, yet stable, annual job growth of approximately one percent through the mid-term of the forecast period.

Altogether, the Woods & Poole Economics employment forecast for the ERI ASA projects a general growth trend in all sectors of the labor market with the exception of manufacturing, which is showing a moderate decline of 0.3 percent annually throughout the forecast period. Overall, employment (number of jobs) for all other job segments within the ERI airport service area is forecasted to grow at an average annual rate of approximately one percent throughout the twenty-year forecast period.

2.2.4. Per Capita Personal Income

Personal income is the annual income received by all persons from all sources. Per capital personal income (PCPI) is calculated as the total personal income of the residents of a region of a state divided by the population of the same region – average income earned per person in a given region. PCPI is used to compare the wealth of one region of the country with others and to measure changes in a region's standard of living. PCPI in each county within the ERI ASA are sourced from Woods & Poole Economics[1] and compared with data from the Bureau of Economic Analysis (BEA). For Erie and the four surrounding counties, PCPI, in contrast to population growth, has steadily increased year-over-year since 2005.

- Erie County, in 2005 PCPI stood at $29,220 and increased at an average annual rate of 3.2 percent reaching $40,060 by 2015, which is the highest average annual income of any county within the ASA.
- Crawford County, between 2005 and 2015 PCPI grew at an annual average rate of 3.5 percent from $26,027 to $36,833 increasing by the highest dollar amount of any other county within the ASA.

[1] "PCPI data used by Woods & Poole Economics are usually much higher than money income data used by the Census Bureau because money income excludes some forms of income."

- Warren County, from 2005 to 2015 PCPI grew at an average annual rate of 3.7 percent, the highest growth rate within the ASA, increasing from $27,869 to an average annual income of $39,733.
- Mercer and Venango Counties experienced similar growth with PCPI increasing at an average annual rate of 3.0 percent, income improved from approximately $29,000 to $38,000 annually.
- Forrest County experienced the second highest annual growth rate of 3.6 percent with PCPI increasing from $19,961 in 2005 to an average annual income of $28,420 by 2015.

For the total ASA, between 2005 and 2015 PCPI grew at an annual average rate of 3.3 percent compared to 3.4 percent for the three counties comprising ERI's Primary service area (see **Figure 2-1** above), which is higher than that of the State of Pennsylvania (2.1 percent) and the U.S. National PCPI of 1.9 percent.

2.2.5. Retail Sales

Retail sales are a good indicator of the overall health of a region's economy. For the Northwest Region of Pennsylvania retail sales grew at a steady 2.4 percent annual rate between 2005 and 2015, and are forecast to continue growing at an average annual rate of approximately one percent for the 20-year forecast period. Airline tickets sales normally track with and represent two percent of a region's total retail sales.

2.3. ROLE OF ERI IN THE REGION'S AIR TRANSPORTATION INFRASTRUCTURE

Erie International Airport is the primary air service gateway for Northwestern Pennsylvania.

However, airports located at Buffalo, Cleveland, and Pittsburgh influence how airline passengers access the ERI ASA. Erie has an average of seven daily departing flights; Buffalo has over 80 and Cleveland has between 140 and 150, depending on day of week. These data represent very strong competition for ERI's passengers.[2]

Distance between ERI and each competing airports is shown below:

- Buffalo Niagara International Airport (BUF) – 110 miles 1 hour 50 min.
- Cleveland Hopkins International Airport (CLE) – 107 miles 1 hour 44 min.
- Pittsburgh International Airport (PIT) – 137 miles 2 hours 6 min.

These much larger airports serve much larger population centers, thereby supporting higher flight frequencies and larger aircraft that can deliver lower seat-mile costs, and hence, lower fares. These factors affect travel decisions of consumers. Average daily flight departures with average daily seats are shown in **Table 2-1** below.

[2] Source: Innovata LLC Airline schedules filed as of April 20, 2016.

Table 2-1: Average Daily Flight Departures and Seats With Destinations

Airport/Airlines	Flight Departures	Available Seats	Non-Stop Destinations[3]
Erie (ERI)	**6.6**	**324**	**3**
American (AA)	1.9	87	1
Delta Air Lines (DL)	2.9	144	1
United (UA)	1.9	93	1
Buffalo (BUF)	**86.8**	**8,609**	**21**
American (AA)	21.9	1,492	5
Delta Air Lines (DL)	20.8	2,081	5
JetBlue (B6)	13.2	1,432	3
Southwest (WN)	17.7	2,692	8
United (UA)	13.1	912	3
Cleveland (CLE)	**147.0**	**14,918**	**38**
Air Canada (AC)	3.8	174	1
American (AA)	31.4	2,371	8
Delta Air Lines (DL)	24.2	2,267	7
Frontier (F9)	10.2	1,600	14
JetBlue (B6)	3.9	443	2
Southwest (WN)	17.7	2.620	7
Spirit (NK)	8.0	1,300	8
United (UA)	47.8	4,143	15
Pittsburgh (PIT)	**162.7**	**15,118**	**51**
Air Canada (AC)	3.9	197	1
Allegiant Air (G4)	2.8	470	7
American (AA)	45.9	3,976	13
Delta Air Lines (DL)	28.3	3,112	8
Frontier (F9)	1.7	257	5
jetBlue (B6)	4.9	537	2
Southwest (WN)	29.0	4,220	14
Sun Air Express (6G)	20.0	180	6
United (UA)	24.5	2,055	6

Source: Innovata LLC Flight Schedule June 2016.

[3] The number of Airport destinations may vary from airline totals as some airlines may serve the same destination

Other commercial airports located in Northwestern Pennsylvania, listed below and shown in Table 2-2, do not compete with ERI as they either offer limited air service or are located more than five hours away from Erie and its ASA.

- Jamestown (JHW) – 60 miles 1 hour 20 min.
- DuBois (DUJ) – 140 miles 2 hours 10 min.
- Wilkes-Barre/Scranton International (APV) – 344 miles 5 hours 0 min.
- Youngstown (YNG) – 368 miles 5 hours 30 min.

Table 2-2: Other Northwest Pennsylvania Commercial Airports

Airport	Airlines	No. Departures	Avg. Daily Seats	NS Destinations
Jamestown (JHW)	1	4.5	36	1
DuBois (DUJ)	1	2.6	87	2
Wilkes-Barre/Scranton (APV)	4	14.4	846	8
Youngstown (YNG)	1	1.3	219	4

Source: Innovata LLC Flight Schedule June 2016.

It should be noted that the single carrier serving Youngstown (YNG) is not a network carrier and only operates flights to leisure destinations.

2.4. AVIATION FORECAST

Forecasts of aviation demand are a key element in all airport planning activities. The demand forecast, based upon the characteristics of the ASA, provide a basis for determining the type, size, and scheduling of the future airport facility. Elements of the aviation demand forecast are grouped as follows:

- Enplanements
- Operations
- Based Aircraft
- Air Cargo

2.4.1. Enplanements

A key measurement of air carrier activity is the number of annual passenger enplanements. An enplanement is defined as a fare paying passenger who boards a commercial aircraft at ERI. This enplanement forecast provides the basis for the formulation of a long-range development program for the airport passenger terminal, parking facilities, and access roadway system.

2.4.2. Airline Industry Restructuring Affecting Erie International Airport

To fully address the future of airline enplanements at ERI, it is necessary to understand the fundamental changes in the U.S. airline system in the last ten years. Traditional assumptions that airline capacity is driven simply by economic and demographic factors are no longer reliable.

The consolidation of the airline industry has resulted in a situation where airline fleet, route, and capacity decisions – often subjective corporate strategic determinations – can have material effects on enplanements at airports such as ERI.

Since 2005, consolidation has resulted in a much-reduced airline route system in the Northeast. Delta closed its hub at Cincinnati/Northern Kentucky. United closed the former Continental hub at Cleveland. US Airways closed its hub at Pittsburgh. The Delta/Northwest merger resulted in capacity between ERI and Delta's hub at Detroit to decline by over half. Even greater reductions were registered in access to Philadelphia, where the merger of American and US Airways cut capacity to that connecting hub by more than half. In 2015, departing airline seats at ERI were down by over 194,000.

While it might logically be assumed that "other airlines" would be eager to capture this lost traffic, the reality is that there are no such airlines with the route systems compatible with ERI. The issue is that the U.S. airline industry and the financial imperatives, on which it operates, have changed to the point where service that once was profitable, no longer is so.

It needs to be understood that the lost capacity since 2005 – over 63% - at ERI has concurrently restructured air passenger volumes and consumer patterns. The "lost" enplanements at ERI now use other airports, or, in the face of much reduced air service, simply do not travel.

This is not a "problem" in the usual sense of the word, but a new business environment in which ERI passenger demand must be considered and forecasted. While these changes have decimated passenger volumes compared to a decade ago, the core demand at Erie International Airport is based on a new airline industry structure. Based on this, measured growth can be expected at ERI.

2.4.3. Annual Airline Enplanements at ERI

Reflecting the fundamental changes in the airline industry as noted above, enplaned passengers at ERI peaked in 2005 at 188,000 and then began a steady decline to a level of 89,587 in 2015. Exacerbating these airline capacity and enplanement declines is that in the same period, Erie and the Northwest Region of Pennsylvania experienced a declining economy.

Passenger enplanements for both major air carriers and airlines formally known as either Commuter or Regional carriers have been combined under a single category of "Enplanements."

Table 2-3 below displays the baseline enplanement forecast for ERI:

Table 2-3: Baseline Enplanement Forecast

Year	Enplanements
2016	90,468
2021	94,523
2026	98,759
2036	107,810

Source: Boyd Group International, 2016.

2.4.4. Growth Scenarios

In addition to the baseline enplanement forecast shown above, this section presents potential growth scenarios resulting from changes in the local economy and airline scheduling that could have an effect on passenger enplanements at ERI.

As noted above, while changes in the airline industry structure have cut capacity at many airports such as ERI, there are some future expansion opportunities for incumbents. These must be considered in this forecast.

New Destination – The high-revenue business traffic base at ERI, on which current airlines depend, may well entice other airlines to add service at a new hub airport, which could open service to new domestic and international destinations.

Initial service would likely be one daily flight operated with a 50-seat aircraft then increasing to multiple daily flight departures. By year three, the new service could be increased with additional scheduled departures and flights operated with larger 70+-seat aircraft.

Increased Existing Service – Incumbent Carrier increases service in an existing market with larger aircraft in the 70+-seat range. Also, carriers could increase the number of available flights at ERI by adding daily departure to current destinations. It is expected the new service could operate at an 80% load factor.

New Ultra Low Cost Carrier Service (ULCC) – This would entail an airline providing service to a leisure destination. The new service could begin with limited weekly flight operating to a single destination and then potentially increase to multiple weekly flights and multiple destinations. Normally carriers operating in these types of markets use aircraft with 160+ seats similar to the Boeing 737 and A319 aircraft.

Possibility of Decreased Service – ERI is currently served by three major airlines offering flights to three different hub airports where passengers make connections to other flights and worldwide destinations.

While the current levels of service appear to be sound, there are no guarantees in the airline business. Should the airport experience a loss of one of the existing airlines it is expected that the two remaining airlines could absorb approximately fifty-percent of the passenger traffic. The remaining passengers most likely would be lost to airports located outside of the current airport service area.

Peak Hour Enplanements/Peaking Characteristics

An additional element necessary for determining future passenger terminal requirements is the identification of peak period of activity. A peak period is an interval of time, normally defined as a month, day, or hour (60-minute period), that represents an event of the busy flow of passengers that must be accommodated by a given airport facility.

Peak Month – The peak month at an airport represents the busiest month during a calendar year. The busiest month can vary from year to year and over the last five years the peak month for ERI is normally July or August.

Average Day Peak Month – The average peak day is determined by dividing the peak month by thirty.

Peak Hour – The peak hour represents the busiest one-hour period that occurs during the average day of the busiest month. For many airports the size of ERI, this peak hour occurs during the mid-day when airlines schedule flights to arrive and depart within the same hour of day. Other busy periods often occur during the early morning hours when flights originate at the airport and during evening hours when flights arrive and terminate for the day. In special cases charter airlines can, on occasion, introduce large aircraft into a daily flight operations and temporarily change the peak hour dynamics used for planning. To maintain a consistent baseline forecast peak period passenger activity will be based on aircraft sizes in the current and projected airline flight schedule.

Table 2-4 shows peak month and peak day enplanements at Erie.

Table 2-4: Enplanement Peaking Characteristics

	Actual	Forecast			
	2015	2016	2021	2026	2036
Peak Month Enplanements	8,386	8,393	8,769	9,162	10,002
Average Peak Day Enplanements	280	280	292	305	333

Source: BTS T-100 Traffic & Boyd Group International.

Table 2-5 below details available aircraft seats by aircraft type, projected passenger load factors, and estimated peak period activity.

Table 2-5: Aircraft Seats and Scheduling Peaking Characteristics

	Aircraft	Seats Available	Load Factor	90 Min Pax Peak	60 Min Pax Peak
	E-145/CRJ	50	83.0%	42	28
Existing -2016	CRJ-900	76	80.0%	61	40
	Dash 8	37	75.0%	28	18
TOTAL		163		131	86
	E-170	70	83.0%	58	39
Future - 2036	CRJ-900	76	83.0%	66	44
	A319	126	83.0%	105	73
TOTAL		272		229	156

Source: Innovata LLC Flight Schedule & Boyd Group International.

2.4.5. Operations

The FAA defines an aircraft operation as a takeoff or a landing and categorizes the operations by aircraft type and purpose. These categories include commercial (all airline operations at the passenger terminal), general aviation (GA) (both recreational and corporate), and military. The forecasting of these operations by category is used in the planning of terminal buildings, runways, taxiways and other airport infrastructure.

Growth in the number of aircraft operations over the 20-year forecast period is approximately one percent. During this period, general aviation operations are projected to increase at an average annual rate 1.5 percent while commercial flights are shown to decrease by 0.3 percent annually throughout the forecast period. ERI will experience a decline in commercial flight operations as airlines up-gauge to newer and larger aircraft – retiring older 50-seat regional jets with larger 66+ seat aircraft. This increase in capacity (available seats) will be offset by reducing frequency (flight departures) in some markets.

The growth elements shown below include both local and airline industry factors that could impact aircraft operations at ERI.

Growth Elements

Commercial Operations – Airline offering new service to a hub airport location.

Itinerant General Aviation – Annual itinerant aircraft operations, those flights originating or terminating 50 miles or greater from ERI, decline by approximately nine percent annually between 2002 and 2012. After 2012, ERI's itinerant GA flight operations returning to a growth mode, albeit a modest one, increasing flights by 1.3 percent annually. Also, during this same three-year period, GA operations throughout the United States shifted to a growth mode with operations increasing by 1.5 percent annually. The General Aviation Manufactures Association (GAMA), an international trade association representing manufactures of GA airplanes, forecast that North American GA operations will continue growing at an average annual rate of 1.5 percent throughout the twenty-year forecast period. It is expected that itinerant GA at ERI will grow in line with the national forecast.

Local General Aviation – Defined as operations originating or terminating within 50 miles of ERI and includes traffic pattern operation. Local GA activity has trended with the local economy and been in steady decline over the last ten years – operations decreasing at an average annual rate of 10 percent. However, based on key economic indicators (PCPI, retail sales, employment, and population) for the region, the economy is positioned for improvement and growth throughout the 20-year forecast period. Therefore, local GA operations are projected to grow at an annual average rate of 1.5 percent which is in line with the GAMA industry forecast.

Military – The FAA Terminal Area Forecast (TAF) reports zero growth in military operations at ERI. However, it is anticipated that occasional local and itinerant military operations will occur as they have in the past.

Total Operations – Total aircraft operations at ERI are forecast to increase from approximately 18,600 in 2016, to 19,200 in 2021, 20,300 in 2026, and 23,500 in 2036 as shown in Table 2-6 below.

2.4.6. Airline

In regard to ERI, there is no variation in regard to "air carrier" and "commuter regional" airline operations. The airport is served by American, Delta, and United brands. There are no separate "commuter regional" operations.

Air taxi aircraft operated from the general aviation facilities are included with GA itinerant operations.

Table 2-6: Annual Operations Forecast

	Itinerant				Local			Total
Year	Airline	GA	Mil	Total	Civil	Mil	Total	Ops.
2016	4,738	7,622	362	12,722	5,530	342	5,872	18,595
2021	4,384	8,171	362	12,917	5,928	342	6,270	19,187
2026	4,457	8,759	362	13,578	6,355	342	6,697	20,275
2036	4,457	10,066	362	14,885	7,303	342	7,645	22,530

Source: Boyd Group International.

Peaking Characteristics – Aircraft Operations

An additional element necessary for determining future requirements for aircraft operating areas and support facilities is the identification of peak period of aircraft activity. A peak period is an interval of time, normally defined as a month, day, or hour (60-minute period), that represents an event of the busy flow of aircraft movements that must be accommodated by a given airport facility.

Peak Month – The peak operating month at an airport represents the busiest month during a calendar year. The busiest month of the year may not necessarily be the same for each year studied. Between 2011 and 2015, July has typically been the peak month for aircraft operations at ERI.

Average Day Peak Month – The average peak day is determined by dividing total number of aircraft operations by thirty.

Peak Hour – The peak hour represents the busiest one-hour period (60 minutes) that occurs during the average day of the busiest month. For airports like ERI, the busiest period of aircraft activity occurs during the morning or evening hours.

Peaking characteristics for aircraft operations at ERI are show in Table 2-7.

Table 2-7: Peak Hour Operations

	Actual	Forecast			
	2015	2016	2021	2026	2036
Peak Month Operations	2,684	2,515	2,595	2,743	3,047
Average Day Operations	89	84	87	91	102
Peak Hour Operations	11	10	11	11	13

Source: BTS T100 Traffic and ERI Airport Statistics.

2.4.7. Based Aircraft

A based aircraft is an aircraft that is operational and airworthy, and that is typically stationed at an airport for the majority of a year. Forecasting the number and type of based aircraft is critical

to planning future GA facilities, especially the type and size of hangers and aircraft movement and parking areas. The growth elements below discuss both the local and national factors that influence the number of based aircraft at ERI.

Growth Considerations

National Trends – two different national forecasts were considered in developing the GA and based aircraft projections for ERI. First, GAMA has projected GA activity (hours flown) in North America to grow at an average annual rate of 1.4 percent throughout the 20-year planning period. Second, the Federal Aviation Administration (FAA) publishes a nation trend forecast projecting GA activity at an estimated growth rate of 1.2 percent for the forecast period. Both forecast suggest moderate growth of GA hours flown annually through 2036.

Local Socioeconomic Conditions – Economic information within the ASA can provide insight into factors that affect general aviation activity at the local airport. Commonly evaluated metrics include population, personal income, and employment. As previously discussed population is expected to increase at a modest rate through the forecast period. In addition, both jobs and retail sales are forecast to increase at a moderate rate similar to national GA growth trends.

Table 2-8 below provides a detailed forecast of based aircraft by type for the 20-year forecast period.

Table 2-8: Based Aircraft Forecast

Year	Single	Multi	Jet	Rotor	Total	TAF	Diff.
2016	49	2	1	0	52	42	24.2%
2021	53	2	1	0	56	46	22.5%
2026	57	2	2	0	61	51	19.5%
2036	66	3	2	0	71	61	16.9%

Source: FAA Form 5010 & Boyd Group International.

2.4.8. Annual General Aviation Passengers

This is a very important metric as the GA passengers forecast is used to plan future needs for GA hangar and passenger support facilities.

GA passengers are not reported and accounted for like commercial passengers. Consequently, for planning purposes a factor of 2.5 passengers per itinerant GA operation is used to forecast the annual number of GA passengers.

With the general aviation activity growing at a steady annual rate of 1.4 percent, it is expected the number of GA passengers will grow at the same rate of 1.4 percent increasing annual GA passengers from approximately 19,100 in 2016 to 20,400 in 2021 and 25,200 by year 2035.

2.4.9. Commercial Aircraft Fleet Mix

Commercial Aircraft Characteristics – The types of commercial aircraft that make regular use of ERI airport are regional aircraft, both jet and turboprop, best suited to the short and medium-

range hub feed flights as-well-as small piston engine aircraft used exclusively in cargo service. Currently, these commercial aircraft account for approximately 5,300 annual operations with regional jets performing 61% of the operations, turboprop 29%, and piston aircraft 10%.

Critical (Design) Aircraft – Airfield capacity and facility requirements, which include runway requirements, are based on the critical aircraft - the most demanding aircraft in regular use at the airport with at least 500 annual operations. An operation is defined as either a takeoff or landing and excludes touch-and-go operations.

The critical aircraft at ERI is an airplane design group (ADG) comprised of the Embraer ERJ-145 and the Bombardier CRJ-200 as these aircraft share similar design, operational and performance characteristics. The ERJ 145 and CRJ-200 account for 58% of all commercial airline operations at ERI and both aircraft represent the C-II Runway Design Code (RDC).

Table 2-9: Airplane Design Group

Aircraft Type	Approach Speed (knots)	Wingspan (ft.)	Tail Height (ft.)	Approach Category (AAC)	Design Group (ADG)
Embraer E-145	135	65.8	22.2	C	II
Bombardier CRJ-200	140	69.5	20.7	C	II

Source: FAA AC 150/5300-13A.

2.4.10. Air Cargo

Air Cargo represents the total annual weight of air freight that is shipped into or from ERI loaded on commercial passenger or dedicated air cargo aircraft. FedEx is the only dedicated air cargo airline currently at ERI operating Cessna Caravan aircraft between Erie and Cleveland. The three incumbent passenger airlines operate smaller regional type aircraft where capacity for cargo is minimal. Much of the air cargo to and from Erie is shipped through Cleveland and Buffalo then trucked to or from ERI's airport service area.

The airport has experienced a steady decline in volume of air cargo shipments since 2005 being negatively impacted by a reduction in airline service and a fundamental change in the way air freight was being shipped. In 2005, ERI reported approximately 17,000 commercial aircraft operations (all aircraft types) and, by 2015, the number of operations had declined by 64 percent to a little more than 6,000 annually. During this same period, the volume of air cargo (inbound and outbound) dropped by 79.8 percent from 701 tons in 2005 to approximately 142 tons in 2015. Air freight shipments were further affected by shippers "trading down" to lower-cost services[4] and the need to comply with increased security regulations for air cargo. This change appears to be permanent and impacts the worldwide air cargo market.

As a matter of reality, due to the frequency of scheduled passenger operations and the aircraft type utilized, ERI is not positioned to significantly increase the amount of air cargo. However, the

[4] Supply Chain Nation, The Future of Air Cargo by Anand Medepalli 2012.

amount of air cargo shipment at ERI has stabilized to approximately 142 tons annually and is forecast to grow at a stable rate of 0.5 percent annually throughout the forecast period. Growth at ERI is in line with the FAA forecast 0.5 percent average annual rate of growth for U.S. domestic air cargo over the 2016-2036 forecast period.

Table 2-10 shows total cargo (inbound and outbound) projections through 2036.

Table 2-10: Forecast of Enplaned Air Cargo

Year	Total Air Cargo* Forecast (pounds)
2005 (Historical)	1,402,028
2010 (Historical)	365,338
2015 (Historical)	283,312
2016	284,729
2021	320,548
2026	360,873
2036	457,379

**Inbound and Outbound Cargo*
Source: Boyd Group International, 2016.

Growth Consideration

Air cargo growth at ERI most likely would be achieved through economic development and the attraction of new businesses to the ASA. New business such as an e-commerce distribution center for consumer products (books, apparel, toys, sporting equipment, etc.) is heavily dependent on air cargo for shipping these time-sensitive items. This type of new business would be a boost to air cargo activity at Erie International Airport.

The air cargo growth forecast for Erie International is based on air cargo demand at other airports currently supporting established e-commerce distribution/fulfillment centers. Estimated enplaned cargo in year one is 250,000 pounds then growing at an average annual rate of ten percent.

2.5. FORECASTS SUMMARY

Table 2-11 presents a summary of the baseline aviation demand forecasts at ERI. These forecasts are considered reasonable and achievable and will be used throughout the Master Plan to help in the development of facility requirement and the identification of alternatives.

2.5.1. Comparison with FAA Terminal Area Forecast (TAF)

In comparing the enplanement and operations baseline forecast with the FAA's most recent Terminal Area Forecast, it shows that the Master Plan update compares favorably with the TAF's 2015 values, which are in line with actual reported 2015 data. Forecasted operation totals are within reasonable ranges (10 percent within 5 years and 15 percent within 10 years) of the TAF. A comparison of the baseline aviation demand forecast with the FAA TAF is displayed in Table 2-

12. Based aircraft are exactly the same as the FAA TAF when adjusted for the difference in the base year.

Table 2-11: Aviation Demand Forecast Summary

	ACTUAL	FORECAST			
	2015	2016	2021	2026	2036
Enplanements					
Air Carriers	89,678	90,468	94,523	98,759	107,810
Peak Hour	81	81	85	88	96
Aircraft Operations					
Air Carrier	6,166	4,738	4,384	4,457	4,457
Peak Hour	5	4	4	4	4
General Aviation					
GA Itinerant	7,517	7,622	8,171	8,759	10,066
GA Local	5,454	5,530	5,928	6,355	7,303
Military	704	704	704	704	704
TOTAL AIRPORT	**19,841**	**18,595**	**19,187**	**20,275**	**22,530**
Based Aircraft	51	52	56	61	71
Single	48	49	53	57	66
Multi	2	2	2	2	3
Jet	1	1	1	2	2
Rotor	0	0	0	0	0

Source: Boyd Group International, 2016.

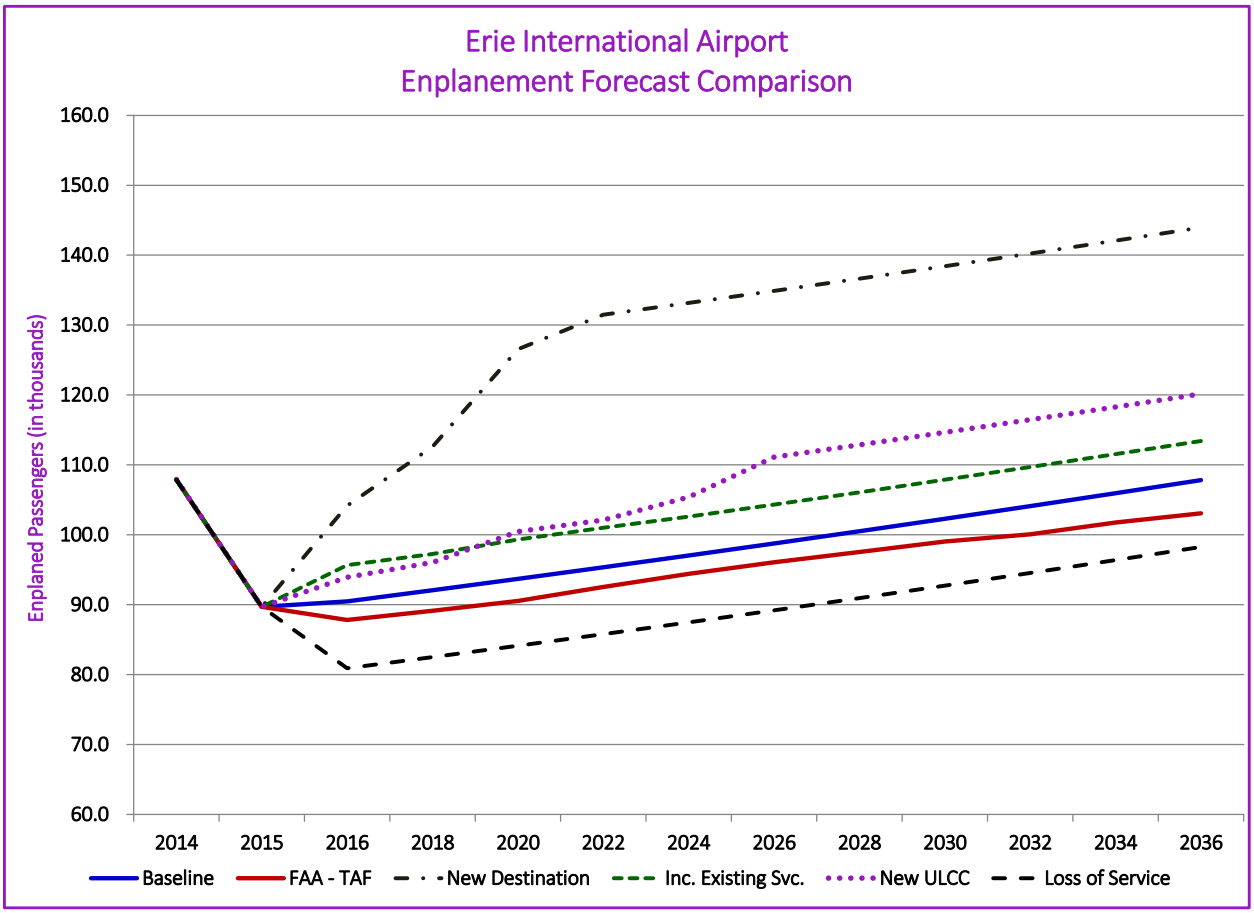
Table 2-12: Aviation Demand Forecast vs. FAA Terminal Area Forecast

	ACTUAL	FORECAST			
	2015	2016	2021	2036	Growth
FAA TAF (2015)					
Enplanements	89,678	87,811	91,634	103,072	0.8%
Operations	19,841	19,631	19,201	19,656	0.01%
Master Plan Forecast					
Enplanements	89,678	90,468	94,523	107,810	0.9%
Operations	19,841	18,595	19,187	22,530	1.0%
Pct. Difference From TAF					
Enplanements	0.0%	3.0%	3.2%	4.6%	
Operations	0.0%	-5.3%	-0.1%	14.7%	

Growth: Compound Average Annual Growth Rate 2016-2036
Source: FAA TAF 2015 and Boyd Group International, 2015.

In **Table 2-13** and the attached graph, ERI's baseline enplanement forecast along with the four growth scenarios covered in Section 2.4 above are compared to the 2016-2036 FAA TAF.

Table 2-13: ERI Enplanement Forecasts Comparison



	2014	2015	2016	2021	2024	2026	2031	2032	2034	2036
Baseline	107.9	89.7	90.5	94.5	97.0	98.8	103.2	104.1	105.9	107.8
FAA - TAF	107.9	89.7	87.8	91.6	94.4	96.1	99.6	100.1	101.8	103.1
New Destination	107.9	89.7	104.2	127.4	133.2	134.9	139.3	140.2	142.1	143.9
Inc. Existing Svc.	107.9	89.7	95.7	100.2	102.6	104.3	108.8	109.7	111.5	113.4
New ULCC	107.9	89.7	93.9	101.3	105.4	111.1	115.5	116.4	118.3	120.2
Loss of Service	107.9	89.7	80.9	85.0	87.5	89.2	93.6	94.5	96.4	98.2

Source: FAA and Boyd Group International, 2016.

2.6. FUTURE DESIGN AIRCRAFT

The FAA uses a coding system, the Airport Reference Code (ARC), to relate airport design criteria to the operational and physical characteristics of aircraft intended to operate at the airport. There are two components to the ARC the first, depicted by a letter (A, B, C, …), relates the Aircraft Approach Category (approach speed) and the second component is depicted by a Roman numeral (I, II, III, …) is the Airplane Design Group category (length, wingspan, and tail height).

These categories, when combined, result in the ARC based on a "design" aircraft (or group of aircraft), which is the largest aircraft having (or forecast to have) a minimum of 500 annual operations (or 250 departures) at the airport. In some cases, there may be two design aircraft, one for geometric standards and another for runway strength (approach speed).

Table 2-14: FAA Airport Reference Code

FAA Airport Reference Code Parameters				
Category	Approach Speed	Group No.	Wing Span (ft.)	Tail Height (ft.)
	(knots)	I	< 49	< 20
A	<91	II	49 to < 79	20 to < 30
B	91 to < 121	III	79 to < 118	30 to < 45
C	121 to < 141	IV	118 to < 171	45 to < 60
D	141 to < 166	V	171 to < 214	60 to < 66
E	166 or more	VI	214 to < 262	66 to < 80

Source: FAA AC 150/5300-13A.

Airline Fleet Changes – Smaller, 50-seat regional jets and 30-seat turboprop aircraft – the most commonly used aircraft at ERI – are being removed from U.S. airline fleets in favor of new more efficient and much larger aircraft. Airlines are replacing these older 50-seat jet aircraft with 60+ seat Bombardier CRJ-700 and 70+ seat Embraer E170 aircraft and, in some situations, with even larger 110+ seat mainline aircraft like the Boeing 717 and Airbus A319. The efficiencies of the newer era aircraft include lower operational costs, improved customer satisfaction with roomier dual-class aircraft, and the additional seat capacity allows them to maximize revenue opportunities.

Future Critical (Design) Aircraft – Over the next five years, it is reasonable to expect the majority of the current commercial airline fleet at ERI to be replaced with aircraft similar to the Bombardier CRJ-700. As the three major airlines serving ERI operate the Airbus A319 are moving this and other similar mainline aircraft into regional markets.

Aircraft in the ARC C-II/C-III categories are expected to increase through the planning period. See Table 2-15 below:

Table 2-15: Future Design Aircraft

	Future Design Aircraft		
Aircraft Model	Bombardier CRJ-700	Airbus A-319	Airbus A-320
Length Overall	106 feet 7 inches	111 feet 0 inches	123 feet 3 inches
Wingspan	76 feet 3 inches	111 feet 9 inches	111 feet 9 inches
Tail Height	24 feet 10 inches	39 feet 7 inches	39 feet 6 inches
Maximum Takeoff Weight	75,000 lbs.	166,449 lbs.	171,961 lbs.
Typical Approach Speed	134 knots	138 knots	142 knots
Approach Speed Category	C	C	C
Aircraft Design Group	II	III	III

Source: FAA AC 150/5300-13A.