Appendix D: HEF PEA Planning White Paper

The purpose of this paper is to document the background and rationale for certain issues that influence the fundamental planning elements of the Manassas Regional Airport Part 139 Certification and Terminal Redevelopment Program. The purpose and need is as follows:

1. *Achieve Part 139 certification at HEF to support scheduled commercial operations; and,*
2. *Expand the existing HEF Airport terminal building and associated airside and landside facilities to support scheduled commercial operations.*

The program has been initiated by the City, the owner and operator of the Airport, and is specifically intended to utilize the existing airport terminal. Further all proposed improvements will be constructed within existing HEF property boundaries and/or lease areas. The needs are:

- To safely and efficiently accommodate the projected number of passengers at HEF at an acceptable level of service.
- To meet airfield design standards to accommodate anticipated commercial service traffic.
- To provide efficient and safe terminal roadways and parking.
- To construct adequate facilities to support commercial service operations, such as ARFF, deicing pad, and SRE buildings.

The federal action for this program is related to the ALP approval for the Build Alternatives and the issuance of the FAR Part 139 certificate. The Airport is a General Aviation (GA) facility without scheduled commercial service and is not FAR Part 139 compliant. Under 14 CFR Part 139, the FAA issues Airport Operating Certificates to allow airport operators to serve air carrier passenger operations. This Programmatic Environmental Assessment (PEA) has been prepared pursuant to NEPA as part of the requirements for issuance of Part 139 certification and the accompanying changes to the HEF Airport Layout Plan (ALP). The changes to the ALP are in support of Part 139 Certification and improvements to support commercial service. The changes to the Airport Layout Plan (ALP) are subject to NEPA and the issues that will influence the FAA's environmental review include clarification of the following issues:

1. Pursuing commercial service
2. Forecast Comparison – Master Plan versus Avports
3. Project Components
4. Defining the No Action Alternative

5. Preferred Alternative and Alternatives
6. Screening Criteria

The following sections below provides detail on the decisions that were made to address these issues.

1. Pursuing Commercial Service

HEF serves a variety of GA operations from single-engine light aircraft used for training to large corporate jet aircraft. In 2024 HEF had 94,434 aircraft operations making it the busiest GA airport in Virginia. The Airport does not currently have scheduled commercial service, but it did have commercial airline service in the past. HEF is classified in the FAA's National Plan of Integrated Airport Systems (NPIAS) as a reliever airport. In this role, HEF acts as a reliever to Dulles International Airport (IAD) located 16 miles north of HEF and Ronald Reagan Washington National Airport (DCA) located 27 miles northeast of HEF.

The purpose of this Program is to reestablish commercial scheduled airline service at HEF. The Airport is owned by the City of Manassas and is operated and managed by the Manassas Regional Airport Commission (the Commission). Commercial service was present at the Airport between 1971 and 1986. Though commercial operations ended, the Airport and the City continued to work toward re-establishing commercial service in the decades that followed.

In the Spring of 2023, the City issued a Request for Proposal (RFP) for a provider to enter into a Franchise Agreement to re-establish commercial airline services at HEF. Avports was the single respondent to the RFP. Based on Avports demonstrated ability to manage commercial services airports and to initiate and expand commercial service, Avports and the City entered into the Franchise Agreement (Agreement) in July 2023. As part of this agreement, Avports proposed to re-develop and expand the existing Terminal building, expand the terminal parking lot, and build an economy parking lot. These actions would take place in HEF Parcels A through F (see **Figure A3 – Franchise Agreement Lease Parcels A, B, C, D, E** and **Figure A4 – Franchise Agreement Lease** in EA Chapter 1). Avports also agreed to provide support for the reconstruction and strengthening of Runway 16L/34R and the construction of a new Snow Removal Equipment (SRE) building. No other locations on-airport or off-airport for these actions are identified in the Agreement. The other stipulations in the Franchise Agreement are:

- Development on the parcels is fully funded by Avports – no FAA funding is used -

PFCs may be applied for in the future after passenger service is established.
- Avports pays rent on the terminal and parcels which incentivizes them to develop air service as soon as practicable.
- Contract would be void if Avports were required to develop elsewhere.
- No accommodation for off-site or off-airport development.
- The Airport is responsible for Part 139 certification.

What has made the potential for reestablishing commercial service at HEF possible is the proliferation of Ultra Low-Cost Carriers (ULCC). Some of the ULCC airlines include Allegiant, Avelo, Breeze, Frontier, Spirit, and Sun Country. These carriers consist of airlines that operate with a low-cost business model, focusing on offering its customers airfare at much lower costs than competing legacy carriers (Delta, United, American, etc.). The ULCC airlines offer unbundled fares, meaning they do not include seat assignments, check-in or carry-on baggage fees, or in-flight meals. Each of these services incurs an additional cost. This allows passengers to determine which options they are willing to pay for and which services the airline must plan for thus allowing the ULCC airlines to keep costs at a minimum. Because of the cost minimization the airlines can then provide a higher frequency of flights.

Given their ultra low-cost business model, ULCCs favor airports with lower fees which are typically secondary airports within a larger market area. With some exceptions, the ULCCs avoid large airports and associated cost structures and favor secondary airports with lower cost structures. HEF will fulfill this role because it has access to a large metropolitan area (Washington D.C. at 26 miles) and densely populated areas. Key benefits of airlines operating at HEF over other airports include:

- Cost Per Enplanement (CPE) is projected to be 10-20% cheaper compared with IAD and DCA.
- No slot constraints or operational restrictions
- No airside or landside congestion
- Sufficient gates available to meet projected demand
- Passengers can go from curb to gate in less than 10 minutes

2. Forecast Comparison – Master Plan versus Avports

Forecasts are an estimation of the future activity at an airport over a specific planning period. Forecasts are used for planning capital projects, financial review, and for analyzing potential environmental impacts. Two developments were underway at HEF in 2024 that required airport forecasts – a Master Plan (MP) and Avports' proposed introduction of commercial airline service. For each of these efforts, forecasts were needed to support the Master Plan and to quantify the level of airline activity (Avports' projects). The resultant forecasts are the Master Plan forecast (Attachment #1) and the Avports' forecast (Attachment #2). The Master Plan forecast provides projections from base year (2021) to 2041 and includes general aviation and scheduled commercial service. The forecast was approved by the FAA in August 2024[1] and was used to justify the proposed development contained in the Master Plan.

In contrast, the Avports' forecast supports their proposal to introduce commercial service at HEF, in accordance with the City of Manassas RFP and the subsequent Franchise Agreement. The Avports' forecast provides a projection of commercial service only and covers the period of 2024 to 2041. It does not include projections for general aviation activity. Although the two forecasts cover a similar period, the projections are materially different primarily due to assumptions related to:

- Catchment area size
- Growth Rate in market area
- Aircraft up gauging and load factor

Table 1 highlights the differences between the two commercial service forecasts.

Table 1 – Comparison of Results of the Avports and Master Plan Forecasts

	Avports' Forecast	Master Plan Forecast	Net Difference
Enplanements (2026)	584,773 annual passengers	37,100 annual passengers	547,673 annual passengers
Enplanements (2041)	1.4M annual passengers	49,931 annual passengers	1,350,000 annual passengers
Daily Commercial Departures (2026)	11	0.8	10.2 daily flights
Daily Commercial Departures (2041)	29	1.0	28 daily flights

Table 2 highlights the affect these differences have on the Master Plan forecast and the Avports forecast results.

[1] August 12, 2024, Letter from Chad Carper (FAA) to Juan Rivera (HEF Airport Director)

Table 2 – Commercial Service Forecast Comparison			
	Avports' Forecast	**Master Plan Forecast**	**Affect**
Core Catchment[2] Area Size Figure X	45-mile radius from HEF	15-20 mile proximity from HEF	This difference more than doubles the area where passengers are drawn between the MP forecast and Avports' forecast.
DC Area Airports	IAD DCA BWI	IAD DCA RIC	BWI is a DC area airport and falls within the HEF catchment area. RIC is nearly a 2-hour drive (95 miles) from Manassas and does not fall within the HEF catchment area.
DC Area Forecast Growth	Domestic: 2.4% (2024-2041) Internat.: 2.8% (2024-2041)	Total: 1.8% (2023-2041)	Avports projects greater growth in the DC area airports for both domestic and international passengers. This increases the potential passenger pool.
DC Area Forecast Methodology	Econometric regression analysis	Growth rate from FAA Terminal Area Forecast (TAF)	Regression analysis is a more focused method of predicting passenger activity and accounts for socio-economic growth at an airport
Core Catchment / DC Area O/D Traffic	Assumes HEF passenger share would increase over forecast period as service is established	Maintains a flat ratio of 14% - No Change during forecast period	This is typical for a commercial service airport. Increases HEF pool of passengers and HEF share based on airline growth.
Aircraft Capacity Assumptions	Seat capacity growth, up-gauging and load factor over forecast period	Fixed seat at 169 seats and 79 percent load factor	MP forecast assumes no change in seating capacity or load factor. Avports assumes seating capacity growth and load factor growth.

In summary, the difference between the Master Plan forecast and the Avports forecast is driven by the market area assumptions and potential growth in the catchment area. The Master Plan assumes a smaller catchment area (see **Figure A13**), TAF growth projections rather than econometric regression model, and leakage from DCA, IAD and

[2] Catchment Area refers to the geographic region surrounding an airport from which an airport can reasonably expect to draw commercial air service passengers, influenced by factors such as accessibility, service level, and competition from other airports.

RIC. Therefore, the forecast for commercial service contained in the Master Plan forecast should not be considered in the EA for the following reasons:

- The catchment area is restrictive and not realistic at 15-20 miles from HEF – passengers routinely travel further than this distance to an airport.
- Growth projections are low given the metropolitan nature of the DC area – TAF used to project commercial growth rather than using an econometric model for passenger projections.
- An airline could not initiate service with less than 1 daily departure – this low level of activity would not cover the investment in staffing and developing adequate facilities to support airline operations.
- Airline departures would only increase to 1 daily departure by 2041.

Despite the differences in the forecast approach and assumptions contained in the Master Plan forecast and the Avports' forecast for commercial service, the general aviation forecast in the Master Plan seems to be reasonable. The general aviation forecast is based on steady growth in single engine aircraft and corporate jet aircraft. The fleet mix remains similar with changes in aircraft types reflecting the introduction of new aircraft models. Therefore, for the purposes of the EA, it is recommended that the general aviation forecast from the Master Plan be incorporated with the Avports' forecast of commercial service.

3. Projects Associated with the Program

The 16 projects proposed for this Program and included in this PEA are directly related to the Purpose and Need statement. These projects are designed to satisfy the Part 139 requirements and accommodate the projected passengers. The projects, sequencing of projects, funding sources, and their specific purpose is shown in the attached **Table 3**.

4. Defining the No Action

In the No Action alternative, the Airport remains status quo. There would be no capital projects completed except for those needed to maintain state of good repair, safety and standards. The Airport would remain as a regional general aviation airport with no commercial service and no Part 139 certification. The projection of aircraft operations contained in the master plan would be assumed for future growth and comparison with the Action scenarios.

5. Proposed Action and Alternatives

As directed by the FAA, in addition to the No Action, there will be five Build Alternatives considered in the EA. The purpose of this approach is to consider a potential build scenario should air carrier service not occur and to consider alternative locations on and of airport. The Alternatives are:

- **No Action** - In the No Action alternative, the Airport would remain as a regional GA airport with no commercial service and no Part 139 certification. The projection of GA aircraft operations contained in the Master Plan would be assumed for future growth and comparison with the Build scenarios.
- **Alternative #1: General Aviation Only** – Considers projects needed to support GA only using the GA forecast from Master Plan. This alternative does not include Part 139 certification nor commercial service.
- **Alternative #2: Commercial Service** – Includes the Avports Forecast for commercial service plus the GA forecast from the Master Plan. This alternative assumes the airport would build the projects needed to achieve Part 139 certification and to accommodate projected passengers based on the Avports Forecast.
- **Alternative #3: Use of Another Existing Airport** – This alternative involves the use of an existing airport within the passenger catchment area other than HEF.
- **Alternative #4: New Airport Construction –** Construct a new airport.
- **Alternative #5: New Terminal Construction Alternate Location** – This alternative includes development of new terminal facilities at an alternate location on HEF in place of the existing terminal to address the need for terminal and apron space.

As shown in Table 3, Alternative #1 would essentially be the No Action plus PEA Projects #7, #8 and #12. Aircraft operations would reflect the projections contained in the Master Plan forecast for general aviation. There would be no scheduled commercial service, nor would projects required for Part 139 certification be part of this alternative. Alternative #2 assumes HEF would build the projects needed to achieve Part 139 certification and to accommodate projected passengers in accordance with Avports' forecast. This includes all of the PEA projects listed in Table 3.

Attachment 3 provides detail on other airports within the catchment area that were considered and their respective capabilities toward accommodating commercial airline operations.

6. Screening Criteria

Evaluation criteria will be applied to all alternatives. The No Action will be carried forward in accordance with NEPA requirements. The screening criteria that will be used for evaluation include:

- **Fulfills Purpose and Need** – Considers if the alternative fulfills the Purpose and Need as described in Section 2 of the EA.

- **Accommodate Forecast Demand at Acceptable LOS** – This criteria considers the LOS needed to support commercial airline service and establishes the size and functionality of the passenger terminal building. Attempting to accommodate passengers in a terminal that does not meet IATA and FAA design standards would result in an inadequate facility.

- **Provide airfield suitable for scheduled air carrier operations** – This criteria considers the necessary infrastructure required for commercial service. HEF has the necessary runways, airspace procedures, instrument approaches, and ground access in-place. Attachment 2 provides detail on the infrastructure requirements to support commercial airline operations.

- **Direct Roadway Connections from Off-Airport Roads –** This criteria specifies the use of existing roadway connections. This is driven by the need of the City to utilize existing and available infrastructure without going through the time, expense and environmental impact of construing new roadways.

Table 3: PEA Projects

Table 3

PEA Tier: Construction Year Start-End	PEA Project Number	PEA Project Name	Total Project Cost	Project Driven by: Build - GA Only	Project Driven by: Build - Commercial Service
Tier 1: 2026-2026	1	Terminal Building Expansion (north, south, and west)	$24,549,749	NO	YES
Tier 1: 2026-2026	2	West Ramp General Aviation Tie-Down Relocation	$72,291	NO	YES
Tier 1: 2026-2028	3	East Ramp Strengthening, Reconfiguration, and Rehabilitation	$21,000,000	NO	YES
Tier 1: 2026-2026	4	Terminal Parking Lot Rehabilitation and Expansion	$9,793,523	NO	YES
Tier 1: 2026-2026	5	Economy Parking Lot Construction	$9,631,242	NO	YES
Tier 1: 2026-2027	6	Bridge Rehabilitation - Runway 16L/34R and Taxiway Bravo	$6,400,000	NO	YES
Tier 1: 2027-2028	7	Construction of a new Snow Removal Equipment (SRE) Building	$17,036,000	YES	YES
Tier 1: 2027-2028	8	Taxiway Bravo Widening	$6,191,000	YES	YES
Tier 1: 2027-2029	9	Runway 16L/34R Reconstruction and Strengthening	$16,100,000	NO	YES
Tier 1: 2027-2029	10	Taxiway Echo Fillet Widening	$1,740,000	NO	YES
Tier 1: 2029-2030	11	Taxiway B Reconstruction and Strengthening (south of the bridge)	$12,400,000	NO	YES
Tier 2: 2032-2034	12	Construction of a new East Ramp Taxiway	$1,243,000	YES	YES
Tier 2: 2033-2033	13	Runway 16L/34R Widening	$17,814,000	NO	YES
Tier 2: 2033-2034	14	Construction of an Aircraft Deicing Pad and Apron Expansion between Taxiways Delta and Echo	$7,620,000	NO	YES
Tier 2: 2033-2036	15	Construction of new Expanded East Ramp and Taxilane between Taxiways Delta and Echo	$8,196,000	NO	YES
Tier 2: 2035-2036	16	Construction of new Aircraft Rescue and Fire Fighting (ARFF) Facility	$30,285,000	NO	YES

Attachment #1 – Master Plan Forecast

Chapter 2A
Aviation Activity Forecast Amendment

TABLE OF CONTENTS

Chapter 2A Aviation Activity Forecast Amendment

LIST OF TABLES

APPENDIX

LIST OF FIGURES

CHAPTER 2A

AVIATION ACTIVITY FORECAST AMENDMENT

2.1 INTRODUCTION

The Aviation Activity Forecast (the Forecast) for Manassas Regional Airport (HEF or the Airport) was completed and approved by the Federal Aviation Administration (FAA) in 2022 as part of the Master Plan process. In 2023 the HEF Board signed an agreement with a private airport operator to bring commercial passenger air service to HEF.

HEF has historically operated as a general aviation airport with no airline passenger commercial activity. Considering this major change in proposed activity it is necessary for HEF to update its recently approved forecasts by integrating commercial passenger service into the 20-year master plan planning period. Knowing future levels of activity from commercial passenger operations will allow HEF to determine the impact and needs they will have on current and future airport facilities.

Aviation activity forecasting is an analytical and subjective process providing future order of magnitude traffic level estimates. The methodology used in estimating future commercial passenger activity at HEF described in future sections of this document follows FAA guidance included in FAA's AC 150/5070-6B Airport Master Plans Chapter 7 and Forecasting Aviation Activity report from FAA's office of Aviation Policy and Plans (APO).

The updated forecast will focus only on adding commercial passenger enplanements and operations values to the previously approved FAA forecast numbers, shown in **Table 2A-1**, considering that previously forecasted values are trending closely with current numbers.

Per FAA guidance forecast will include projected activity levels for passenger enplanements and aircraft operations expected within the 20-year planning period from Fiscal Year (FY) 2021[1] to FY 2041 (the Forecast Period) The forecast will be presented in five and ten-year increments beginning with the base year FY 2021 outward to FY 2026, FY 2031, and FY 2041.

[1] 2021 is used as the base year in this analysis to remain consistent with the forecast created and approved by the FAA in 2022.

TABLE 2A-1 HEF 2022 FAA APPROVED FORECAST SUMMARY

					Compound Annual Growth Rates		
	Base Yr. Level	Base Yr.+5yrs.	Base Yr.+10yrs.	Base Yr.+20yrs.	Base Yr. to +5	Base Yr. to +10	Base Yr. to +20
	2021	2026	2031	2041	2026	2031	2041
Operations							
Itinerant							
Air carrier	1	5	5	5	37.97%	17.46%	8.38%
Commuter/air taxi	12,890	14,250	16,177	20,849	2.03%	2.30%	2.43%
General aviation	37,396	39,676	42,094	47,383	1.19%	1.19%	1.19%
Military	2,425	2,425	2,425	2,425	0.00%	0.00%	0.00%
Local							
General aviation	46,766	49,617	52,642	59,255	1.19%	1.19%	1.19%
Military	171	171	171	171	0.00%	0.00%	0.00%
TOTAL OPERATIONS	**99,649**	**106,144**	**113,514**	**130,088**	**1.27%**	**1.31%**	**1.34%**
Based Aircraft							
Single Engine	312	314	319	324	0.13%	0.22%	0.19%
Multi Engine	51	51	52	55	0.00%	0.19%	0.38%
Jet Engine	27	30	32	35	2.13%	1.71%	1.31%
Helicopter	18	18	18	20	0.00%	0.00%	0.53%
Other	2	2	2	2	0.00%	0.00%	0.00%
TOTAL	**410**	**415**	**423**	**436**	**0.24%**	**0.31%**	**0.31%**

2.2 HEF BACKGROUND

At a national level, the National Plan of Integrated Airport Systems (NPIAS) classifies HEF as a reliever airport. HEF acts as a reliever to Dulles International Airport (IAD) located 16 miles as the crow flies north of HEF and Ronald Reagan Washington National Airport (DCA) located 27 miles as the crow flies northeast of HEF. As a reliever HEF's main purpose is to relieve congestion at IAD and DCA though also offering a range of services to the general aviation community. In 2022 HEF had over 110,000 aircraft operations making it the busiest general aviation airport in Virginia.

2.3 FACTORS AFFECTING COMMERCIAL AVIATION DEMAND

Commercial aviation demand is impacted by a variety of key socioeconomic qualitative and quantitative factors and non-economic factors within the HEF service area.

2.3.1 HEF Catchment Area

The HEF catchment area (Catchment Area) is defined in Section 1.5 and includes the six immediate counties within proximity to the Airport including Prince William County/City of Manassas, Arlington County, Fairfax County, Fauquier County, Loudoun County, Stafford County. The following sections provide historic and forecast information of the key socioeconomic factors that have been identified as having the most impact in commercial passenger growth at HEF for the Catchment Area.

2.3.2 Key Socioeconomic Factors

There are numerous socioeconomic factors that contribute to the growth of commercial passenger service considering the many reasons that contribute to the decision of passengers traveling by air from a particular airport. Potential for growth in commercial passenger traffic can be quantified when statistically compared with relevant key local, state, and national socioeconomic indicators and trends. For example, as regional manufacturing expands, so does employment associated with the growth in industry and regional per capita income as well as the propensity of the regional population to travel. Similarly, establishing headquarters, national businesses, healthcare, and/or educational facilities can further drive the population, jobs, employment and associated income of the market area. The presence of businesses and industries within the region coupled with growth in population, employment, income, and manufactured goods provides a strong baseline for air service and its potential progression.

The 2023 Woods and Poole Economics, Inc. (W&P), economic and demographic data sets provide key socioeconomic data and forecasts key socioeconomic elements that commonly impact commercial air travel including: population, employment, personal income, and per capita personal income (PCPI) in the local region, statewide and nationally.

2.3.2.1 Population

Table 2A-2 shows the population size of the counties that are within the Catchment Area. The historical and forecasted population for the Catchment Area is broken out by county and compared to the entire Commonwealth of Virginia and the United States as a whole. As seen in the table, the Catchment Area is growing at a higher rate than the Commonwealth of Virginia and the United States at 1.2 percent throughout the Forecast Period.

TABLE 2A-2 HEF CATCHMENT AREA - POPULATION

		Population								
	Calendar Year	**Prince William/ Manassas**	**Arlington**	**Fairfax**	**Fauquier**	**Loudoun**	**Stafford**	**Manassas Catchment Area**	**Virginia Total**	**U.S.**
	2010	458,846	209,319	1,121,203	65,433	315,486	129,857	2,300,144	8,024,004	309,327,089
Historical	**2015**	512,915	228,227	1,164,303	69,264	374,119	141,534	2,490,362	8,390,283	321,753,440
	2020	542,643	238,799	1,187,410	72,990	422,669	157,746	2,622,257	8,636,471	331,511,512
Baseline	**2021**	545,052	233,574	1,180,582	74,022	428,435	161,584	2,623,249	8,657,365	332,031,554
Forecast	**2022**	546,288	233,574	1,177,752	74,664	432,085	163,380	2,627,743	8,683,619	333,287,557
	2023	555,561	236,005	1,187,370	75,283	443,870	166,319	2,664,408	8,754,269	335,546,979
+ 5 years	**2026**	583,909	241,948	1,215,815	77,170	480,838	175,457	2,775,137	8,967,442	342,320,505
+ 10 Years	**2031**	632,379	251,381	1,260,701	80,422	547,664	191,814	2,964,361	9,321,044	353,366,671
+ 15 years	**2036**	681,926	260,059	1,301,621	83,811	621,094	209,698	3,158,209	9,669,260	363,987,894
+ 20 years	**2041**	732,010	267,812	1,337,758	87,343	701,166	229,248	3,355,337	10,008,938	374,072,743
Compound Annual Growth Rate (CAGR)										
2010 - 2019		1.8%	1.4%	0.7%	1.2%	3.1%	2.0%	1.4%	0.8%	0.7%
2019 - 2020		0.8%	0.7%	-0.1%	0.3%	1.9%	2.0%	0.6%	0.4%	0.4%
2020 - 2022		0.3%	-1.1%	-0.4%	1.1%	1.1%	1.8%	0.1%	0.3%	0.3%
2022 - 2023		1.7%	1.0%	0.8%	0.8%	2.7%	1.8%	1.4%	0.8%	0.7%
2021 - 2041		1.5%	0.7%	0.6%	0.8%	2.5%	1.8%	1.2%	0.7%	0.6%

Source: Woods & Poole Economics, Inc; RS&H Analysis, 2023

2.3.2.2 Employment

Based on W&P data, the trades within the Catchment Area with the highest level of employment are federal, state, and local government, construction, healthcare, accommodations, and retail trade. In addition to the many governmental entities within the area, some of the top employers within the Catchment Area include Lockheed Martin, Nestle, Virginia Hospital, Amazon, Inova Health System, and Northrop Gruman. Being in close proximity to the Nation's capital makes the area more attractive to select individual trades. For example, accommodations rank high in employment because not only due to numerous lawmakers and business travelers commute frequently to this area, but it is also a major domestic and international tourist attraction due to its vast American history and cultural sites, architecture, museums and national memorials.

The employment history for the Prince William/Manassas County had a CAGR of 3.1 percent between CY 2010 thru CY 2019 which is almost twice as high as the remaining Catchment Area counties, the Commonwealth of Virginia as a whole, and the entire United States. Due to the COVID-19 Pandemic between CY 2019 and CY 2020, the employment rate within Prince William/Manassas County dropped to 0.6 percent, but not as much as the rest of the Catchment Area counties, the Commonwealth of Virginia, or the United States which saw a drop of -1.3 percent, -2.0 percent, and -3.1 percent, respectively during that same period.

The forecast indicates a strong return from the COVID-19 Pandemic with Prince William/Manassas County at a 3.9 percent growth rate between CY 2020 thru CY 2022 with the remaining catchment counties, following close behind.

Table 2A-3 depicts the historical and forecasted employment totals for the Catchment Area counties and the total Catchment Area.

TABLE 2A-3 HEF CATCHMENT AREA - EMPLOYMENT

	Employment				
	Calendar Year	**Prince William/ Manassas**	**Catchment Area Counties Total**	**Virginia Total**	**U.S.**
Historical	**2010**	194,470	1,498,252	4,743,187	172,901,666
	2015	228,558	1,926,935	5,060,281	190,325,771
	2020	256,562	1,767,312	5,224,995	195,301,627
Baseline	**2021**	265,492	1,815,399	5,350,770	201,142,587
Forecast	**2022**	276,762	1,898,972	5,540,070	208,286,623
	2023	282,502	1,941,085	5,635,851	211,873,718
+ 5 years	**2026**	303,065	2,044,240	5,899,838	221,286,830
+ 10 Years	**2031**	341,837	2,267,608	6,304,221	235,031,660
+ 15 years	**2036**	384,203	2,474,807	6,705,007	248,421,812
+ 20 years	**2041**	430,575	2,687,670	7,105,810	261,624,407
Compound Annual Growth Rate (CAGR)					
2010 - 2019		3.1%	2.0%	1.3%	1.7%
2019 - 2020		0.6%	-1.3%	-2.0%	-3.1%
2020 - 2022		3.9%	3.7%	3.0%	3.3%
2022 - 2023		2.1%	2.2%	1.7%	1.7%
2021 - 2041		2.4%	2.0%	1.4%	1.3%

Source: Woods & Poole Economics, Inc.; RS&H Analysis, 2023

2.3.2.3 Personal Income

Between CY 2010 thru CY 2019, the growth rate on personal income within the Prince William/Manassas County was 2.1 percent with the remaining Catchment Area counties at 2.5 percent. These growth rates were lower than the national trend which had a CAGR of 2.8 percent during the same time period.

Based on W&P data, throughout the Forecast Period, the personal income CAGR for Prince William/Manassas County is projected to be 3.2 percent which is higher than the remaining Catchment Area counties, the Commonwealth of Virginia, and the United States which are projected to have a CAGR of 2.9 percent, 2.3 percent, and 2.0 percent, respectively. This is a positive indicator for the area, as it suggests that individuals in the Prince William/Manassas area are likely to experience an increase in their personal income over the next two-decade period at a higher rate than the rest of the United States.

Table 2A-4 depicts the historical and forecast of total personal income rates for the Prince William/Manassas County, the remaining Catchment Area counties, the Commonwealth of Virginia as a whole, and the entire United States.

TABLE 2A-4 HEF CATCHMENT AREA – PERSONAL INCOME

	Personal Income in the 000's (In 2012 Dollars)				
	Year	**Prince William/ Manassas**	**Catchment Area Counties Total**	**Virginia Total**	**U.S.**
Historical	**2010**	$ 22,578,277	$ 148,908,794	$ 381,469,332	$ 13,145,590,848
	2015	$ 24,915,764	$ 168,011,760	$ 425,028,849	$ 15,207,371,341
	2020	$ 28,803,439	$ 191,691,281	$ 482,988,169	$ 17,825,517,052
Baseline	**2021**	$ 29,562,295	$ 194,913,454	$ 495,608,858	$ 18,412,493,489
Forecast	**2022**	$ 30,282,374	$ 204,682,432	$ 499,945,810	$ 18,166,519,026
	2023	$ 31,286,190	$ 210,930,106	$ 512,752,489	$ 18,563,688,896
+ 5 years	**2026**	$ 34,537,221	$ 230,494,199	$ 552,434,301	$ 19,851,596,580
+ 10 Years	**2031**	$ 40,670,659	$ 265,767,400	$ 622,556,549	$ 22,154,966,723
+ 15 years	**2036**	$ 47,664,167	$ 304,306,728	$ 697,591,238	$ 24,593,413,338
+ 20 years	**2041**	$ 55,618,547	$ 346,435,769	$ 777,865,958	$ 27,174,814,874
Compound Annual Growth Rate (CAGR)					
2010 - 2019		2.1%	2.5%	2.2%	2.8%
2019 - 2020		5.7%	3.1%	4.5%	5.5%
2020 -		2.5%	3.3%	1.7%	1.0%
2022 - 2023		3.3%	3.1%	2.6%	2.2%
2021 -		3.2%	2.9%	2.3%	2.0%

Source: Woods & Poole Economics, Inc.; RS&H Analysis, 2023

2.3.2.4 Per Capita Personal Income

Similar to total personal income, historically per capital personal income between CY 2010 through CY 2019 for Prince William/Manassas County was below the rest of the Catchment Area counties, the Commonwealth of Virginia, and the United States with a CAGR of just 0.3 percent.

During the Forecast Period between CY 2021 through CY 2041, the per capita personal income for Prince William/Manassas County is projected to trend on par with the remaining Catchment Area counties, but slightly higher than the Commonwealth of Virginia and the United States with a CAGR of 1.7 percent. Nevertheless, the projected growth rates for the per capita personal income in the Catchment Area and the Commonwealth of Virginia indicate a positive trend that could translate to higher standards of living for residents of the Commonwealth over the next two decades.

It is worth noting that changes in economic conditions, government policies, and other factors could impact the growth rates for per capita personal income in the HEF Catchment Area, the Commonwealth of Virginia, and the United States. Even so, the projected growth rates provide valuable insights into the potential trajectory of income growth in these regions. **Table 2A-5** depicts the historical and forecasted per capita personal income for the Prince William/Manassas County, the remaining Catchment Area counties, the Commonwealth of Virginia as a whole, and the entire United States.

TABLE 2A-5 HEF CATCHMENT AREA – PER CAPITA PERSONAL INCOME

	Per Capita Personal Income (In 2012 Dollars)				
	Year	**Prince William/ Manassas**	**Catchment Area Counties Total**	**Virginia Total**	**U.S.**
Historical	**2010**	$ 49,207	$ 64,739	$ 47,541	$ 42,497
	2015	$ 48,577	$ 67,114	$ 50,657	$ 47,264
	2020	$ 53,080	$ 73,102	$ 55,924	$ 53,770
Baseline	**2021**	$ 54,238	$ 74,302	$ 57,247	$ 55,454
Forecast	**2022**	$ 55,433	$ 77,880	$ 57,573	$ 54,507
	2023	$ 56,315	$ 79,166	$ 58,572	$ 55,324
+ 5 years	**2026**	$ 59,148	$ 83,057	$ 61,604	$ 57,991
+ 10 Years	**2031**	$ 64,314	$ 89,654	$ 66,790	$ 62,697
+ 15 years	**2036**	$ 69,896	$ 96,354	$ 72,145	$ 67,567
+ 20 years	**2041**	$ 75,981	$ 103,249	$ 77,717	$ 72,646
Compound Annual Growth Rate (CAGR)					
2010 - 2019		0.3%	1.1%	1.4%	2.1%
2019 - 2020		4.8%	2.5%	4.1%	5.1%
2020 -		2.2%	3.2%	1.5%	0.7%
2022 - 2023		1.6%	1.7%	1.7%	1.5%
2021 -		1.7%	1.7%	1.5%	1.4%

Source: Woods & Poole Economics, Inc.; RS&H Analysis, 2023

2.3.3 Oil and Jet Fuel Prices.

The association between jet fuel prices and aviation demand is complex and can be influenced by a range of economic, political, and environmental factors. Jet fuel price is a critical factor in the aviation industry because it has a significant impact on airlines' operating costs and profitability. The demand for aviation fuel is driven by the level of air travel and the size of active airline fleets. In general, jet fuel prices tend to fluctuate in response to global oil prices, geopolitical tensions, and market supply and demand conditions. At the start of the COVID-19 Pandemic in April 2020, when demand was at a record low, gasoline fuel prices reached a price of $1.03 per gallon.

Industry and economic changes across the world, such as the Russia-Ukraine War and the U.S.-Iran conflict related to the Israel-Hamas War, have caused instability in oil prices which saw a peak in CY 2022. Oil prices fell in CY 2023 and have remained stable into CY 2024 due to an increase in fuel production outside of OPEC countries such as the U.S. OPEC has announced that it will cut oil supply during the first quarter of 2024 which will likely trigger fuel prices to increase in the short-term.

When fuel prices are high, airlines often respond by reducing capacity or raising ticket prices to offset the increased costs. Conversely, when fuel prices are low, airlines may expand their operations or offer lower fares to attract more passengers.

Table 2A-6 depicts the forecast of oil and jet fuel prices during the Forecast Period. The forecast years included in the table are based on the FAA's most recent Aerospace Forecast published in May 2023 and consequently do not match the milestone years discussed throughout this document.

TABLE 2A-6 FORECAST – FUEL AND OIL PRICE

Comparison of Fuel and Oil Price Projections (2022 Dollars)			
Year	**U.S. Refiner's Acquisition Cost ($/Barrel) (a)**	**Crude Oil Prices ($/Barrel) (b)**	**Jet Fuel Prices ($/Gallon)**
2023	$84.29	$92.00	$2.71
2028	$89.68	$89.00	$2.50
2033	$98.57	$92.00	$2.48
2038	$104.30	$95.00	$2.37
2043	$112.70	$98.00	$2.29
CAGR 2023-2043	**1.5%**	**0.3%**	**-0.8%**

(a) Brent Spot Price (rounded)
(b) Monthly census of all U.S. refiners collecting the net acquisition costs and volumes of crude oil, both domestic and imported, on a corporate regional bases (not for individual refineries); data reported in 2023 FAA Aerospace Forecast
Source: U.S. Energy Information Administration; FAA Forecast 2023-2043

2.3.4 Average Airfares

As discussed in the previous section, volatile prices of oil and jet fuel eventually end up affecting the consumer, which in this case comes in the form of increased airfares. Airfare prices are volatile and can change by the minute due to travel demand, available capacity, seasonality, airlines' costs and other factors. After airfares dropped significantly in CY 2020 due to decreased demand caused by the COVID-19 Pandemic, demand for travel began rebounding in CY 2022 and returned to and/or surpassed pre-pandemic levels in mid-CY 2023 at many US airports. The increase in travel is a welcome trend for the airline industry which struggled to maintain profits; however, the law of supply and demand affects the customer as more demand drives higher fuel prices. Around the US, airfares have risen recently, particularly over the past 18 months. Both the rising costs of aviation fuel and airline debt following the COVID-19 Pandemic shutdown have impacted average ticket prices causing them to steadily increase since the start of CY 2022. Airfare prices in the long-term, however, are expected to decrease domestically at a CAGR of 0.3 percent during the planning period when adjusted for inflation in 2023 dollar values **(Table 2A-7**Error! Reference source not found.**)**.

TABLE 2A-7 FORECAST – AVERAGE AIR FARES

Projected Domestic Fares (2023)			
Calendar Year	**FAA Adjusted Yield (cents) (a)**	**FAA Average Trip Length (b)**	**FAA Fare (dollars) ©**
2024	15.95	1,008	$160.77
2025	15.76	1,020	$160.75
2030	15.42	1,033	$159.28
2035	14.99	1,046	$156.79
2040	14.53	1,059	$153.87
2044	14.17	1,070	$151.62
CAGR 2024-2044	**-0.6%**	**0.3%**	**-0.3%**

(a) FAA forecast of domestic aviation activity; yield (extrapolated)
(b) FAA forecast of domestic aviation activity; average trip length in miles.
(c) FAA yield multiplied by average trip length and divided by 100.
Source: FAA Aerospace Forecast 2023-2043

DCA and IAD are large hub airports in close proximity to HEF. In addition, Richmond International Airport (RIC) has also been incorporated into the analysis due to the close proximity and easy access from the cities and counties in the ECA. RIC is served by numerous Ultra Low-Cost Carriers (ULCC) including Spirit Airlines (Spirit) and Breeze Airways (Breeze). For HEF to be successful in adding commercial passenger service, the passenger trends at these three airports will be analyzed throughout this document to understand the available potential.

Since HEF historically has not ever had commercial passenger traffic and due to it is in close proximity to major airports such as DCA, IAD an RIC it would be expected that new regular passenger traffic would be provided by ULCC which have generally provide similar startup service in similar markets throughout the United States. Startup service offered by ULCC such as Avelo Airlines (Avelo) and Breeze, in similar markets as HEF, is to offer lower fares than traditional legacy airlines with unbundled air fares making passengers responsible for costs such as seat assignments and onboard catering.

Table 2A-8 shows average airfare prices from 2021 to 2023 out of DCA and IAD, compared with Avelo's systemwide average airfare which are 60.0 and 70.0 percent lower. In terms of yield, which account for stage length, Avelo recorded 11.15 cents compared to an average of 11.99 cents at IAD and DCA or 7.0 percent lower.

TABLE 2A-8 HISTORICAL AVERAGE AIR FARE PRICES OF THE U.S., DCA, IAD, AND AVELO AIRLINES

Domestic – Historic Average Gross Air Fares					
Year	DCA	IAD	DC Region Average	Avelo Airlines	% Difference Avelo/DC Region
2021	$184.56	$218.04	$196.77	$54.47	-69.3%
2022	$222.47	$277.70	$239.74	$88.50	-60.1%
2023	$226.36	$271.32	$240.82	$89.33	-62.9%

Source: U.S. DOT T-100;
Compiled by RS&H, 2024

2.4 FORECAST OF COMMERCIAL PASSENGER SERVICES

Developing a forecast of commercial passenger services for an airport that currently does not have air carrier operations requires a different approach compared to those airports with existing passenger airline services. The first step was to develop a list of potential destinations from HEF with similar characteristics as those that are served as startup markets for ULCC and would be attractive to the residents of the Catchment Area and other neighboring counties and cities where commercial passengers would potentially originate when traveling from HEF. The additional counties and cities considered in what is defined as the Expanded Catchment Area (ECA) would include the counties/cities included in **Table 2A-9**.

TABLE 2A-9 HEF EXPANDED CATCHMENT AREA

Alexandria City
Arlington County
Clarke County
Culpeper County
Fairfax City
Fairfax County
Falls Church City
Fauquier County
Frederick County
Fredericksburg
Loudoun County
Madison County
Manassas City
Manassas Park
Prince William County
Rappahannock County
Spotsylvania County
Stafford County
Warren County
Winchester City

2.4.1 HEF Potential Airline Passenger Markets

When considering potential airline passenger markets from HEF, several factors come into play, including local demographics, nearby competing markets and attractions, business interests, and existing transportation infrastructure. Here are some potential passenger markets to consider:

- Tourism: This would include residents within the ECA traveling to tourist destinations on the East coast including Florida and North and South Carolina. It could also include tourists coming from other locations to visit the DC region, considering the wide array of tourist attractions including monuments, museums, and historical sites. Additionally, Virginia itself offers attractions such as

Shenandoah National Park, Charlottesville's wineries, and historical sites like Colonial Williamsburg, making leisure travel another potential market.

- Business Travel: Manassas Airport is situated within the Northern Virginia technology corridor, with many businesses and government contractors in the vicinity. Targeting business travelers for flights to key business destinations such as New York City, Boston, Chicago, Atlanta, and other major business hubs could be lucrative. The business travel market, however, would probably be composed of smaller companies that don't have dedicated agreements with the major airlines at IAD and DCA.

- Regional Connectivity: Offering flights to nearby regional airports within a few hundred miles could attract passengers looking for convenient connections to smaller cities and towns not served by major airports. Airlines considered for these services would include Cape Air and Southern Airways Express.

- College Student Travel: HEF is relatively close to several universities and colleges, including George Mason University. Providing flights catering to college students traveling to and from their hometowns or other college towns could be a viable market.

- Charter: Services to Caribbean destinations chartered by travel companies such as Apple Vacations could be attractive to residents of the Catchment Area and reduce the need for longer airport commutes and expensive car parking rates.

After reviewing numerous market factors and considering large network carriers such as American, low-cost carriers (LCC) including Southwest Airlines (Southwest) and JetBlue, ULCC's like Avelo, Allegiant and Breeze, and charter operators similar to Omni Air International, it was concluded that basing the forecast analysis on a ULCC model would be optimal given the Catchment Area's market saturation and highly diversified airline mix at IAD and DCA. The ULCC would have targeted consideration to leisure and tourism travel as a major component, government/military travel, student and charter travel as a less significant passenger components but none-the-less an important added segment to HEF's passenger profile.

We have assumed, based on operations of ULCC at similar markets to HEF that the majority of passengers would be O&D with minimal connectivity until the later years of the forecast as service and passenger preference at HEF matures. The large DC region metroplex has enough O&D passengers to satisfy ULCC break-even load factors without the need to rely on connecting passenger activity.

2.4.1.1 Potential Primary Markets

Potential primary markets were selected based on destinations serviced by ULCCs in key markets in the mid-Atlantic, Northeast, and Florida. These markets also have a strong passenger performance history from airports in the DC region. The Manassas market share percentages depict the number of passengers residing in HEF's Catchment Area. These market share percentages were observed to be particularly high to Florida destinations. Shown on **Table 2A-10**.

TABLE 2A-10 HEF PRIMARY MARKETS

City/State	Airport Code	Pax Per Day	Expanded Catchment Area	Manassas Market Share (%)
Orlando, FL	MCO	2,145.5	513.7	23.9%
Fort Lauderdale, FL	FLL	1,250.7	205.8	16.5%
Tampa, FL	TPA	985.1	140.8	14.3%
West Palm Beach, FL	PBI	510.2	108.3	21.2%
Fort Myers, FL	RSW	396.8	83.2	21.0%
Knoxville, TN	TYS	161.1	18.5	11.5%
Destin/Fort Walton, FL	VPS	103.5	21.3	20.6%
Lexington, KY	LEX	51.4	4.2	8.2%
Chattanooga, TN	CHA	46.9	5.1	10.9%
New, Haven, CT[2]	HVN	35.4	N/A	N/A

Source: US DOT O&D Survey; Airline Reporting Corporation (ARC 2023); RS&H Analysis, 2024

2.4.1.2 Potential Secondary Target Markets – No Non-Stop Service from DC Region

The secondary markets were selected based on the largest O&D city-pair markets in year ending 3rd quarter of 2023 (latest available) served from DCA, IAD, or RIC without nonstop service. Airlines observe these types of destinations in a study called a gap analysis. Most markets have non-stop services from a specific airport or region which historically have had optimal operational and financial results for the airline and are governed by the laws of supply and demand. Sometimes gaps occur in the analysis where a potential market is overlooked. **Table 2A-11** shows secondary markets selected for potential services to HEF based on a lack of non-stop service.

TABLE 2A-11 HEF SECONDARY MARKETS

City/State	Airport Code	Pax Per Day	Manassas Market Share	Manassas Market Share (%)
Panama City, FL	ECP	93.9	12.6	13.5%
Bozman, MT	BZN	84.7	15.8	18.6%
Daytona Beach, FL	DAB	39.4	11.4	29.0%
Springfield-Branson, MO	SGF	30.3	6.3	20.7%

Note: This table is derived from combining 2023 data from DCA, IAD, and RIC US DOT data

Source: US DOT O&D Survey; ARC 2023; RS&H Analysis, 2024

[2] Beginning July 12, 2024, Avelo will operate from HVN to IAD twice weekly.

2.4.1.3 Additional Florida Markets Considered – Existing Nonstop Service

Florida markets were researched in the HEF analysis as ULCCs tend to select markets with high tourism and considered vacation locations. Florida is a popular vacation destination because of its plentiful beaches, theme parks among other attractions. Florida is also home to many seasonal residents deemed "snowbirds" who travel to and from Florida during the winter months. In 2022, Florida received about 137.6 million visitors and 38 percent of those arrived by air.[3] Avelo currently serves 8 markets within Florida with Orlando International Airport (MCO) being one of their hubs or "focus cities".

Six additional Florida airports that already have nonstop service from RIC, DCA, or IAD were analyzed and are shown in **Table 2A-12.**

TABLE 2A-12 HEF FLORIDA MARKETS

City/State	Airport	Pax Per	Manassas Share	Manassas Market Share (%)
Fort Lauderdale, FL	FLL	1,803.5	201.0	11.1%
Jacksonville, FL	JAX	749.84	68.3	9.1%
Pensacola, FL	PNS	164.0	25.2	15.4%
Sarasota, FL	SRQ	423.29	41.5	9.8%
Key West, FL	EYW	101.43	29.8	29.3%
Tallahassee, FL	TLH	62.29	8.2	13.2%

Note: This table is derived from combining 2023 data from DCA, IAD, and RIC
Source: US DOT O&D Survey; ARC 2023; RS&H Analysis, 2024; RS&H Analysis, 2024

Even though the Florida markets considered are key to the analysis, it is important to note that recent market data indicates increased capacity and the reduction of average fares by all U.S. airlines have impacted ULCCs disproportionally. Despite the oversaturation of airline seat capacity to Florida markets, this approach remains the most viable market strategy for ULCC from HEF.

2.4.1.4 Potential International Markets

International markets such as Cancun (CUN), Punta Cana (PUJ) and Montego Bay (MBJ) were also considered during the analysis given some ULCCs provide service to these destinations through tour operators.

After careful consideration, the primary markets served by ULCC as seen in **Table 2A-10** were chosen for the purposes of creating a market analysis. The selected primary markets (Core Destinations) have a robust demand from the population residing in the ECA and represent a good balance of tourism and business/other travelers from the region.

[3] Research FAQ. (n.d.). https://www.visitflorida.org/resources/research/research-faq/

2.4.2 HEF Market Analysis/Forecast Methodology

To better understand the potential target group of passengers that would choose HEF as their airport gateway from the DC region, a market analysis was conducted using U.S. DOT data, the FAA Terminal Area Forecast (TAF) and Airline Reporting Corporation (ARC) market locator data which will be discussed later in this section. The first step was to look at all enplaned passengers from IAD, DCA and RIC projected by the TAF from Federal Fiscal Year (FFY) 2022 through FFY 2041 matching the timeframe for the Forecast Period. The next step was to isolate all Origin & Destination (O&D) passengers from the DC region to single out only those passengers that started and ended their travel in IAD, DCA or RIC. To analyze the O&D percentage from the DC region, a historical trend of annual O&D percentages was pulled from the U.S. DOT T-100 database and U.S. DOT airline O&D survey (DB1B) from 2010 to 2023[4]. The annual historical O&D passengers were divided by the total enplaned passenger to calculate total DC region O&D passengers as can be seen in **Table 2A-13.**

TABLE 2A-13 DC REGION HISTORICAL O&D PASSENGER PERCENT, 2010 - 2023

IAD, DCA and RIC			
	O&D Enplaned Passengers	**Total Enplaned Passengers**	**Total O&D Percent**
2010	12,293,412	21,679,502	56.7%
2011	12,309,381	21,659,659	56.8%
2012	12,265,380	21,763,232	56.4%
2013	12,335,823	21,874,461	56.4%
2014	12,866,807	22,029,048	58.4%
2015	14,187,209	23,231,737	61.1%
2016	14,729,786	23,680,452	62.2%
2017	15,216,353	24,171,586	63.0%
2018	15,478,596	24,834,325	62.3%
2019	15,813,635	25,443,508	62.2%
2020	5,198,761	8,276,398	62.8%
2021	9,489,506	15,302,992	62.0%
2022	14,067,676	23,569,134	59.7%
2023	16,012,348	26,576,949	60.2%
2010 -2023 Average:			**60.0%**

Source: US DOT T-100; US DOT O&D Survey

For the historical trend, an average O&D passenger percentage was calculated at 60.0 percent. The trend included the anomalous COVID-19 Pandemic years of 2021 and 2022 which were included in the average percent calculation as not to ignore irregular exogenous events or economic shocks that will likely occur again within the Forecast Period. As the historical O&D percent of enplaned passengers is very stable in

[4] For U.S. DOT O&D survey, 4 quarters Year Ending 3rd Quarter were used (latest available data).

the DC region airports, the 60.0 percent was applied to total TAF enplaned passengers and kept flat throughout the Forecast Period as can be seen in **Table 2A-14**.

TABLE 2A-14 TOTAL DC REGION O&D ENPLANEMENT FORECAST, 2021 - 2041

		2024 FAA TAF					
		IAD	DCA	RIC	TOTAL	O&D Percent	Total DC Region O&D Enplanements
Actual	2021	7,097,977	6,680,270	1,564,892	15,302,992	62.0%	9,489,506
	2022	10,112,551	11,496,552	2,009,677	23,569,134	59.7%	14,067,676
	2023	11,987,683	12,283,716	2,362,937	26,576,949	60.2%	16,012,348
Forecast	2024	12,887,960	12,260,183	2,527,131	27,675,274	60.0%	16,605,164
	2025	13,453,196	12,471,839	2,633,997	28,559,032	60.0%	17,135,419
	2026	13,809,967	12,657,817	2,681,025	29,148,809	60.0%	17,489,285
	2027	14,149,798	12,817,003	2,733,307	29,700,108	60.00%	17,820,065
	2028	14,494,027	12,969,275	2,787,840	30,251,142	60.0%	18,150,685
	2029	14,830,088	13,121,182	2,837,037	30,788,307	60.0%	18,472,984
	2030	15,166,234	13,274,155	2,887,977	31,328,366	60.0%	18,797,020
	2031	15,499,893	13,427,327	2,936,215	31,863,435	60.0%	19,118,061
	2032	15,835,229	13,558,627	2,988,338	32,382,194	60.0%	19,429,316
	2033	16,170,153	13,689,886	3,038,510	32,898,549	60.0%	19,739,129
	2034	16,503,738	13,819,066	3,088,457	33,411,261	60.0%	20,046,757
	2035	16,843,245	13,944,530	3,139,583	33,927,358	60.0%	20,356,415
	2036	17,189,786	14,066,468	3,194,224	34,450,478	60.0%	20,670,287
	2037	17,537,690	14,184,461	3,250,529	34,972,680	60.0%	20,983,608
	2038	17,886,917	14,298,889	3,308,383	35,494,189	60.0%	21,296,513
	2039	18,241,148	14,410,157	3,367,164	36,018,469	60.0%	21,611,081
	2040	18,600,688	14,515,059	3,429,086	36,544,833	60.0%	21,926,900
	2041	18,954,817	14,615,299	3,488,905	37,059,021	60.0%	22,235,413
CAGR 2023 - 2041		**2.6%**	**1.0%**	**2.2%**	**1.9%**		**1.8%**

Source: FAA TAF; US DOT O&D Survey

The next step was to continue to segregate the DC region O&D passengers to only those passengers traveling to the Core Destinations. For that purpose, U.S. DOT T-100 data was used to calculate the percentage of DC region O&D passenger traveling only to the Core Destinations. It was estimated that the O&D from the DC region to the Core Destinations ranged between 13.0 percent to 14.0 percent of total DC region passengers. The O&D to Core Destination was then projected for the Forecast Period from 2023 to 2041 and grown at the same rate as total DC region O&D passengers, 1.8 percent. See **Table 2A-15.**

TABLE 2A-15 TOTAL DC REGION O&D TO CORE DESTINATIONS, 2021 - 2041

		O&D DC Region to Core Destinations	Percent DC Region to Core Dest/DC Region Total O&D
Actual	2021	1,312,760	14%
	2022	1,926,417	14%
	2023	2,115,274	13%
Forecast	2024	2,324,723	14%
	2025	2,398,959	14%
	2026	2,448,500	14%
	2027	2,494,809	14%
	2028	2,541,096	14%
	2029	2,586,218	14%
	2030	2,631,583	14%
	2031	2,676,529	14%
	2032	2,720,104	14%
	2033	2,763,478	14%
	2034	2,806,546	14%
	2035	2,849,898	14%
	2036	2,893,840	14%
	2037	2,937,705	14%
	2038	2,981,512	14%
	2039	3,025,551	14%
	2040	3,069,766	14%
	2041	3,112,958	14%
CAGR 2023 - 2041		**2.2%**	

Source: FAA TAF; US DOT O&D Survey

The last step in the identification of target passengers who could potentially use HEF as a gateway airport was to isolate DC region O&D passengers to the Core Destinations to those living in the ECA as defined in Section 1.4. The market analysis considered all the city pairs that were booked by passengers to the Core Destinations residing in the ECA. This data collection included the use of market locator data sourced from the Airline Reporting Corporation (ARC) for 2023. ARC is the clearing house for most airline tickets purchased with credit cards in the U.S. and almost all carriers process their ticket sales via ARC. Credit cards are the most common form of payment for air travel today. Data based on the billing address of credit cards used to purchase airline tickets is a reliable source of information about the distribution of air travel demand in the HEF ECA. The credit card transaction analysis detailed the local originating demand that would most effectively be served from HEF. The ARC data was analyzed and the number of passengers per day each way (PDEW) was calculated for the Core Destinations.

The analysis further took the total O&D passenger numbers from the ECA passengers to the Core Destinations and grew them by 2.0 percent from 2023 thru 2041 as seen in **Table 2A-16**. The growth rate was selected because it represents the employment growth in the Catchment Area as seen in **Table 2A-4**. **Table 2A-17** summarizes the HEF Market Analysis from 2022 thru 2041.

TABLE 2A-16 TOTAL CATCHMENT AREA PASSENGERS TO CORE DESTINATIONS PER DAY EACH WAY

Year	2023 ARC Data to Core Destinations	Percent ARC ECA/DC Region O&D to Core Dest	Passengers Per Day Each Way (PDEW)
Actual 2023	401,838	19.0%	1,101
Forecast 2024	409,875	17.6%	1,123
2025	418,072	17.4%	1,145
2026	426,434	17.4%	1,168
2027	434,962	17.4%	1,192
2028	443,662	17.5%	1,216
2029	452,535	17.5%	1,240
2030	461,586	17.5%	1,265
2031	470,817	17.6%	1,290
2032	480,234	17.7%	1,316
2033	489,838	17.7%	1,342
2034	499,635	17.8%	1,369
2035	509,628	17.9%	1,396
2036	519,820	18.0%	1,424
2037	530,217	18.0%	1,453
2038	540,821	18.1%	1,482
2039	551,637	18.2%	1,511
2040	562,670	18.3%	1,542
2041	573,924	18.4%	1,572
CAGR 2023 - 2041	**2.0%**		**2.0%**

Source: ARC 2023

TABLE 2A-17 SUMMARY OF HEF MARKET ANALYSIS, 2022-2041

	HEF Market Analysis							
	Year	**DC Region Enplanements**	**DC Region O&D %**	**DC Region O&D**	**Core Destinations**	**DC Region/ Core %**	**ECA Pax to Core Destinations**	**HEF catchment / Core %**
	2022	23,569,134	60%	14,067,676	1,926,417	14%	n/a	n/a
Forecast	2023	26,576,949	60%	16,012,348	2,115,274	13%	401,838	19%
+ 5 years	2026	29,148,809	60%	17,489,285	2,448,500	14%	426,434	17%
+ 10 Years	2031	31,863,435	60%	19,118,061	2,676,529	14%	470,817	18%
+ 15 years	2036	34,450,478	60%	20,670,287	2,893,840	14%	519,820	18%
+ 20 years	2041	37,059,021	60%	22,235,413	3,112,958	14%	573,924	18%
CAGR 2023 - 2041		2.1%		2.3%	2.3%		1.7%	

Source: US DOT T-100; US DOT O&D Survey (DB1B); ARC 2023

2.4.3 Forecast of PDEW and Daily Departures

Once the number of O&D enplaned passengers from the ECA were calculated, further analysis was conducted to pinpoint how many of those travelers would potentially choose HEF as their gateway airport. The first step was to look at PDEW from the ECA and estimate how many departures would that equal to if the Airport captured 100.0 percent of those passengers. By taking the forecast PDEW for the ECA and dividing them by average capacity of Avelo Boeing 737-800 (189 seats) and Boeing 737-700 (149 seats) aircraft, multiplied by a representative ULCC load factor (79.0 percent), the estimate would equal approximately 8.2 daily departures in 2025 and growing to approximately 11.8 departures in 2041. See **Table 2A-18.**

TABLE 2A-18 FORECAST TOTAL DAILY DEPARTURES WITH 100% CAPTURE OF EXPANDED CATCHMENT AREA PASSENGERS

Year	Passengers Per Day Each Way (PDEW)	Avelo 737-700/800 Blended Seat Capacity	Avelo Average Load Factor (%)	Daily Departures
2023	1,101	169	79.0%	8.2
2024	1,123	169	79.0%	8.4
2025	1,145	169	79.0%	8.6
2026	1,168	169	79.0%	8.8
2027	1,192	169	79.0%	8.9
2028	1,216	169	79.0%	9.1
2029	1,240	169	79.0%	9.3
2030	1,265	169	79.0%	9.5
2031	1,290	169	79.0%	9.7
2032	1,316	169	79.0%	9.9
2033	1,342	169	79.0%	10.1
2034	1,369	169	79.0%	10.3
2035	1,396	169	79.0%	10.5
2036	1,424	169	79.0%	10.7
2037	1,453	169	79.0%	10.9
2038	1,482	169	79.0%	11.1
2039	1,511	169	79.0%	11.3
2040	1,542	169	79.0%	11.5
2041	1,572	169	79.0%	11.8

Source: ARC 2023; Avelo

Note: Avelo seat capacity is based on average of Avelo fleet of 737-700 and 737-800.

Since not all passengers from the ECA will fly from HEF to the Core Destinations based on air carrier product preferences, airline mileage membership loyalty and other intangible factors, a further estimation was prepared to further refine how many PDEW HEF could conceivably be captured from the ECA.

For this approach, the analysis further narrowed-down the data at the zip code level to only the communities within a 15-to-20-mile proximity to Manassas (ECA Subset) flying to Core Destinations in 2023. Those communities are listed in **Table 2A-19**.

TABLE 2A-19 ECA SUBSET COMMUNITIES WITH 15-20 MILE PROXIMITY TO MANASSAS

ALDIE	FRONT ROYAL	PARIS
BEALETON	GAINESVILLE	PURCELLVILLE
BRISTOW	HAMILTON	QUANTICO
BROAD RUN	HAYMARKET	SPOTSYLVANIA
BRUNSWICK	LORTON	THE PLAINS
CENTREVILLE	MANASSAS	WARRENTON
CULPEPER	MIDDLEBURG	WINCHESTER
DELAPLANE	MIDDLETOWN	WOODBRIDGE
DUMFRIES	MIDLAND	WOODVILLE
FREDERICK	NEW MARKET	
FREDERICKSBURG	OCCOQUAN	

Source: ARC 2023

It was calculated that the ECA Subset represented 31.0 percent of PDEW from the ECA to the Core Destinations. To further refine the analysis, a study was conducted to determine the number of departures that ULCCs typically operate from airports from which they launch service[5]. The study focused on new markets for Allegiant from January 2003 to March 2023, Avelo from April 2021[6] to March 2023, and Breeze from July 2021[7] to March 2023. Of the 320 markets in which these airlines launched services during the aforementioned time periods, the average number of daily departures was 0.7, equivalent to 4.6 weekly departures. These ULCC new market operational patterns are similar to what would be expected at HEF for their initial service in 2025.

Based on a historical analysis of ULCC business models related to new airport and market startup patterns, a 0.7 daily departures metric was selected for the first year of operations at HEF. This would represent approximately an 8.7 percent market share captured from the ECA to the Core Destinations. Based on the historical analysis of passenger growth on ULCC's at markets like HEF, it was projected that HEF will continue to experience a flat 8.7 percent market share of the ECA through 2041. A PDEW growth rate of 2.0 percent was selected based on W&P Catchment Area employment growth rate as seen on Table 1-3. Employment growth was selected as the key economic driver in forecasting passenger enplanements considering the direct impact that employment has on non-essential spending associated with leisure travel.

Based on this metric, daily departures at HEF are projected to grow from 0.7 daily departures in 2025 to 1.0 daily departures in 2041. See Table 2A-20. To support the limited growth in daily departures throughout the Forecast Period, an analysis was undertaken to look at the average departures per day in the 82 markets served by Allegiant in the past 10-years[8] (2014 -2023) where they have had consistent service excluding their operational bases of AZA, Orlando Sanford International Airport (SFB), Las Vegas Harry Reid International Airport (LAS) and St. Pete-Clearwater International Airport (PIE). It was concluded

5 Study conducted using USDOT T-100 data via Diio Mi.

6 Month in which Avelo started operations.

7 Month in which Breeze started operations.

8 Analysis conducted using USDOT T-100 data via Diio Mi.

that Allegiant averaged approximately 1.0 daily departure indicating that even after long-term services at an airport, ULCCs such as Allegiant do not have a long-term trend of high increases in frequencies.

TABLE 2A-20 FORECAST OF HEF PDEW AND DAILY DEPARTURES

Year	Passengers Per Day Each Way (PDEW)	% of Pax Captured by HEF	Passengers Per Day Each Way (PDEW) from HEF	Daily Departures from HEF
2023	1,101	n/a	n/a	0.0
2024	1,123	n/a	n/a	0.0
2025	1,145	8.7%	99.7	0.7
2026	1,168	8.7%	101.6	0.8
2027	1,192	8.7%	103.7	0.8
2028	1,216	8.7%	105.7	0.8
2029	1,240	8.7%	107.9	0.8
2030	1,265	8.7%	110.0	0.8
2031	1,290	8.7%	112.2	0.8
2032	1,316	8.7%	114.5	0.9
2033	1,342	8.7%	116.8	0.9
2034	1,369	8.7%	119.1	0.9
2035	1,396	8.7%	121.5	0.9
2036	1,424	8.7%	123.9	0.9
2037	1,453	8.7%	126.4	0.9
2038	1,482	8.7%	128.9	1.0
2039	1,511	8.7%	131.5	1.0
2040	1,542	8.7%	134.1	1.0
2041	1,572	8.7%	136.8	1.0

Source: ARC 2023; RS&H Analysis

The forecast of PDEW were further annualized through the Forecast Period. Overall, enplanements at HEF grow from 36,372 in 2025 to 49,931 equating to a CAGR of 2.0 percent throughout the Forecast Period. A comparison with the "Prorated Forecast 2024 – 2030" published in January 2024 and developed by Avports, LLC (AvPorts), the operator selected by HEF to assist them in the development of commercial passenger market, is included as part of this analysis. See **Table 2A-21**.

TABLE 2A-21 HEF ENPLANEMENTS FORECAST

Year	HEF Enplanements	Avports Enplanements
2025	36,372	585,000
2026	37,100	788,000
2027	37,842	843,000
2028	38,599	974,000
2029	39,371	1,096,000
2030	40,158	1,183,000
2031	40,961	
2032	41,780	
2033	42,616	
2034	43,468	
2035	44,338	
2036	45,224	
2037	46,129	
2038	47,051	
2039	47,992	
2040	48,952	
2041	49,931	
CAGR		
2025 - 2030	2.0%	15.1%
2025 - 2041	2.0%	n/a

Source: RS&H Analysis; Avports

2.4.4 Forecast of Operations

To calculate operations at HEF, the total enplaned passenger forecast was combined with a projection of average load factors and average seat per departure in a mathematical formula to derive a forecast of scheduled passenger operations. As previously discussed, an average load factor was used representative of a ULCC load factor in 2023 equal to 79.0 percent. A proxy average seats per departure was calculated using the average capacity of Avelo Boeing 737-800 with 189-seats and Avelo Boeing 737-700 with 149 seats (average of 169 seats) and left flat throughout the Forecast Period.

The mathematical formula expressed below is used to calculate total annual operations at HEF.

$$\frac{Enplanements}{(Avg\ Load\ Factors)(Avg\ Seats\ per\ Departure)}(2) = Operations$$

Passenger aircraft operations at HEF are projected to increase from 545 in 2025 to approximately 748 in 2041. This produces a CAGR of 2.0 percent over the Forecast Period.

TABLE 2A-22 HEF OPERATIONS FORECAST

Year	RS&H Operations	Avports Operations
2025	545	4,000
2026	556	5,500
2027	567	6,100
2028	578	7,100
2029	590	8,100
2030	602	8,800
2031	614	
2032	626	
2033	638	
2034	651	
2035	664	
2036	677	
2037	691	
2038	705	
2039	719	
2040	733	
2041	748	
CAGR		
2025 - 2030	2.0%	17.1%
2025 - 2041	2.0%	n/a

Source: RS&H Analysis; Avports

2.4.5 Avelo LOI Scenario

In addition to the baseline scenario, the forecast model created for HEF also addressed an alternative forecast scenario of annual enplaned passengers and operations over the Forecast Period based on the number of daily flights as stated in the Letter of Intent (LOI) from Avelo to Avports dated February 14, 2024 (The Avelo LOI Scenario). The Avelo LOI Scenario assumes Avelo starting operations at HEF with up to 3 daily departures in May 2025 and up to 10 daily departures by December 2025 as stated in the LOI. In addition, the LOI states that Avelo will operate a mix of Boeing 737-700 and Boeing 737-800 aircraft with a maximum capacity of 189 passengers. Using the number of departures as stated in the LOI and growing them by 2.0 percent per year throughout the Forecast Period based on the W&P employment growth in the Catchment Area, the Avelo LOI scenario projects 3,088 operations in 2025 growing to 4,239 operations in 2041. As per the LOI, the Avelo LOI Scenario assumes a mix of Boeing 737-700 and Boeing 737-800 aircraft with an average ASPD of 169 seats based on current Avelo seat configurations for those two aircraft and kept flat throughout the Forecast Period. Using an 81.9 percent load factor (average load factor of Avelo to Florida markets in 2023) also kept flat throughout the Forecast Period, the Avelo LOI scenario projects 213,077 enplanements in 2025 growing to 293,272 enplanements in 2041 at a CAGR of 2.0 percent. See **Table 2A-23**.

TABLE 2A-23 HEF FORECAST OF ENPLANEMENTS AND OPERATIONS – BASELINE, AVELO LOI SCENARIO

Year	BASELINE		AVELO LOI SCENARIO	
	Enplanements	Operations	Enplanements	Operations
2025	36,372	545	213,707	3,088
2026	37,100	556	505,200	7,300
2027	37,842	567	515,304	7,446
2028	38,599	578	525,610	7,595
2029	39,371	590	536,122	7,747
2030	40,158	602	546,845	7,902
2031	40,961	614	557,782	8,060
2032	41,780	626	568,937	8,221
2033	42,616	638	580,316	8,385
2034	43,468	651	591,922	8,553
2035	44,338	664	603,761	8,724
2036	45,224	677	615,836	8,899
2037	46,129	691	628,153	9,077
2038	47,051	705	640,716	9,258
2039	47,992	719	653,530	9,443
2040	48,952	733	666,601	9,632
2041	49,931	748	679,933	9,825
CAGR				
2025-2030	2.0%	2.0%	20.7%	20.7%
2030-2035	2.0%	2.0%	2.0%	2.0%
2035-2041	2.0%	2.0%	2.0%	2.0%
2025 – 2041	2.0%	2.0%	7.5%	7.5%

Source: RS&H Analysis; USDOT T-100; Avelo LOI, February 13, 2024.

2.5 CRITICAL AIRCRAFT IDENTIFICATION

The FAA requires identification of existing and future critical/design aircraft for airport planning purposes. The term critical aircraft and design aircraft can be used interchangeably. The critical aircraft is the most demanding aircraft, or grouping of aircraft, using the airport regularly. Regular use is specifically defined in AC 150/5000-17, Critical Aircraft and Regular Use Determination, as 500 total annual operations, not counting touch-and-go landings.

Three parameters are used to classify the critical aircraft: Aircraft Approach Category (AAC), Airplane Design Group (ADG), and Taxiway Design Group (TDG). The AAC, depicted by a letter, relates to aircraft landing speeds. The ADG, depicted by a Roman numeral, relates to airplane wingspan and tail height. The TDG, classified by number, relates to the outer-to-outer main gear width and the distance between the cockpit and main gear. These parameters serve as the basis for design and construction of airport infrastructure. An accurate critical aircraft determination helps ensure facilities are developed to meet the proper needs of each portion of the airport.

The 2022 HEF Master Plan forecast identified the airport's critical aircraft as a C-III. Since there was not a single aircraft type that met the FAA requirements of "regular use", the determination was made by grouping aircraft with similar operational performance and/or physical dimensions with the Gulfstream V making up nearly half of those operations.

Based on the updated forecast for HEF that includes commercial service, an updated critical aircraft was determined for Runway 16L/34R, the main runway at HEF. The parallel runway, 16R/34L would not be able to accommodate commercial service operations operated by existing ULCC and therefore is not considered in the critical aircraft determination update. The most demanding aircraft used by existing ULCCs in the United States, including Avelo is the Boeing 737-800, ergo the future critical aircraft for Runway 16L/34R is a Boeing 737-800 (D-III) which is anticipated to have over 500 annual operations by 2025. See **Table 2A-24.**

TABLE 2A-24 HEF CRITICAL AIRCRAFT DETERMINATION

AAC/ADG	Representative Aircraft	TDG
D-III	Boeing 737-800	3

2.6 HEF TOTAL OPERATIONS COMPARED TO THE FAA TAF

The FAA has oversight responsibility to review and approve aviation forecast developed in conjunction with airport planning studies. FAA must approve sponsor forecasts before they can be used to prepare facility requirements in a master plan or before going forward with an environmental document that requires a forecast. The FAA uses a 10.0 percent threshold for the first 5 years and a 15.0 percent threshold for the subsequent 5-year period as a rule-of-thumb for accepting non-FAA forecasts as the basis for planning and environmental studies. If these stated thresholds are exceeded, the FAA Region office in which the airport is located, will forward the forecasts to FAA headquarters for review.

After developing the forecast of commercial passenger operations for HEF, total aircraft operations were consolidated by activity type (air carrier/air taxi, general aviation, and military) for comparison purposes with the FFY 2024 FAA TAF, the latest available TAF document produced and published by the FAA in January 2024. The results show HEF's forecast of total operations is within the 10.0 percent and 15.0 percent thresholds. See **Table 2A-25**.

TABLE 2A-25
BASE CASE FORECAST COMPARISON WITH FAA TAF 2024

	2021		2026		2031		2041	
Category	**Base Case**	**TAF 2024**	**Base Case**	**TAF 2024**	**Base Case**	**TAF 2024**	**Base Case**	**TAF 2024**
Air Carrier & Air Taxi Operations	12,891	12,890	14,806	17,696	16,791	19,444	21,597	23,464
GA & Local GA Operations	84,162	84,162	89,293	84,986	94,736	86,650	106,638	90,153
Military Operations	2,596	2,050	2,596	2,050	2,596	2,050	2,596	2,050
Total Operations	99,649	99,649	106,854	104,732	114,744	108,144	131,985	115,667
GA Based Aircraft	410	372	415	397	424	422	436	472
Comparison with FAA TAF 2024 (percent different)								
Air Carrier & Air Taxi Operations	0.00%		16.3%		13.7%		8.0%	
GA & Local GA Operations	0.00%		5.1%		9.3%		18.3%	
Military Operations	0.00%		26.6%		26.6%		26.6%	
Total Operations	0.00%		2.0%		6.1%		14.1%	
GA Based Aircraft	0.00%		4.5%		0.5%		-7.6%	

Source: RS&H, 2022; FAA TAF, 2024

TABLE 2A-26
AVIATION FORECASTS SUMMARY

	Base Yr. Level	Base Yr.+5yrs.	Base Yr.+10yrs.	Base Yr.+20yrs.	Compound Annual Growth Rate		
					Base Yr. to +5	Base Yr. to +10	Base Yr. to +20
	2021	2026	2031	2041	2026	2031	2041
Enplanements	**N/A**	**37,100**	**40,961**	**49,931**	**720.0%**	**189.0%**	**72.0%**
Operations							
Itinerant							
Air carrier	1	556	614	741	254.0%	90.0%	39.0%
Commuter/air taxi	12,890	14,250	16,177	20,849	2.0%	2.3%	2.4%
General aviation	37,396	39,676	42,094	47,383	1.2%	1.2%	1.2%
Military	2,425	2,425	2,425	2,425	0.00%	0.00%	0.00%
Local							
General aviation	46,766	49,617	52,642	59,255	1.2%	1.2%	1.2%
Military	171	171	171	171	0.00%	0.00%	0.00%
TOTAL OPERATIONS	**99,649**	**106,695**	**114,123**	**130,824**	**1.38%**	**1.37%**	**1.37%**
Based Aircraft							
Single Engine	312	314	319	324	0.13%	0.22%	0.19%
Multi Engine	51	51	52	55	0.00%	0.19%	0.38%
Jet Engine	27	30	32	35	2.13%	1.71%	1.31%
Helicopter	18	18	18	20	0.00%	0.00%	0.53%
Other	2	2	2	2	0.00%	0.00%	0.00%
TOTAL	**410**	**415**	**423**	**436**	**0.24%**	**0.31%**	**0.31%**

Source: RS&H Analysis, 2022-2024; FAA TAF, 2024

APPENDIX A

2.1 BENCHMARKING AIRPORTS WITH ULTRA LOW-COST CARRIER (ULCC) SERVICE

Since HEF historically hasn't had commercial passenger traffic benchmarking airports that added ULCC service with a similar operational background to HEF, such as being in close proximity to a large-hub airport, is an effective way to gain a high-level insight into measures of added capacity and departures. However, it is important to note that each airport is unique in how commercial air traffic evolves as there is no unique formula for determining how passenger traffic will grow when compared to these benchmark airports. Each airport operates in its own geographic area, supported or burdened by its own policies, political environments, and/or other forms of limitations/requirements. The main objective in looking at these airports is to observe behavioral patterns from benchmarking metrics that are associated with growth patterns of daily departures and available seats at each airport based on the addition of ULCC service. Though these comparable airports may have other mainline full-service airlines, this section focuses on the impacts of the integration of ULCC service at these facilities.

2.1.1 Tweed-New Haven Regional Airport (HVN)

HVN is defined as a non-hub primary service airport in the NPIAS which means it serves less than 0.05 percent of all passengers in the U.S. HVN is one of two commercial service airports in the state of Connecticut, the other being Bradley International Airport (BDL) which is located in the center of the state and serves the capital city of Hartford.

As can be seen in Error! Reference source not found., daily departures and available seats at HVN were on a downward trend with the exception of CY 2019 when American Airlines (American) increased service that year. American, like most airlines at HVN, decreased service in CY 2020 and CY 2021 due the COVID-19 Pandemic. American eventually ceased service at HVN in CY 2021. Avelo began service at HVN in CY 2021 and increased service significantly in CY 2022, ultimately establishing a hub at the airport. Daily departures and available seats increased to record levels at HVN with the introduction of Avelo, as seen in Error! Reference source not found.. Avelo initiated service at HVN to three destinations in CY 2021 and expanded to 17 destinations within two years, including Puerto Rico. Based on U.S. DOT T-100 data, load factors have also been the highest experienced by HVN with the introduction of Avelo, at 80.0 percent.

Between CY 2010 and CY 2019, prior to ULCC service, departures per day had a CAGR of -3.9 percent while available seats increased at a CAGR of 2.1 percent. Since Avelo began service in CY 2021, departures per day increased by 168.1 percent and available seats increased by 539.4 percent.

FIGURE 2A-1 HVN DEPARTURES PER DAY AND AVAILABLE SEATS

Source: DOT T-100; RS&H Analysis, 2023

2.1.2 Phoenix-Mesa Gateway Airport (AZA)

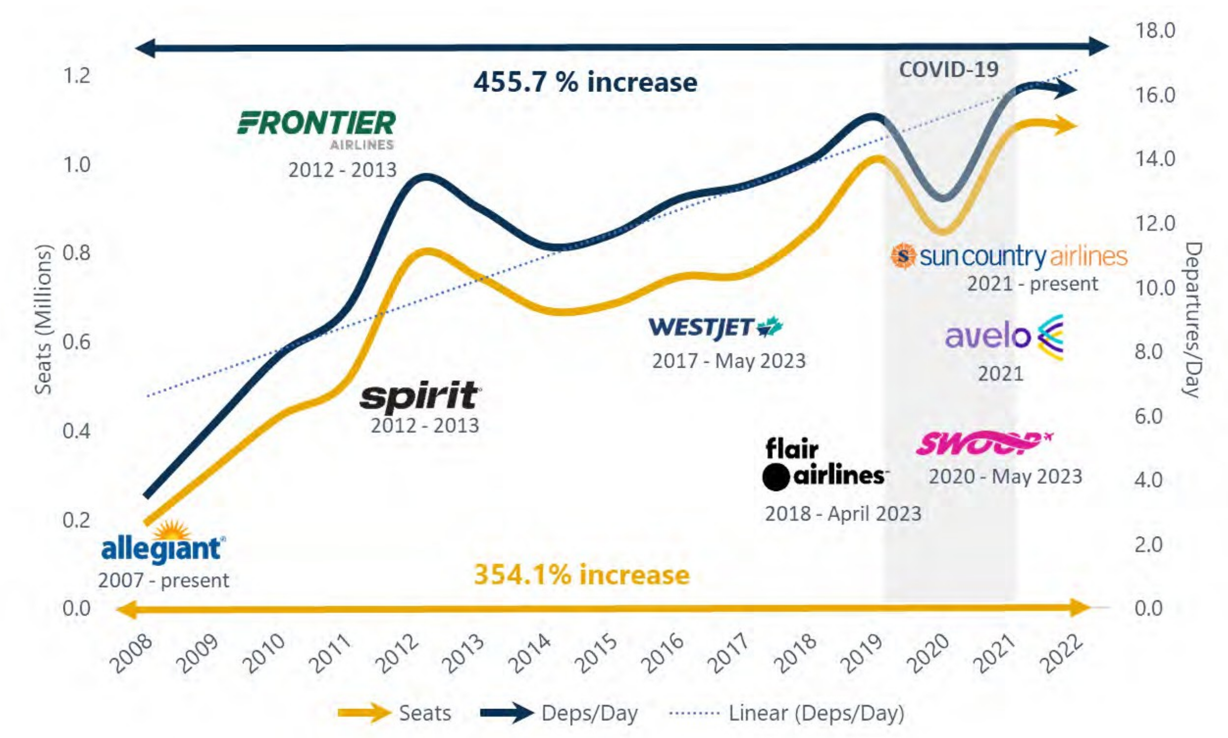
AZA is defined as a small-hub primary service airport in the NPIAS which means it accounts for 0.05 percent to 0.25 percent of total U.S. passengers. AZA is located approximately 20 miles southeast of Phoenix Sky Harbor Airport (PHX), a primary large-hub airport. Formally known as Williams Air Force Base, AZA began serving commercial passenger traffic in CY 2007 as a reliever airport to PHX.

As can be seen in Error! Reference source not found., daily departures and available seats at AZA have fluctuated due to airlines entering/exiting the market, increasing/decreasing service, and/or up gauging aircraft. Allegiant Airlines (Allegiant) began service in CY 2007 and was the first airline to offer commercial passenger service at AZA[9]. AZA is currently one of Allegiant's focus cities. There was a significant increase in both departures per day and available seats from CY 2011 thru CY 2012 as a result of an increase in departures and destinations by Allegiant in addition to Spirit Airlines (Spirit) and Frontier Airlines (Frontier) entering the market with a combined 800 additional annual flights. Similar to the rest of the world, commercial passenger service decreased during the COVID-19 Pandemic. Enplanements and operations at AZA recovered quickly and surpassed pre COVID-19 Pandemic enplanement levels in CY 2022 due to

[9]Terminal Modernization | Phoenix-Mesa Gateway Airport. (n.d.). https://www.gatewayairport.com/terminalmodernization#:~:text=Since%20the%20start%20of%20commercial,nearly%20two%20million%20passengers%20annually.

quite a significant service increase by Allegiant and Swoop Airlines (Swoop), a Canadian based ULCC. With Canadian carriers WestJet, Swoop and Flair Airlines suspending service in CY 2023, AZA currently has 2 ULCC operators, Allegiant and Sun Country Airlines (Sun Country). Many ULCC airlines have initiated and ceased services at AZA, however, with Allegiant as an airline partner, AZA's seat capacity increased 354.1 percent from CY 2008 thru CY 2022 while daily departures increased by 455.7 percent in the same time period.

FIGURE 2A-2 AZA DEPARTURES PER DAY AND AVAILABLE SEATS



Source: DOT T-100; RS&H Analysis, 2023

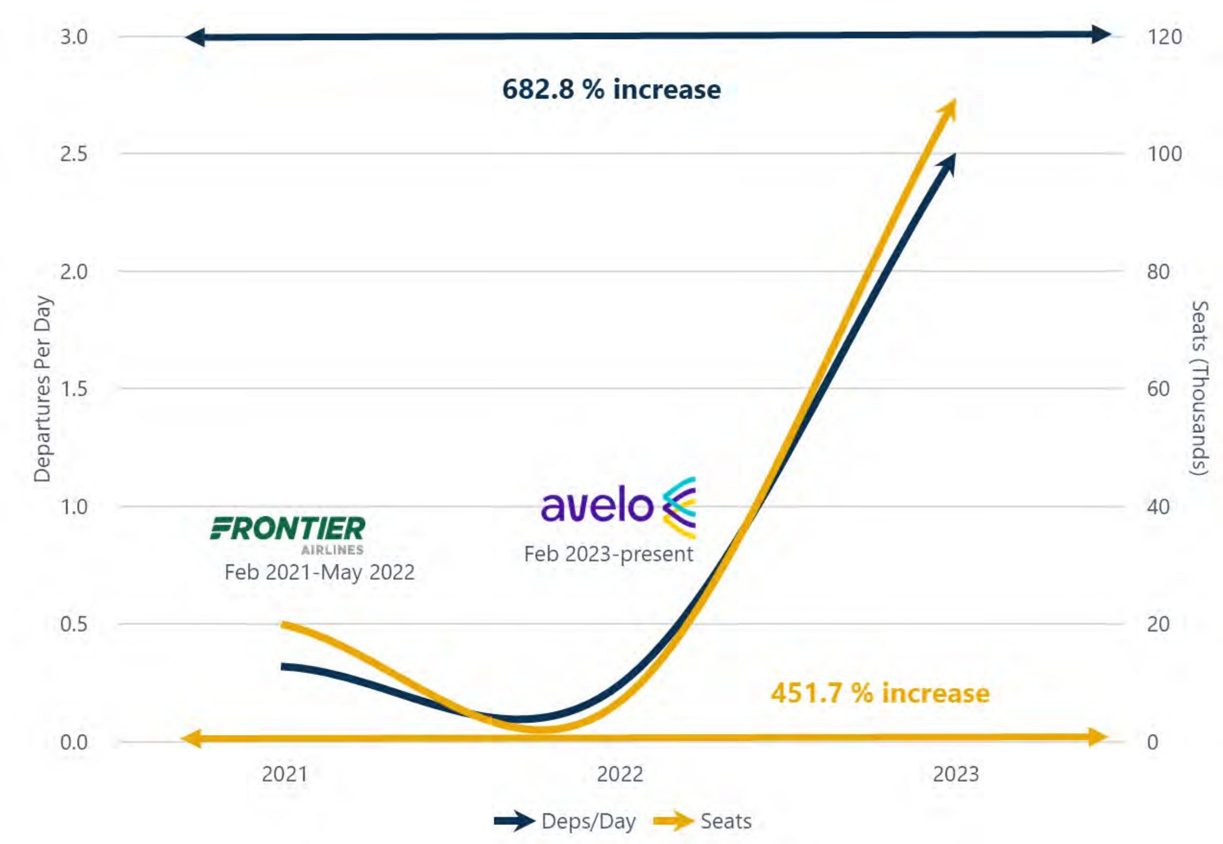
2.1.3 Wilmington Airport (ILG)

ILG opened for commercial service in 1947 and is classified as a non-hub primary service airport by the NPIAS. It is located 35 miles southwest of Philadelphia International Airport (PHL) and is the base for the Delaware Air National Guard.

Frontier served ILG between CY 2013 and CY 2015 and returned from CY 2021 through CY 2022. Avelo announced plans to serve ILG in FY 2022 and began service in February 2023 to 10 markets with over 600 annual flights as of September 2023. Between May 2022 and February 2023, there was no commercial passenger service available at ILG. Once Avelo began service, from CY 2021 thru September 2023[10], departures per day at ILG increased by 682.8 percent while available seats increased by 451.7. See **Figure 2A-3** Error! Reference source not found.**.**

[10] DOT T-100 data only has data up to September 2023. 2023 data was used for ILG because that is when the ULCC service began to grow.

FIGURE 2A-3 ILG DEPARTURES PER DAY AND AVAILABLE SEATS



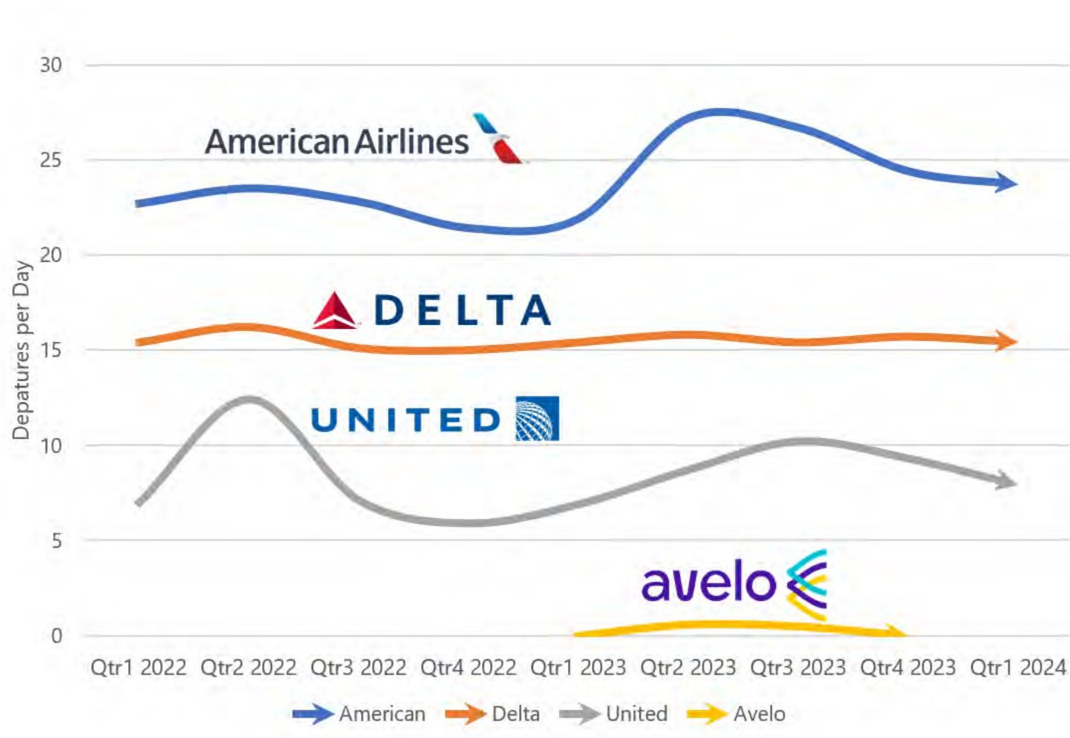
Source: DOT T-100; RS&H Analysis, 2023

2.1.4 Charlottesville-Albemarle Airport (CHO)

CHO welcomed its first commercial airline service, operated by Piedmont Airlines in 1955. CHO is classified as a non-hub primary service airport by the NPIAS. Throughout its history CHO has played a pivotal role in serving the transportation needs of Central Virginia. It is located 66 miles northeast of Richmond, the capital of the Commonwealth.

CHO historically operated services to large connecting hubs concentrating on a core of corporate travel activity with high yields. Avelo entered the market in May 2023 with two weekly services to MCO as an alternative to the network carriers. Avelo withdrew service in August 2023 after only five month of service achieving an average load factor of 60.3 percent. In addition to CHO, from the period between July 2023 and March 2024 Avelo left a further five markets where they operated twice weekly. Those markets included Mobile International Airport (BFM), Colorado Springs Airport (COS), Dayton International Airport (DAY), Chicago Midway Airport (MDW), and Memphis International Airport (MEM). Avelo also left Melbourne Orlando International Airport (MLB) where they operated 18 monthly departures.

FIGURE 2A-4 CHO DEPARTURES PER DAY



Source: DOT T-100; RS&H Analysis, 2023

2.1.5 Summary

The ULCC business model, which offers fewer services and amenities than the legacy airline model, is rapidly expanding in the U.S, however, it's growth has slowed due to market saturation in some areas (such as Florida) and financial underperformance of two key ULCC airlines. The ULCC business model proved successful in Europe with airlines such as Ryanair which ranked as the third largest carrier in the world in terms of passengers carried[11] in CY 2022 and largest airline in the world by market capitalization ($29.6 billion) in CY 2023[12]. The benchmarked airports in this report demonstrate the positive effect ULCC's have at non and small-hubs when initiating service.

[11] Flight Global, December 2023

[12] Companies Market Cap, 2023

Attachment #2 – Avports Commercial Service Forecast

Avports' Forecast Methodology

The methodology used for projecting HEF traffic involved a multi-layered approach, combining standard econometric projections with specific analyses tailored to the unique characteristics of HEF.

- The airport currently does not have the operation of based scheduled carrier and will undergo a substantial transformation and can be considered a semi-greenfield project.
- There is no historical airport precedent near the surrounding area that can serve as a direct comparison for such a development project.
- It will not be a case of a competition between a major and a secondary airport, as DC area is served by 3 major airports (DCA, IAD and DWI).

An econometric analysis as stated in ICAO's Doc 8991, is *the most common method of forecasting civil aviation demand* in the industry. Also, as stated by FAA in Forecasting Aviation Activity by Airport, it *is one of the fundamental techniques used to analyze and forecast aviation activity*.

The projection was composed of 3 steps: 1) Estimating the size of the catchment area, 2) projecting underlying organic growth, 3) determining the reduction of leakage.

1. Catchment Area Sizing

As an initial step, the total catchment area for HEF (current number of O/D passengers) needed to be accurately estimated. This process involved several key components:

- ***Estimating HEF's Geographical Catchment Area***: The physical boundaries and reach of HEF's catchment area were determined, considering geographical, demographic, and passenger demand as factors. It is important to understand that a catchment area is porous: it represents the core passengers using the airport, but there is also passenger demand to be captured beyond it.
- ***Propensity to Fly benchmark on other airports***: Comparative benchmark from similar airports or states to assess the likelihood of individuals within the catchment area to use air travel. This provided a contextual understanding of travel habits and market potential. It was further particularized at a statehood level to give a better picture (Exhibit 1)
- ***Mobile Data to size O/D Passengers Inside HEF's Catchment Area***: Mobile data analytics was used. This consists in using geolocation data obtained from cellphone apps from a geofenced location (DC airports) to identify and quantify origin and destination (O/D) passengers within the catchment area. This data provided granular insights into passenger routes as well as size. Most importantly, it served to understand which geographical zones within DC generate or receive passengers. (Exhibit 2)

This step allowed sizing the maximum market potential (as per when the forecast was done) inside HEF's catchment area if there was no leakage to other airports.

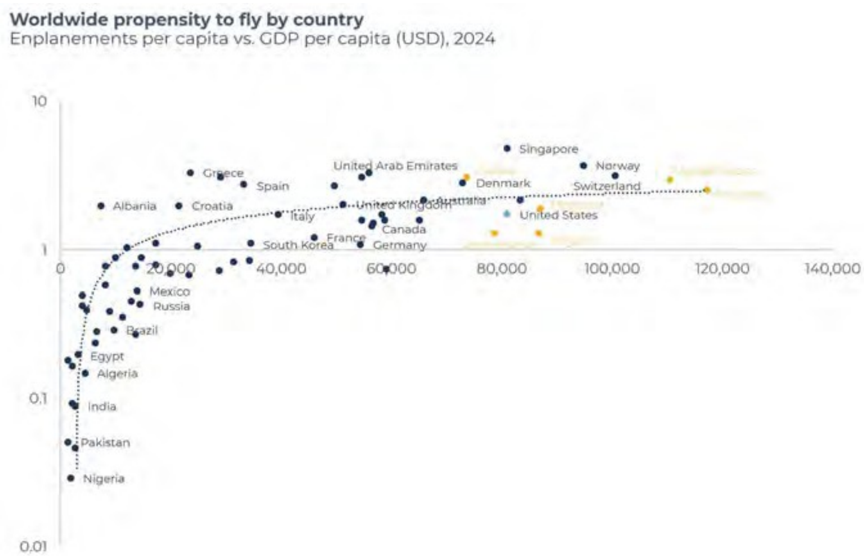


Exhibit 1: Propensity to fly as a function of GDP per capita in select countries and select US states. Both Maryland and Virginia (excluding DC) are around the US average and are expected to continue growing in line.

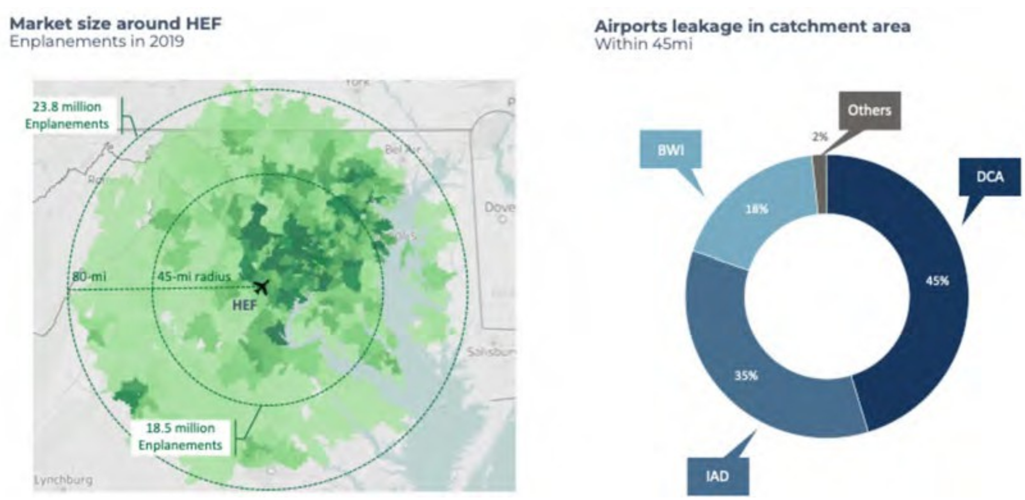


Exhibit 2: Within a 45-mile radius from HEF, there were 18.5m enplanements in 2019, of which 45% flew via DCA, 35% IAD, 18% BWI and 2% from other airports. No passengers flew from HEF.

2. Organic Growth Projection

Once the catchment area was determined (maximum market potential), the next step was to project the underlying organic growth within this area. This projection was based on a comprehensive assessment of historical and forward-looking data:

- ***Historical Growth Analysis:*** Historical growth rates were analyzed and compared with different market growth rates to identify trends and patterns. This analysis helped to understand past performance and set a baseline for future projections.

- ***Econometric analysis***: The relationship between historical air traffic growth and economic development indicators (GDP, Income, Population) was examined. This allowed us to develop a forecast according to this model specific for the region. (Exhibit 3)
- **Top-down forecast:** Using the insights gained from the historical analysis and econometric correlations, forward-looking projections were made for the total catchment area at HEF. (Exhibit 4)

This step allowed us to determine the size of HEF's catchment area forward looking for the next 15-20 years.

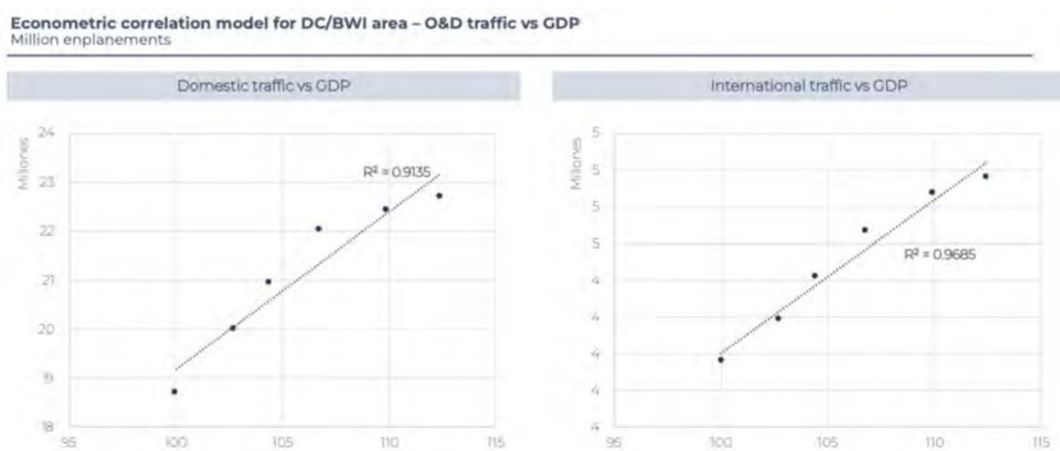


Exhibit 3: Correlation model for domestic and international traffic in DC area, relating GDP with enplanements. This serves as a projection of the total demand in the area on a forecast up to 2040.

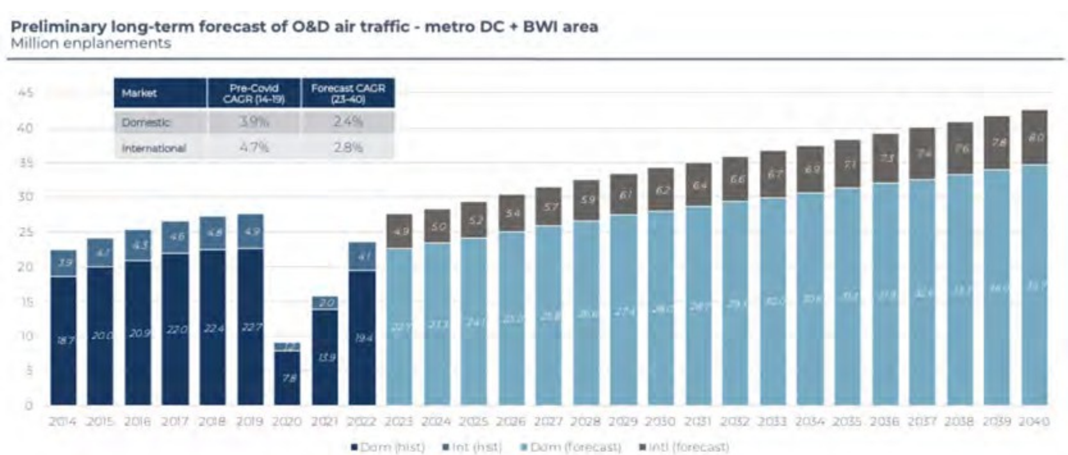


Exhibit 4: Resulting own passenger traffic forecast for DC area passengers (2023-2040) using the correlation model shown in Exhibit 3.

3. Leakage Reduction

The final step involved determining the reduction of leakage, of HEF's catchment area to other alternative airports on a long-term steady scenario, to obtain the number of passengers that HEF would capture inside its own geographical area.

- ***Leakage Dynamics Benchmark by Traffic Segment:*** The effect of distance in competing airports at DC Area was analyzed by traffic segments to obtain the existing relationship in the ability to attract traffic depending on the airport distance versus other airports.
- ***Traffic capture curve at other US airports***: Leakage levels capture curves were analyzed for other airports (competing versus hubs). The curves were parametrized and used in order to project the fair traffic capture share. (Exhibit 5)
- ***HEF Long-term leakage***: A projection was made for future leakage rates with and without infrastructure limitations (such as runway length or terminal capacity), according to the leakage benchmark and by traffic segments. This was done by combining the traffic capture curve with the total traffic projection from DC.
- ***Ramp-up estimation***: The ramp-up period was incorporate into the forecast in order to adjust for the transition from the short-term traffic into the mid and long-term projection. This considered an airline entering the market with a similar growth shown as HVN (when the forecast was done)

With this analysis, combined with step number 2 it was possible to obtain a forecast for HEF's evolution in the next 15-20 years.

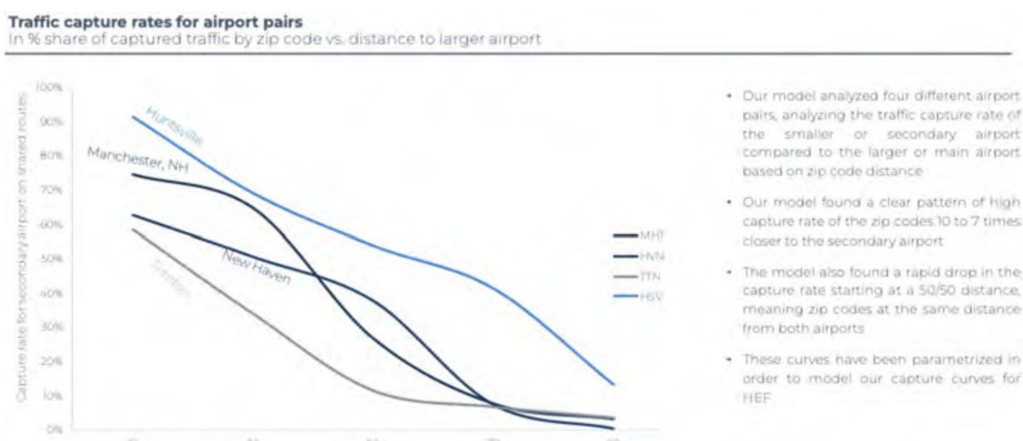
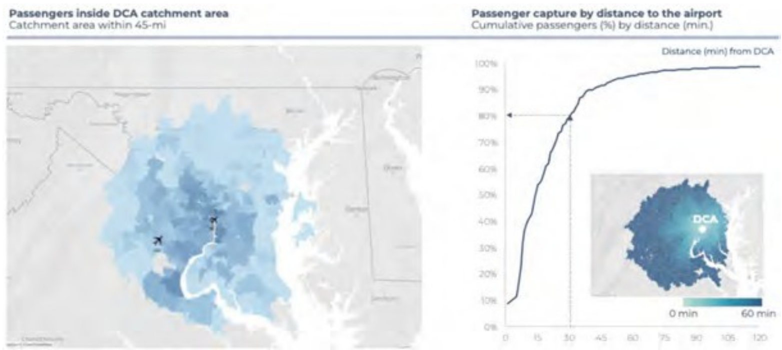
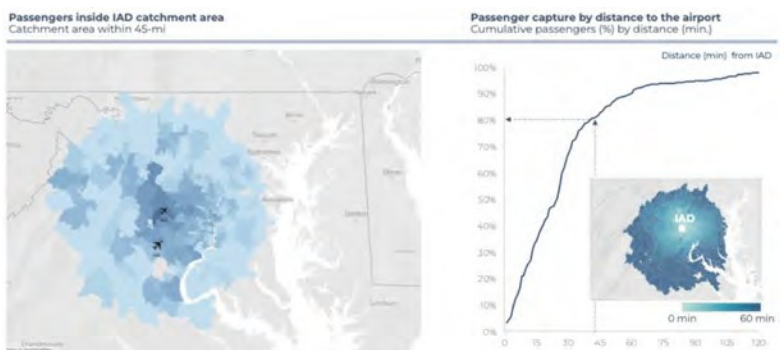


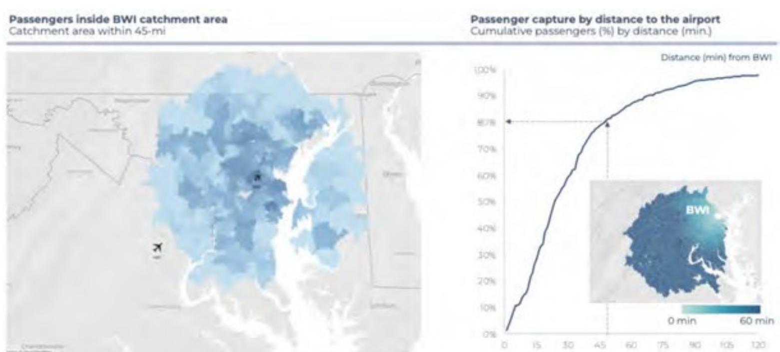
Exhibit 5: Traffic captured by a secondary airport (versus a main airport) on 4 selected airports in the US, showing how traffic captured is a function of the relative distance between demand and both airports. Passengers prefer airports which are closer to their true origin or destination (which is obtained by using mobile data)

Current Catchment Areas

An analysis of the catchment areas (data for 2024) has been obtained to show the current dynamics at the 3 main airports which serve DC Area (DCA, IAD and BWI). The graphs show at the left side the distribution of their own passengers at a zip-code level, and at the right side the cumulative traffic by driving distance. (Exhibits 6, 7 and 8)







- DCA: Concentrates 80% of their traffic within a 30 min distance (without jams)
- IAD: Concentrates 80% of their traffic within a 45 min distance (without jams)
- BWI: Concentrates 80% of their traffic within a 50 min distance (without jams)

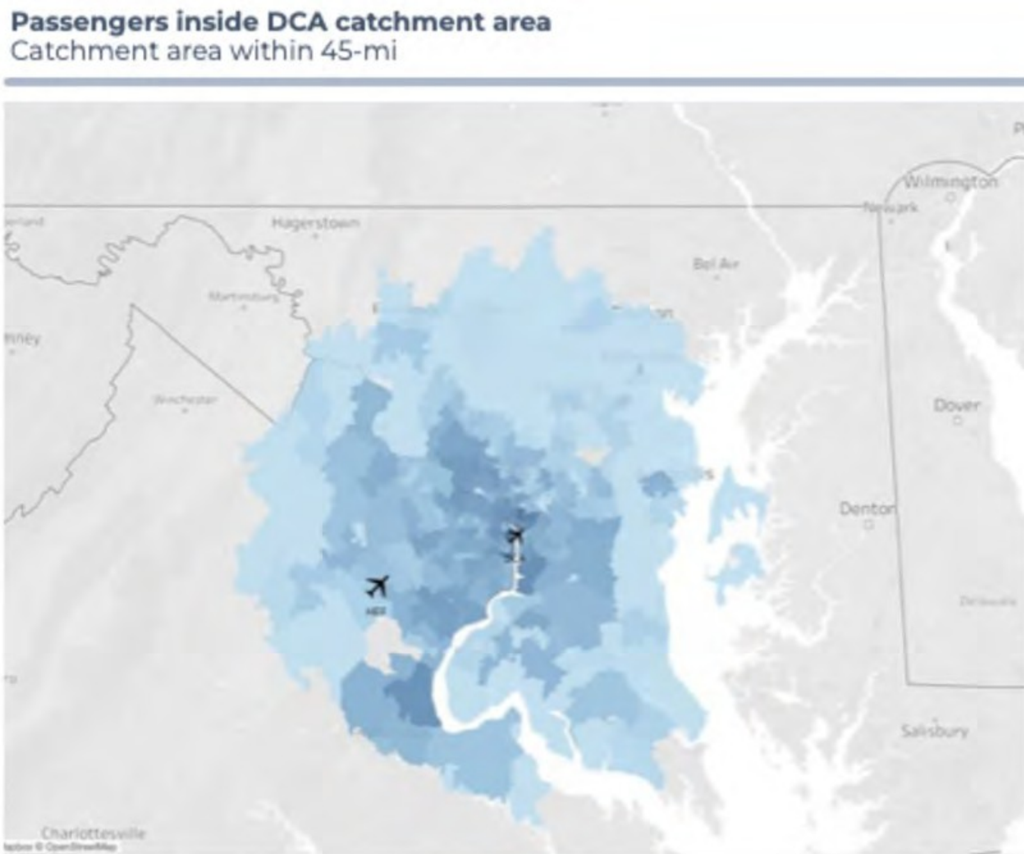
It is worth noting that BWI, which is the airport with a bigger share of Low-Cost Carriers operating at the airport, is the airport in which their traffic is more thinly distributed, attracting their core passengers further than DCA or IAD do. It should be expected that HEF, composed mainly by LCCs or ULCCs, would be able to attract demand beyond its geographical vicinity.

Differences – Master Plan Forecast vs EA Forecast

A list of differences has been compiled to explain the fundamental distinctions between the forecast from the Master Plan and the EA Forecast presented.

	Master Plan	EA Forecast
Core Catchment Area Size	Six counties from Manassas	45-mile radius from HEF
O/D Data Source	Credit Cards	Geolocated Mobile Data
DC Area Airports	IAD DCA RIC	IAD DCA BWI
DC Forecast Growth	Total: 1.8% ('23-'41)	Domestic: 2.4% ('23-'40) Internat.: 2.8% ('23-'40)
DC Forecast Methodology	Use the growth from the published TAF	Econometric regression analysis
Core Catchment / DC Area O/D Traffic	Maintain a flat ratio of 14%	Variable ratio dependent on each airport growth direct from independent airport traffic forecast
Potential O/D from the core catchment ratio	Flat ratio versus current	Progressive leakage reduction up to serviceable core catchment O/D routes critical passenger mass
Market conditions	No change (baseline)	Core anchor-based airline would be operating at HEF servicing potential demand alongside other airlines
Enplanements (2040)	Baseline 50k	Base 1,400k
Operations	Fixed seat (169 seats) and load factor (79%)	Non fixed seat capacity (progressive up-gauging) and load factor in the long-term

Fundamentally, the Master Plan does not account for any change in the market conditions, while the EA Forecast assumes a major change (which is the entry of an anchor airline able to serve the potential demand, thus realizing the potential passengers)



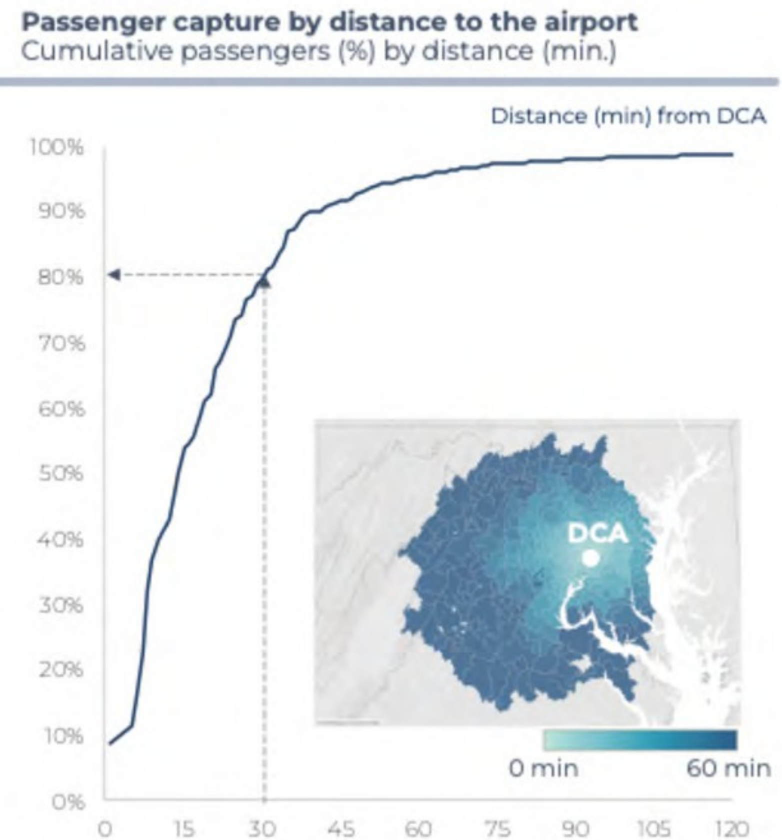


Exhibit 6: Distribution of passengers using DCA airport (left), and cumulative traffic as a function of distance (in min) from the airport.

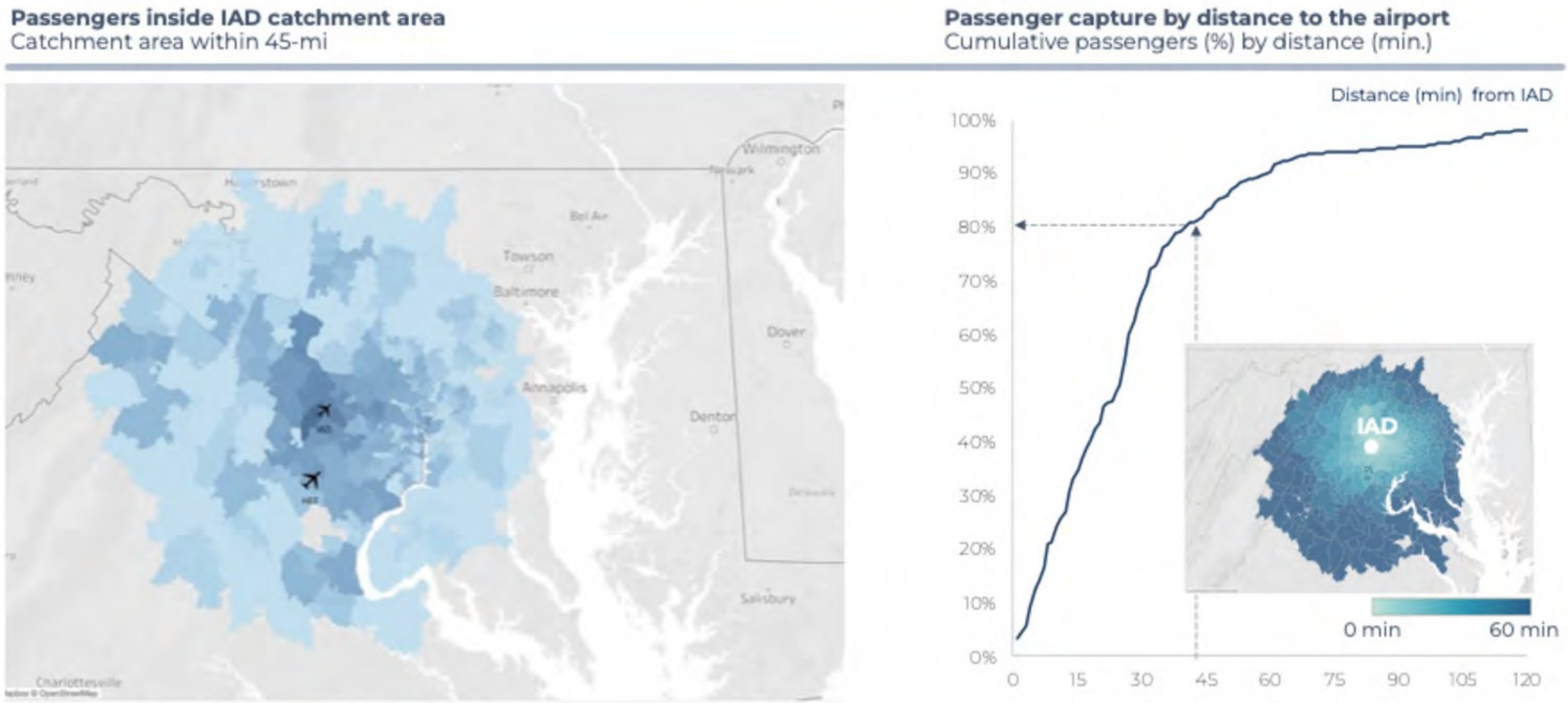
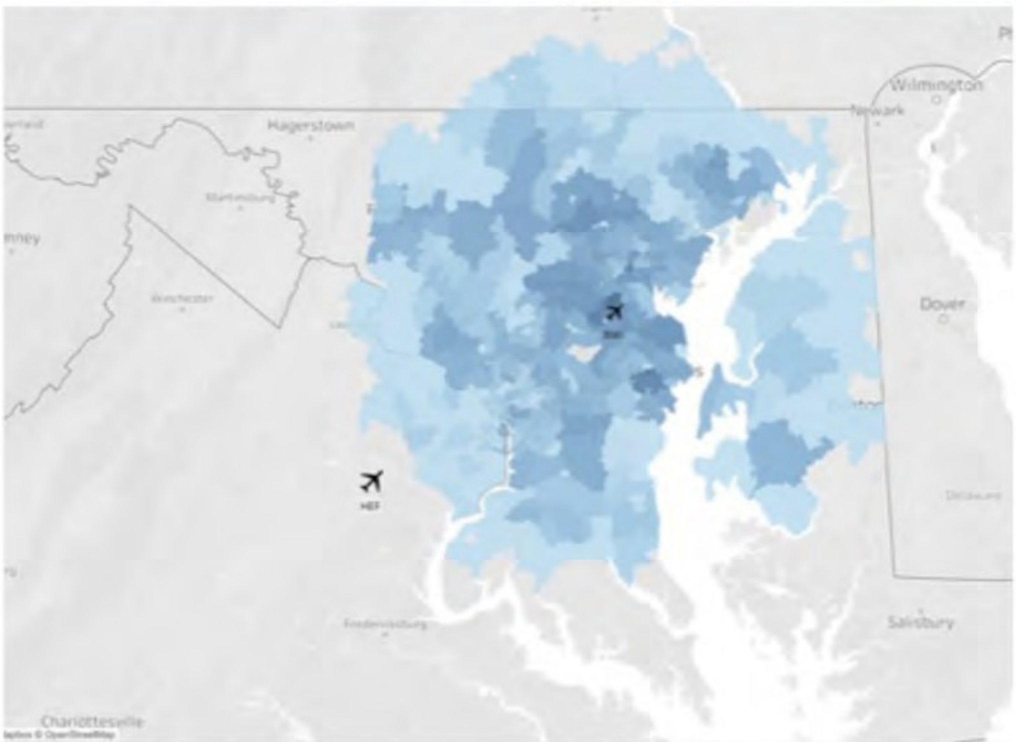


Exhibit 7: Distribution of passengers using IAD airport (left), and cumulative traffic as a function of distance (in min) from the airport.

Passengers inside BWI catchment area
Catchment area within 45-mi



Passenger capture by distance to the airport
Cumulative passengers (%) by distance (min.)

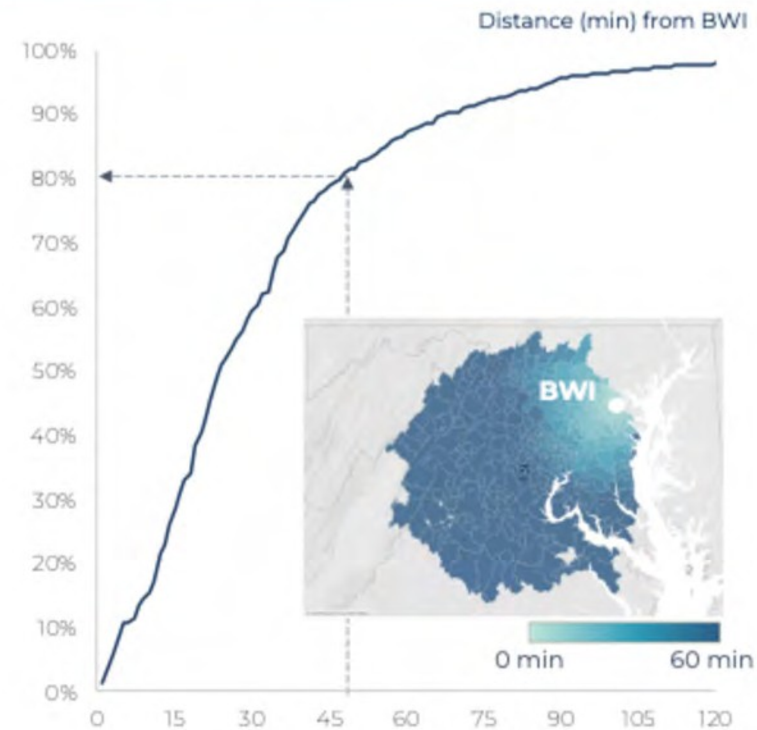


Exhibit 8: Distribution of passengers using BWI airport (left), and cumulative traffic as a function of distance (in min) from the airport.

FLARE AVIATION CONSULTING

Prorated Forecast 2024-2040

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Enplanements (k)	0	585	788	843	974	1096	1183	1210	1238	1266	1279	1291	1304	1317	1331	1370	1409

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Daily Depatures	0	11	15	17	20	22	25	25	26	26	26	26	27	27	28	28	29

Attachment #3 - Alternative Airports and Runway Length Analysis

Alternate Airport Analysis and Runway Length Analysis

Table of Contents

1. Utilization of Surrounding Airports

An alternative considered in this Environmental Assessment (EA) involves utilizing nearby surrounding airports to accommodate the proposed addition of commercial airline operations, rather than implementing it at HEF. This alternative explores the potential of introducing new passenger service at a neighboring airport. However, the consideration of an alternate airport requires that the alternate airport has the minimum capabilities to support commercial airline operations as contemplated at HEF.

Any alternative airport that could be considered as an alternative to HEF must be based on factors such as public use airport, proximity of the alternative airport to the passenger catchment area[1], the runway length available, instrument approach capabilities, Part 139 certification, and the ability of the surrounding airport to handle the proposed infrastructure demands associated with the proposed level of commercial airline operations.

This analysis evaluated surrounding National Plan of Integrated Airport System (NPIAS) airports using two catchment area radii to identify potential facilities capable of accommodating the forecasted passenger service at HEF. The first radius, 20 nautical miles (NM), aligns with the service area used in the most recent Airport Master Plan (AMP) forecast. The second radius, 45 nm, is based on the broader catchment area defined in the recent Avports' forecast. These radii were applied to assess which nearby public-use airports could potentially support the proposed commercial airline operations. A total of 16 potential alternative public-use airports were identified for this comparison assessment. **Figure 1** illustrates the identified airports and the boundaries of the two catchment areas used in this analysis.

[1] Catchment Area refers to the geographic region surrounding an airport from which an airport can reasonably expect to draw commercial air service passengers, influenced by factors such as accessibility, service level, and competition from other airports.

1.1 Airport Requirement Categories

The following sections outline key requirements to accommodate the proposed scheduled commercial airline operations; it is essential to assess the surrounding airports and their critical infrastructure to verify they can viably support safe and efficient airline operations as an alternative facility. The following sections outline critical airport criteria necessary for commercial airline operations, including adequate runway dimensions, availability of instrument approach procedures, compliance with Federal Aviation Administration (FAA) Federal Aviation Regulation (FAR) Part 139 certification standards, and the presence of an Air Traffic Control Tower (ATCT). Each of these components plays a vital role in ensuring the airport is a viable candidate to support scheduled passenger operations in accordance with airline preferences and federal safety guidelines.

1.1.1 Runway Dimensions

Runway dimensions are determined based on critical aircraft types, operational characteristics, and safety standards established by the FAA. Factors such as aircraft weight, performance requirements, wind conditions, and airport elevation influence the necessary runway length, while width requirements are based on the aircraft's wingspan and approach speed.

Runway length should accommodate the landing and departure length needed by the critical aircraft[2]. Operational conditions such as airport elevation, aircraft type, weather conditions, and stage length can significantly impact runway length requirements for air carrier operators. As part of this alternatives analysis, a runway length analysis was performed to evaluate if the existing runway configurations at the alternative airports can adequately accommodate forecasted critical aircraft operations. The standard methodologies provided in Advisory Circular (AC) 150/5325-4 Runway Length Requirements for Airport Design were used. It was determined that a runway length of 6,200 feet (ft) can accommodate a majority of the Boeing 737-800 payload[3]**. T**here are three airports in the study radius that provide at least one runway with a length greater than 6,200 ft. These airports are outlined in **Table 1-1.**

Table 1-1 Catchment Area – Airports Offering a 6,200 or Greater Runway Length

Airport	Airport Code	Radius	Runway Length (ft)
Manassas Regional Airport	HEF	20 NM	6,200
Ronald Reagan Washington National Airport	DCA	45 NM	7,169
Washington Dulles International Airport	IAD	20 NM	11,500

Source: (AirNav, 2025),

[2] The Critical Aircraft determination sets the dimensional requirements on an airport, such as the separation distance between taxiways and runways, and the size of certain areas protecting the safety of aircraft operations and passengers. The Critical Aircraft determination matches aircraft operational area dimensions to the most demanding aircraft that regularly use the runways, taxiways, and apron areas. FAA AC 150/5000-17 *Critical Aircraft and Regular Use Determination*, June 20, 2017.

[3] A detailed runway length analysis supporting a 6,200' runway length requirement is provided in Section 2 of this report.

AAC (Aircraft Approach Category) and ADG (Airplane Design Group) are classification systems defined in FAA Advisory Circular 150/5300-13B that help guide runway design to ensure safe and efficient airport operations. AAC is based on an aircraft's approach speed, and ADG is based on aircraft wingspan and tail height, influencing the design of runway width, shoulders, safety areas, obstacle free areas, and taxiway separation.. Together, these categories determine the dimensional standards and safety areas needed to accommodate specific aircraft types, ensuring that runway design aligns with the operational characteristics of the aircraft using the airport.

The critical aircraft included in the recent HEF forecast effort includes the Boeing 737-800 family of aircraft which is a C/D-III due to its approach speed and physical dimensions. According to FAA Advisory Circular 150/5300-13B, airports that regularly serve C/D-III with a Maximum Takeoff Weight (MTOW) of greater than 150,000 lbs. the standard runway width is 150 ft, the shoulder width is 25 ft, and the runway blast pad width is 200 ft (FAA, 2024). Currently there are two airports in the study radius that provide at least one runway with a width equal to or greater than 150 ft. These airports are outlined in **Table 1-2** below. It is important to note that HEF currently has a runway widening project included in the Airport Capital Improvement Project (ACIP) to bring the runway width to a full 150 ft width and this is Project #13 in the EA (FAA, 2024).

Table 1-2 Catchment Area – Airports Offering a 150ft or Greater Runway Width

Airport	Airport Code	Runway Width (ft)
Ronald Reagan Washington National Airport	DCA	150
Washington Dulles International Airport	IAD	150

Source: (AirNav, 2025),

1.1.2 Instrument Approach Availability & Air Carrier Preferences

Instrument Approach Procedures (IAPs) are essential for air carriers who operate under Instrument Flight Rules (IFR). They provide a structured way for aircraft to navigate to a runway under reduced visibility conditions. Different types of IAPs exist, including precision (PA), approaches with vertical guidance (APV), and non-precision approaches (NPA), each offering varying levels of precision and guidance. Air carriers have preferences for specific IAPs, often based on factors like aircraft capabilities, weather conditions, and airport infrastructure. For the purposes of this analysis IAP's are classified into the following categories:

- Precision Approaches (PA) - These approaches provide both horizontal and vertical guidance to the runway, allowing for landings with low visibility, even in low-decision height (DH) conditions. These approaches require the airport to have an Instrument Landing System (ILS), runway approach lights, and marker beacons.

- Approaches with Vertical Guidance (APV) - These approaches provide vertical guidance, but not as precisely as PA. They still offer a degree of accuracy but may have higher minimum descent altitudes (MDAs) and visibility requirements.
- Non-Precision Approaches (NPA) - These approaches rely solely on horizontal guidance. They may not provide vertical guidance and require pilots to manage their descent manually.

Air carriers generally prefer airports with precision approaches and established IAPs utilizing ILS to ensure safe, efficient, and reliable operations, particularly during poor weather conditions or periods of low visibility. Precision approaches, such as those supported by an ILS or satellite-based systems like WAAS-enabled LPV/APV approaches, are especially valued because they provide greater accuracy and vertical guidance for aircraft on approach to the runway. The availability and efficiency of these procedures can influence airline decisions regarding airline service routes, airport selection, and scheduling. As such, an airport looking to attract and or expand commercial airline operations should offer established PA IAPs with visibility minimums of ½ Statute Mile (SM) or less. Currently, there are four (4) airports in the study radius that provide at least one PA IAP with visibility minimums as low as ½ SM. These airports are outlined in **Table 1-3**.

Table 1-3 Catchment Area – Precision Approach IAP Capable Airports

Airport	Airport Code	Radius	IAP Types	Lowest Minimums
Manassas Regional Airport/Harry P. Davis Field	HEF	20 NM	PA/APV/NPA	1/2 SM
Ronald Reagan Washington National Airport	DCA	45 NM	PA/APV/NPA	<1/2 SM
Washington Dulles International Airport	IAD	20 NM	PA/APV/NPA	<1/2 SM
Winchester Regional Airport	OKV	45 NM	PA/APV/NPA	1/2 SM

Source: (AirNav, 2025),

1.1.3 FAR Part 139 Certification

FAR Part 139 certification, governed by the FAA, is a regulatory requirement for airports that serve scheduled air carrier operations with aircraft designed for more than nine (9) passenger seats. This certification ensures that airports meet specific safety, operational, and maintenance standards necessary to support commercial airline operations. Key requirements include maintaining safe airfield conditions, conducting regular inspections, implementing wildlife hazard management, providing Aircraft Rescue and Firefighting (ARFF) services, and having an FAA-approved Airport Certification Manual (ACM). FAR Part 139 certification is essential for airports seeking to accommodate commercial airline operations, as it demonstrates compliance with federal safety standards and operational readiness (FAA, 2024). Currently there are two (2) airports in the study radius which are FAR Part 139 certified, these airports are outlined in **Table 1-4**.

Table 1-4 Catchment Area Part - 139 Certified Airports

Airport	Airport Code	Radius	ARFF Index
Ronald Reagan Washington National Airport	DCA	45 NM	C
Washington Dulles International Airport	IAD	20 NM	E

Source: (AirNav, 2025), Part 139 Airport Certification Status List (Federal Aviation Administration, 2025)

It is critical to note that while not included on this list of existing Part 139 certified facilities in the study radius, Manassas Regional Airport, currently a non-Part 139 general aviation facility, is actively pursuing Part 139 certification. This will support scheduled commercial airline operations and expand its role in regional air transportation. The airport is working to meet FAA safety and operational standards by upgrading its infrastructure, enhancing emergency response capabilities, and developing a formal Airport Certification Manual. Achieving Part 139 status will allow HEF to accommodate larger aircraft, attract airline service, and better serve the growing needs of the community and surrounding areas.

1.1.4 Air Traffic Control Tower

An ATCT allows for direct, real-time communication between air traffic controllers and pilots, enabling safe sequencing of arrivals and departures, conflict resolution, and effective management of taxiing aircraft and ground vehicles. This level of control is especially important for supporting traffic complexity associated with commercial operations, reducing delays, and ensuring regulatory compliance with FAA requirements for certain levels of service. An airport should provide an air traffic control tower when accommodating commercial passenger aircraft to enhance operational safety, efficiency, and coordination in increasingly complex airspace and ground environments.

A Part 121 carrier is not explicitly prohibited from operating out of an airport without an air traffic control tower; however, it is very uncommon, and subject to strict operational and safety requirements in an air carriers' operational specifications. Additionally, the presence of an air traffic control tower improves airline confidence in the airport's operational capabilities and contributes to a more predictable and professional environment for commercial airline activity. Currently there are four (4) airports in the study radius which have an operating ATCT. These airports are outlined in **Table 1-5**.

Table 1-5 Catchment Area – Airports with Operating ATCT

Airport	Airport Code	Radius	Hours Attended
Leesburg Executive Airport	JYO	45 NM	06:00-21:00
Manassas Regional Airport	HEF	20 NM	06:30-22:30
Ronald Reagan Washington National Airport	DCA	45 NM	Continuous
Washington Dulles International Airport	IAD	20 NM	Continuous

Source: (AirNav, 2025)

1.2 Airport Requirements Summary

The summary of the requirements in Table 1-6 clearly indicates that Manassas Regional Airport is the best fit within the study radius to meet the operational criteria for the forecasted passenger operations. The airport provides the necessary runway length and width to support a range of critical aircraft under varying conditions, including high temperatures and full-load operations. Additionally, Manassas offers precision instrument approach procedures with favorable minimums, enhancing all-weather accessibility and safety. The presence of an operational air traffic control tower further supports efficient and controlled aircraft movements, particularly for commercial and high-performance general aviation operations. Additionally, the airport is well positioned to address the existing Part 139, and runway width limitations in the table below with a developed ACIP project addressing both shortcomings.

While Reagan National Airport (DCA) and Dulles International Airport (IAD) also meet the technical requirements as depicted in **Table 1-6**, both are designated as large hub airports in the NPIAS and currently face capacity constraints (DCA is slot controlled and IAD is subject to delay). These limitations may not accommodate the projected additional passenger service identified in the Avports' forecast, further positioning Manassas Regional Airport as the most viable and sustainable option for future growth. The green highlighted areas meet the selection criteria.

Table 1-6 – Surrounding Airport Requirements Summary

Airport Name	ID	Radius	Runway Length Available (ft)	Runway Width (ft)	Instrument Approach Type	Lowest IAP Minimums	Part 139	ATCT
College Park Airport	CGS	45-NM	2,980	60	APV / NPA	1 SM	No	No
Culpeper Regional Airport	CJR	45-NM	5,000	100	APV / NPA	1 SM	No	No
Davis Airport	W50	45-NM	2,600	50	N/A	N/A	No	No
Freeway Airport	W00	45-NM	2,420	40	APV	1 SM	No	No
Front Royal-Warren County Airport	FRR	45-NM	3,008	75	NPA	1 ¼ SM	No	No
Leesburg Executive Airport	JYO	45-NM	5,500	100	PA/APV/NPA	¾ SM	No	Yes
Maryland Airport	2W5	45-NM	3,740	75	NPA	1 SM	No	No
Montgomery County Airpark	GAI	45-NM	4,202	75	APV/NPA	1 SM	No	No

Orange County Airport	OMH	45-NM	3,200	75	NPA	1 SM	No	No
Potomac Airfield	VKX	45-NM	2,665	40	NPA	1 SM	No	No
Ronald Reagan Washington National Airport	DCA	45-NM	7,169	150	PA/APV/NPA	< ½ SM	Yes	Yes
Shannon Airport	EZF	45-NM	2,902	100	NPA	3 SM	No	No
Stafford Regional Airport	RMN	45-NM	6,000	100	PA/APV/NPA	¾ SM	No	No
Warrenton / Fauquier Airport	HWY	20-NM	5,000	100	APV/NPA	¾ SM	No	No
Washington Dulles International	IAD	20-NM	11,500	150	PA/APV/NPA	< ½ SM	Yes	Yes
Winchester Regional Airport	OKV	45-NM	5498	100	PA/APV/NPA	½ SM	No	No

Airports such as Leesburg Executive Airport and Stafford Regional Airport meet several of the requirements identified in this analysis. However, both facilities lack key infrastructure necessary to attract commercial airline operations and would require significant and costly capital investments, such as runway extensions or the addition of an air traffic control tower (ATCT), to accommodate the projected needs of future air carrier traffic.

2. Full Runway Length Analysis for Appendix

In accordance with FAA Advisory Circular 150/5325-4B, Runway Length Requirements for Airport Design, an analysis was conducted to determine the runway length requirements for proposed passenger air carrier at HEF. AC 150/5325-4B uses a five-step procedure to determine recommended runway lengths for a selected list of critical design airplanes. The five steps (somewhat abbreviated) are listed below.

1. Identify the list of critical design airplanes that will make regular use of the proposed runway for an established planning period of at least five years. For federally funded projects, the definition of the term “substantial use” quantifies the term “regular use”.
2. Identify the airplanes that will require the longest runway lengths at MTOW. This will be used to determine the method for establishing the recommended runway length. When the MTOW of listed airplanes is over 60,000 lbs., the recommended runway length is determined per individual airplanes.
3. Use Table 1-1 in the AC 150/5325-4B (**Table 2-1** in this document) and the airplanes identified in step #2 to determine the method that will be used for establishing the recommended runway length. MTOW is used because of the significant role played by airplane operating weights in determining runway lengths.
4. Select the recommended runway length from among the various runway lengths generated by step #3 per the process identified in chapters 2, 3, or 4 of the AC, as applicable.
5. Apply any necessary adjustment to the obtained runway length, when instructed by the applicable chapter of the AC, to the runway length generated by step #4 to obtain a final recommended runway length. Adjustments to the length may be necessary for runways with non-zero effective gradients, excessive temperatures, wind conditions, airport elevation, etc.

Table 2-1 Airplane Weight Categorization for Runway Length Requirements

Airplane Weight Category Maximum Certificated Takeoff Weight (MTOW)			Design Approach	Location of Design Guidelines
12,500 pounds (5,670 kg) or less	Approach Speeds less than 30 knots		Family grouping of small airplanes	Chapter 2; Paragraph 203
	Approach Speeds of at least 30 knots but less than 50 knots		Family grouping of small airplanes	Chapter 2; Paragraph 204
	Approach Speeds of 50 knots or more	With Less than 10 Passengers	Family grouping of small airplanes	Chapter 2; Paragraph 205 Figure 2-1
		With 10 or more passengers	Family grouping of small airplanes	Chapter 2; Paragraph 205 Figure 2-2
Over 12,500 pounds (5, 670 kg) but less than 60,000 pounds (27,200 kg)			Family grouping of large airplanes	Chapter 3; Figures 3-1 or 3-2 1 and Tables 3-1 or 3-2
60,000 pounds (27,200 kg) or more or Regional Jets 2			Individual large airplane	Chapter 4; Airplane Manufacturer Websites (Appendix 1)

Note 1: When the design airplane's APM shows a longer runway length than what is shown in Figure 3-2, use the airplane manufacturer's APM. However, users of an APM are to adhere to the design guidelines found in Chapter 4.

Note 2: All regional jets regardless of their MTOW are assigned to the 60,000 pounds (27,200 kg) or more weight category.

Source: (Federal Aviation Administration, 2005) FAA AC 150/5325-4B Runway Length Requirements for Airport Design

Table 2-2 identifies the critical jet aircraft mix, as well as their Maximum Take-off Weight (MTOW). The aircraft in the critical fleet mix either have an MTOW of over 60,000 lb., or are classified as regional jets. Therefore, per requirements established in AC-150/5325-4B, outlined in **Table 2-2**, it is appropriate to utilize aircraft specific manufacturer data when calculating runway length requirements.

Figure 2-2 Critical Jet Fleet Mix

Aircraft Type	MTOW (lbs.)
Boeing 737-800, 800W, BBJ2, 800 BCF	174,200
Boeing 737-8, 200, BBJ MAX 8	179,800

Source: NG-737 Airplane Characteristics for Airport Planning (Boeing Commercial Airplanes, 2024)
737 MAX Airplane Characteristics for Airport Planning (Boeing Commercial Airplanes, 2024)

2.1 Methodology & Assumptions

Runway length requirements were calculated using charts published in the individual Aircraft Performance Manuals (APM). Calculations consider the elevation and average temperature of the airport, the performance characteristics of the individual aircraft, runway conditions, and the operating weight which is dependent on the amount of fuel needed to reach the desired destination.

Aircraft takeoff characteristics have many variables, as recommended in AC 150/5325-4B the following basic assumptions were made for calculating the performance of aircraft for Runway 16L-34R at HEF:

- No obstructions creating takeoff penalties
- No Wind scenario
- 0% Runway Gradient

In addition to the fixed variables listed above, runway length requirements were evaluated for temperature, useful load, and runway contamination for the critical fleet mix to better represent the operating characteristics at HEF. These adjustments are described in the following sections.

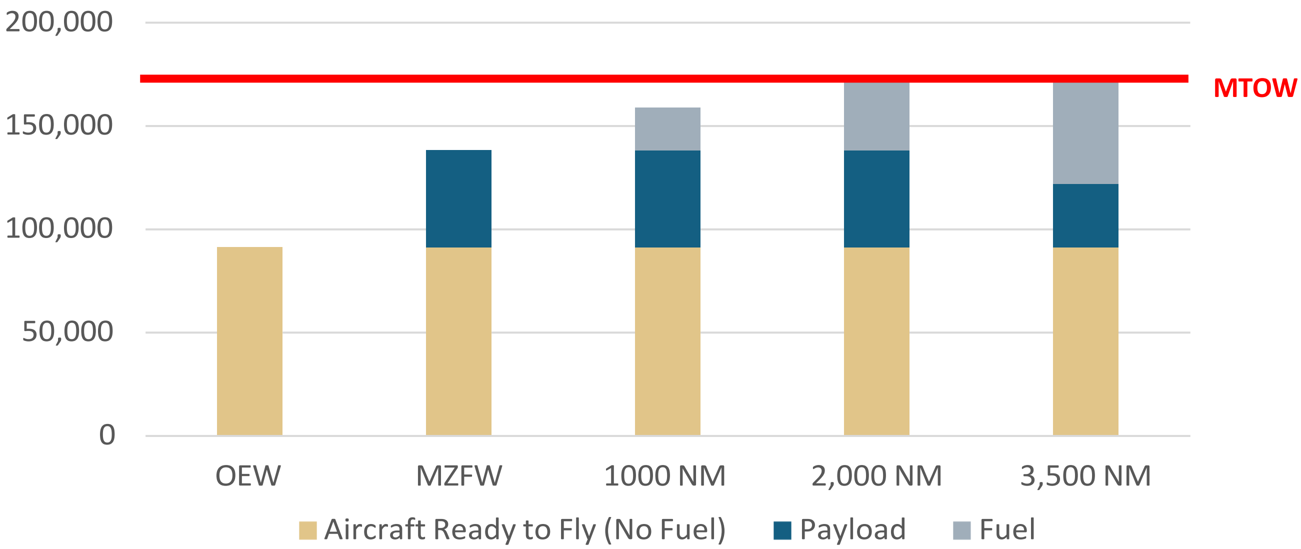
2.1.1 Trip Distance – Stage Length

Consideration in this analysis was given to aircraft stage length and its effect on aircraft takeoff weight. At HEF, the forecasted primary destinations for commercial aircraft consist of short stage length flights within 1,000 nautical miles with common destinations being Chicago, St. Louis, New York, Orlando, and Miami. Shorter stage length flights carry less fuel, have smaller takeoff weights, and therefore increased takeoff performance.

When the Boeing 737-800 takes off for a 1,000 NM trip with a full structural payload of 47,000lb its takeoff weight was calculated to be 159,000lb[4] which is well below its Maximum Takeoff Weight (MTOW) of 174,200lb. This is because a 1,000 NM flight requires significantly less fuel than the aircraft's maximum fuel capacity, and the payload can be accommodated without needing to trade off for range. Beyond a trip of 2,000NM, payload must be reduced for the aircraft to carry additional fuel and stay below MTOW. For the forecasted range of 1,000NM **Figure 2** depicts this relationship between aircraft Operating Empty Weight (OEW), Maximum Zero Fuel Weight (MZFW), MTOW, Payload, and Range

[4] Comprehensive detailed payload/ range / takeoff weight calculations and performance charts for the studied fleet mix are available in Section 2.2.1.1 of this report

Figure 2 - Payload / Fuel / Range Relationship - Boeing 737-800

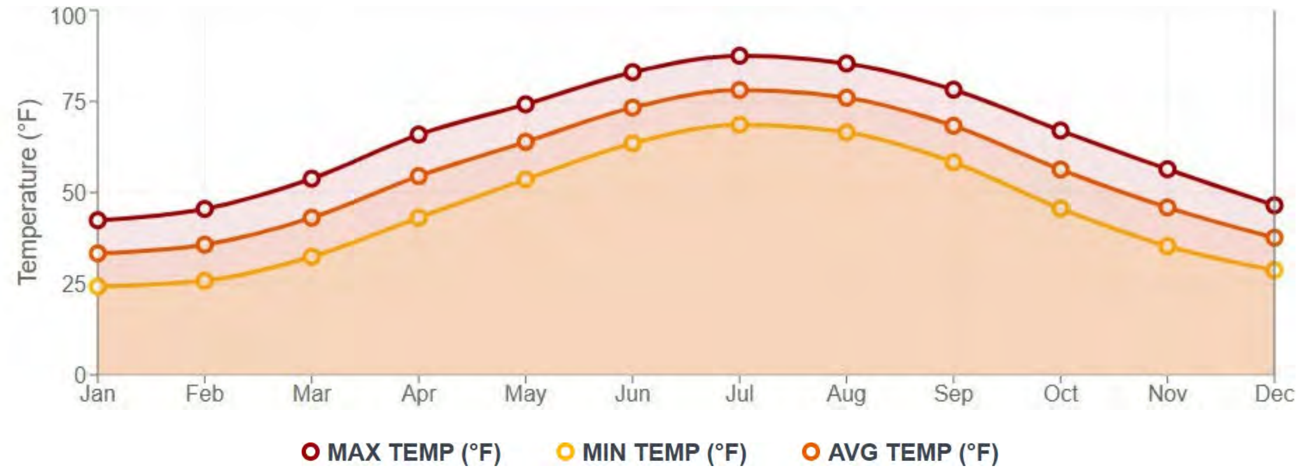


Source: 737 NG Airplane Characteristics for Airport Planning (Boeing Commercial Airplanes, 2024)
Note 1: See detailed performance calculations in Section 2.2.1

2.1.2 Temperature

High temperatures can have a significant effect on aircraft takeoff and landing performance. On a hot day, aircraft will have reduced performance due to the lower density of the air. Aircraft accelerate more slowly and will need to move faster to attain the same lift, subsequently climbing more slowly. The less dense the air (higher the temperature), the less lift, reduced climb performance, and the longer the distance needed for takeoff. The mean daily maximum temperature of the hottest month (July) at HEF is 87.5°F. **Figure 2-3** depicts the National Oceanic and Atmospheric Administration (NOAA) average monthly norms for HEF. In the summer months at HEF, high temperatures can reduce aircraft performance, with July representing the average most demanding conditions for runway length required in this location.

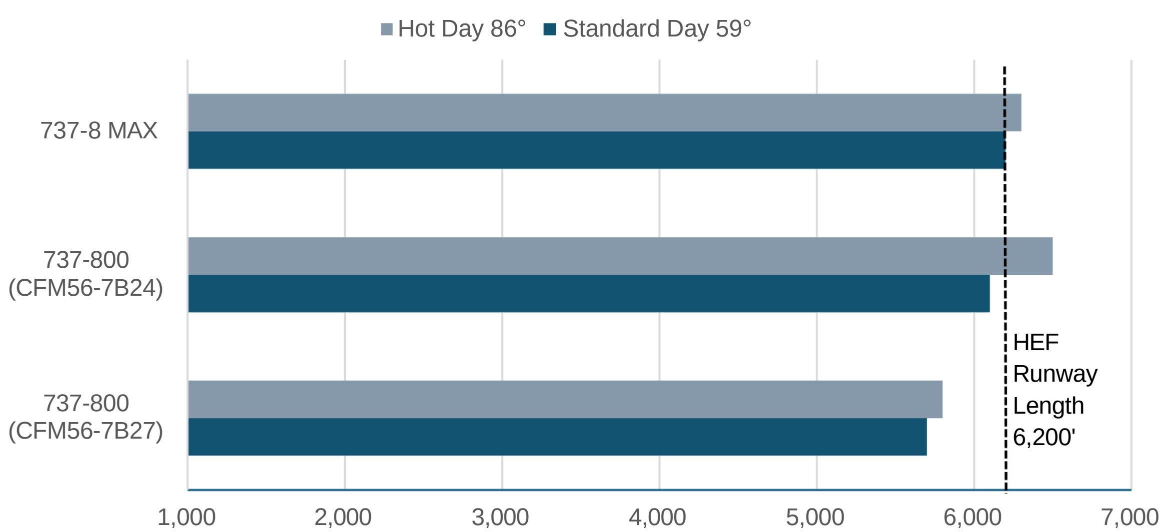
Figure 2-3: Manassas, VA Climate Norms 1991-2020



Source: (National Centers for Environmental Information - NOAA, 2025)

This runway length evaluation considers elevated temperatures in its calculations. To verify these assumptions, individual aircraft performance charts for critical aircraft operating at HEF were evaluated in ISO standard take-off conditions, and adjusted for an 86°F Day, for a 1,000 NM trip distance. **Figure 2-4** depicts the findings of this analysis. Two of these aircraft in the family would have small challenges executing a takeoff for a planned 1000nm trip with full payload in a hot day scenario.

Figure 2-4: B-737-8 Family Runway Take-off Length Requirements Adjusted for Hot Temperature



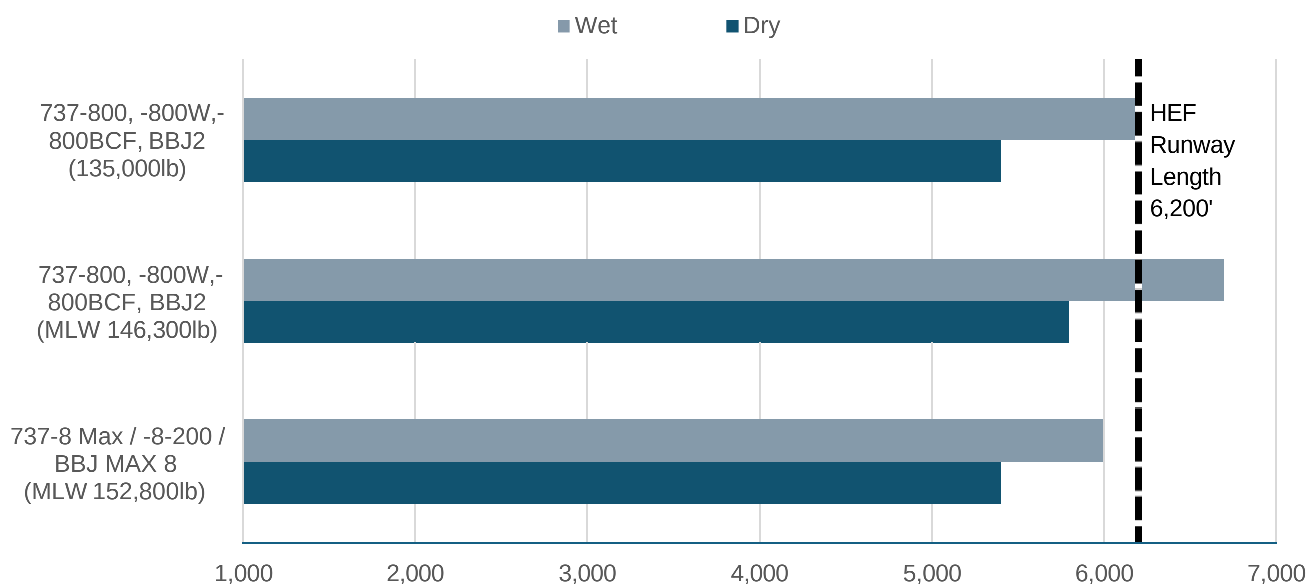
Source: 737 NG Airplane Characteristics for Airport Planning (Boeing Commercial Airplanes, 2024)
737 Max Airplane Characteristics for Airport Planning (Boeing Commercial Airplanes, 2024)

2.1.3 Runway Contamination

Runway contamination including rain and snow can significantly impact landing performance. In fact, when adjusting for contamination, the take-off distance requirements may not always be the most limiting condition when taking and landing distances may become more critical. For the purposes of this analysis, wet and dry runway conditions at Maximum Landing Weight (MLW) and estimated typical landing weight were evaluated for landing. In the analysis depicted in **Figure 2-5** runway landing performance characteristics were calculated at MLW in both wet and dry conditions.

This analysis found that landing operations, during rain contaminated conditions at MLW are sometimes the most critical operation for some of the analyzed critical aircraft fleet mix at HEF. In several instances, contaminated runway landing length requirements were longer than those in the take-off at standard day or nonstandard temperatures.

Figure 2-5: B-737-800 Family Landing Length Requirements Adjusted for Runway Contamination



Source: 737 NG Airplane Characteristics for Airport Planning (Boeing Commercial Airplanes, 2024)
737 Max Airplane Characteristics for Airport Planning (Boeing Commercial Airplanes, 2024)
Note 1: See detailed performance calculations in Section 2.2.2

MLW is recommended by AC 150/5325-4B for runway landing length calculations to promote conservatism in runway length calculations, however it is important to note that MLW weight represents a maximum structural landing weight for the Boeing 737-800 family of aircraft and not a typical operating scenario for a commercial passenger aircraft. In a non-emergency landing configuration for a revenue producing flight, the operator aims to land the aircraft far below MLW. Airlines plan flights with conservative fuel estimates to maintain a safe buffer below MLW while still accounting for possible delays, diversions, or go-arounds. Operating below MLW reduces fuel burn, improves safety, reduces stress on the airframe and landing gear, and helps lower maintenance costs, making it both a safety and economic decision. A more realistic range for a typical landing weight on the 737-800 family of aircraft is between 130,000lb and 135,000lb. Within this range, all models of the B-737-800 family can land in a runway length of 6,200 ft [5].

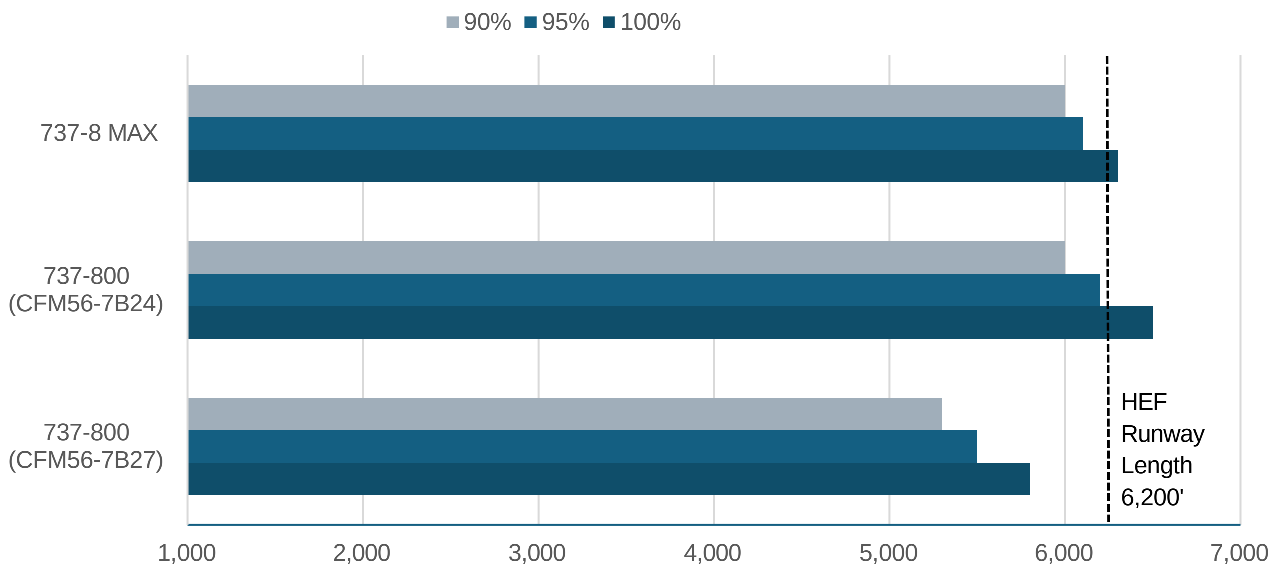
2.1.4 Payload Variance

Advisory Circular (AC) 150/5325-4B recommends using the Maximum Takeoff Weight (MTOW) and Maximum Structural Landing Weight when calculating runway length requirements. However, for this analysis, additional evaluations were conducted on the critical aircraft within the projected fleet mix at a 1,000 nautical mile (NM) trip distance, using various useful load scenarios. This approach provides a more nuanced understanding of potential payload limitations under elevated temperature conditions, such as those experienced during hot weather operations.

Figure 2-6 presents the takeoff distance requirements for the critical jet fleet on an 86º Fahrenheit day, modeled across different useful load percentages. The analysis indicates that with a modest 5% payload reduction, all forecasted aircraft can operate safely on a runway length of 6,200 ft, even under hot day conditions. This level of payload restriction aligns with the projected passenger load factors outlined in the Avports' forecast, ensuring operational feasibility while maintaining efficiency during peak temperature periods.

[5] See Section 2.2.2 for detailed landing length calculations and performance documentation.

Figure 2-6: B-737-800 Family Landing Length Requirements Adjusted for Varying Payload



Source: 737 NG Airplane Characteristics for Airport Planning (Boeing Commercial Airplanes, 2024)
737 Max Airplane Characteristics for Airport Planning (Boeing Commercial Airplanes, 2024)
Note 1: See detailed performance calculations in Section 2.2.2

2.2 Conclusion

In conclusion, this runway length analysis confirms that the forecasted fleet mix including the B737-800 family of aircraft can safely and efficiently operate at the airport under a range of real-world conditions, including high ambient temperatures, varying trip lengths, and moderate payload restrictions. Through detailed evaluation of takeoff performance across these variables, it was determined that a runway length of 6,200 feet is sufficient to accommodate all critical aircraft types in the projected fleet. This ensures operational reliability and flexibility while supporting long-term planning and the anticipated demand outlined in the airport's activity forecast.

2.3 Detailed Performance Calculations & Charts

The following sections provide the general runway length performance calculation process used in this analysis and executed tables based on NG-737 Airplane Characteristics for Airport Planning (Boeing Commercial Airplanes, 2024) and 737 MAX Airplane Characteristics for Airport Planning (Boeing Commercial Airplanes, 2024).

2.3.1 Takeoff Calculations-1,000 NM Range

To determine the required takeoff runway length for a 1,000 nm mission using the Boeing Airplane Characteristics for Airport Planning the following procedure was followed:
Step 1- Determine Takeoff Weight - The first step in the analysis is to establish the takeoff weight for each aircraft model by referencing the Payload/Range for Long Range Cruise charts. These charts provide the Brake Release Gross Weight (BRGW), which represents the aircraft's total weight at the instant the brakes are released to initiate the takeoff roll. BRGW is treated as the effective takeoff weight and serves as a required input for calculating runway length performance.

For this study, the mission distance of 1,000 nautical miles was selected. By locating this range on the horizontal axis of the payload-range chart and moving vertically to the corresponding curve, the maximum allowable payload for this distance was identified. The analysis confirmed that the 1,000 nm range supported the maximum payload consistent with the Maximum Zero Fuel Weight (MZFW). To capture variations in payload, three scenarios were developed based on the combination of Operating Empty Weight (OEW) and payload: 100%, 95%, and 90% of the maximum allowable payload. For each case, BRGW was determined by intersecting the 1,000 nm range with the OEW plus payload condition on the chart. These intersections yielded the effective BRGW values, which account for OEW, payload, and fuel required for the specified range. The supporting Payload/Range for Long Range Cruise charts used in this analysis are presented in **Sections 2.3.1.1 and 2.3.1.2** of this report.

Step 2 – Determine Runway Takeoff Runway Length
The second step involved determining the takeoff runway length requirements by consulting the Takeoff Runway Length Requirement charts found in the Airplane Characteristics for Airport Planning manual. These charts establish runway length based on aircraft takeoff weight, airport elevation, and temperature conditions. Using the BRGW values obtained in Step 1, the required runway lengths were calculated to ensure that performance remained within operational limits for the mission profiles considered at HEF.

The analysis was conducted under both standard day (59°F) and hot day (89°F) temperature conditions. For each aircraft model, the procedure involved identifying the BRGW on the horizontal axis of the runway length chart, moving vertically to the curve corresponding to airport elevation, and then reading the runway length from the vertical axis. This method was applied to the 100%, 95%, and 90% payload scenarios for each temperature condition. The results of the runway length calculations for each aircraft model are presented in **Sections 2.3.1.3 and 2.3.1.4** of this report.

2.3.1.1 Payload/Range for Long Range Cruise: Model 737-800, -800W, - 800BCF, BBJ2

OEW=91,300 MZFW =138,300 Max Payload = 47,000 Range 1,000 Miles

100% Payload (47,000lb) Results: 159,000lb Brake Release Gross Weight

95% Payload (44,650lb) Results: 155,000lb Brake Release Gross Weight

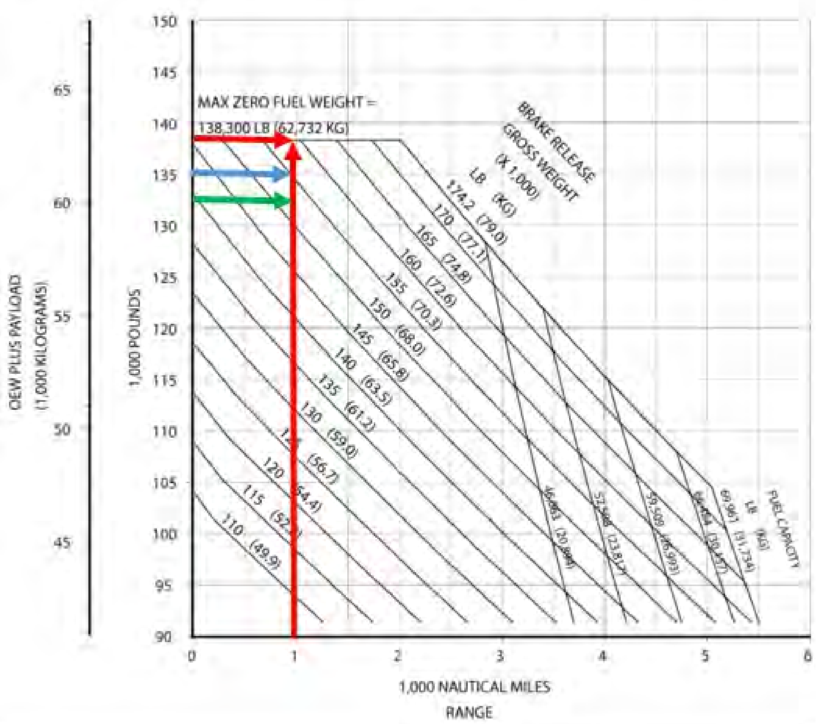
90% Payload (42,300lb) Results: 152000lb Brake Release Gross Weight

3.2.4 Payload/Range for Long Range Cruise: Model 737-800, -800W, - 800BCF, BBJ2

DO NOT USE FOR DISPATCH

Payload/Range
737-800/800W/BBJ2 (CFM56-7B Series)

- STANDARD DAY, ZERO WIND
- CRUISE MACH = LRC
- NORMAL POWER EXTRACTION AND AIR CONDITIONING BLEEDS
- TYPICAL MISSION RULES
- NON-WINGLET PERFORMANCE SHOWN. WINGLET AIRCRAFT WILL HAVE SLIGHTLY GREATER RANGE.
- CONSULT USING AIRLINE FOR SPECIFIC OPERATING PROCEDURE AND OEW PRIOR TO FACILITY DESIGN.



D6-58325-7

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2.3.1.2 Payload/Range for Long Range Cruise 737-8 / -8-200 (LEAP1B Series)

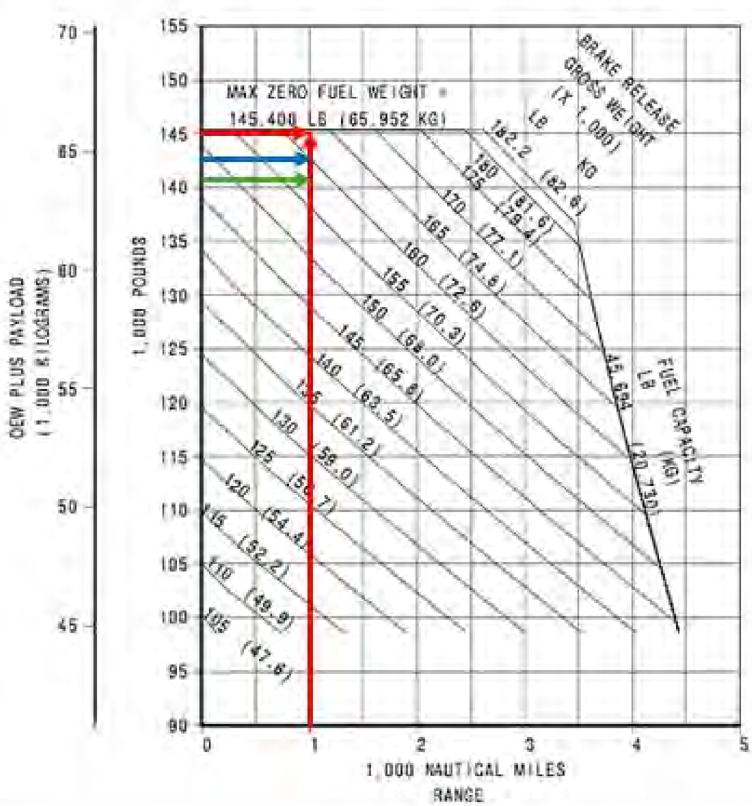
100% Payload (46,400lb) Results: 162,000lb Brake Release Gross Weight
95% Payload (44,080lb) Results: 160,000lb Brake Release Gross Weight
90% Payload (41,760lb) Results: 158,000lb Brake Release Gross Weight

OEW=99,360 MZFW =145,400 Max Payload = 46,040 Range 1,000 Miles

3.2.3 Payload/Range for Long Range Cruise: Model 737-8 / -8-200

Payload/Range
737-8 / -8-200 (LEAP-1B Series)

- STANDARD DAY, ZERO WIND
- CRUISE MACH = LRC
- NORMAL POWER EXTRACTION AND AIR CONDITIONING BLEEDS
- TYPICAL MISSION RULES
- CONSULT USING AIRLINE FOR SPECIFIC OPERATING PROCEDURE AND OEW PRIOR TO FACILITY DESIGN



D6-38A004
REV J December 2024 3-4

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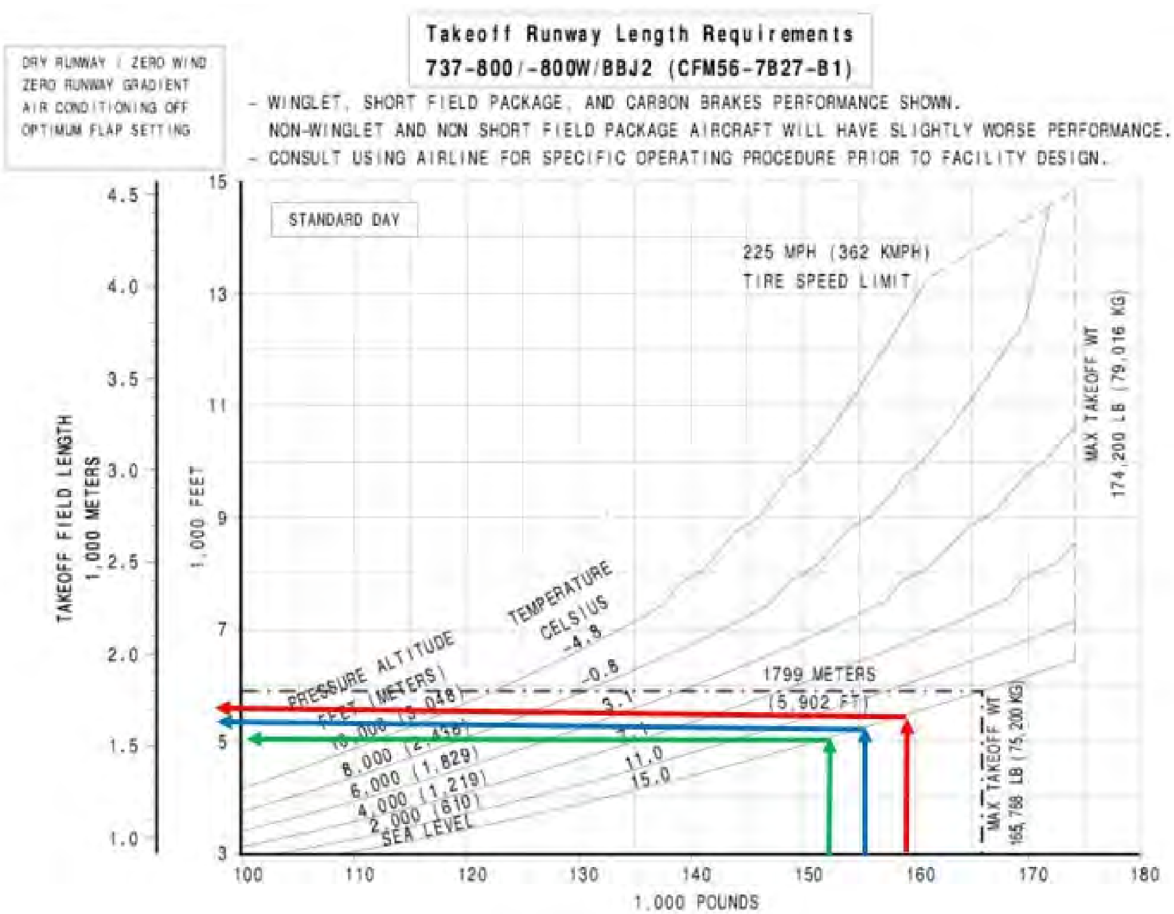
2.3.1.3 Takeoff Runway Length Requirements - Standard Day 59°

Model 737-800, -800W, BBJ2, -800BCF (CFM56-7B27- B1 Engine)

100% Payload Results: 5,700’ Takeoff Length Required
95% Payload Results: 5,400’ Takeoff Length Required
90% Payload Results: 5,100’ Takeoff Length Required

3.3.25 FAA/EASA Takeoff Runway Length Requirements - Standard Day, Dry Runway: Model 737-800, -800W, BBJ2, -800BCF (CFM56-7B27-B1 Engine at 26,000 LB SLST)



D6-58325-7

REV B December 2024 3-32

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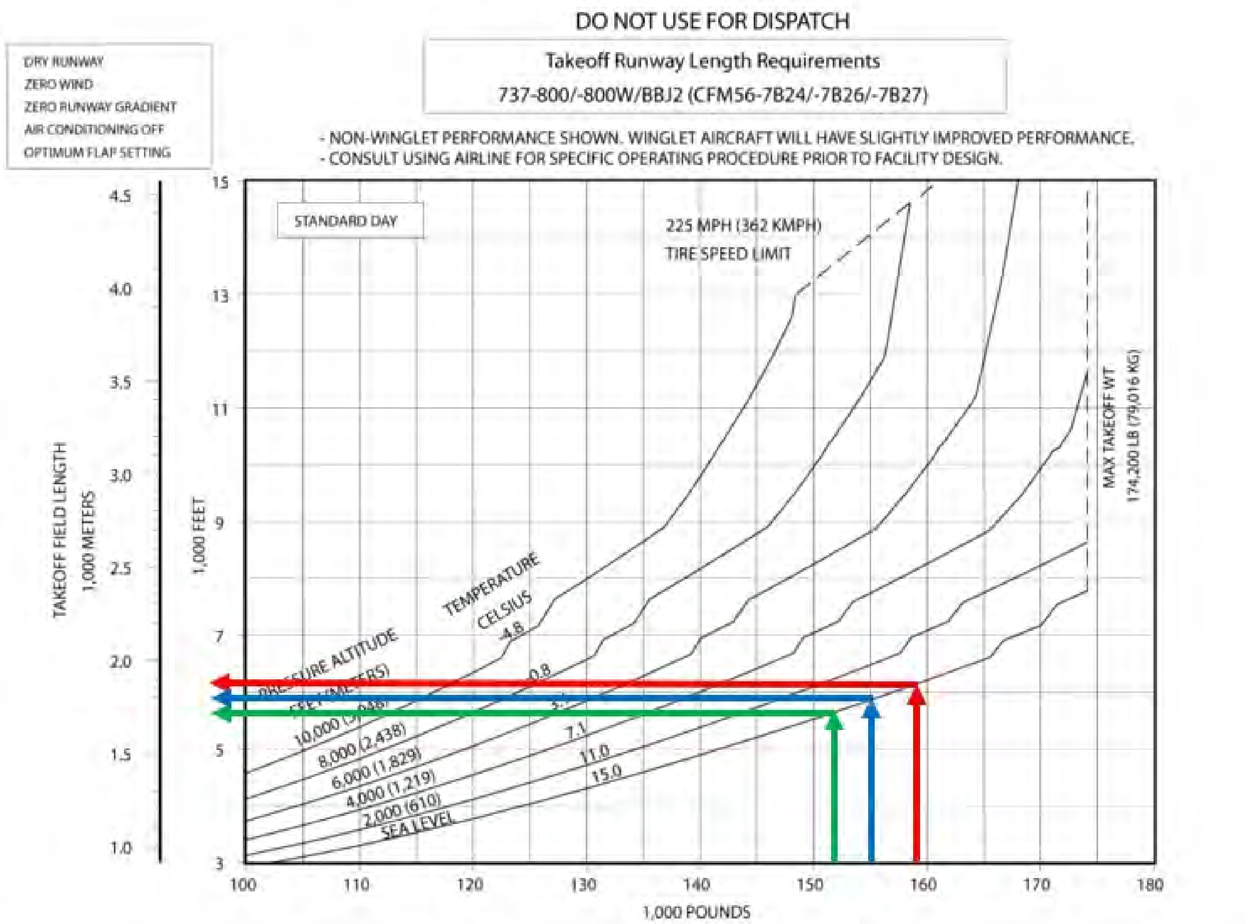
Model 737-800, -800W, BBJ2, -800BCF (CFM56-7B24/- 7B26/-7B27 Engines)

100% Payload Results: 6,100’
95% Payload Results: 5,900’
90% Payload Results: 5,600’

3.3.29 FAA/EASA Takeoff Runway Length Requirements - Standard Day, Dry Runway: Model 737-800, -800W, BBJ2, -800BCF (CFM56-7B24/-7B26/-7B27 Engines at 26,000 LB SLST)



D6-58325-7

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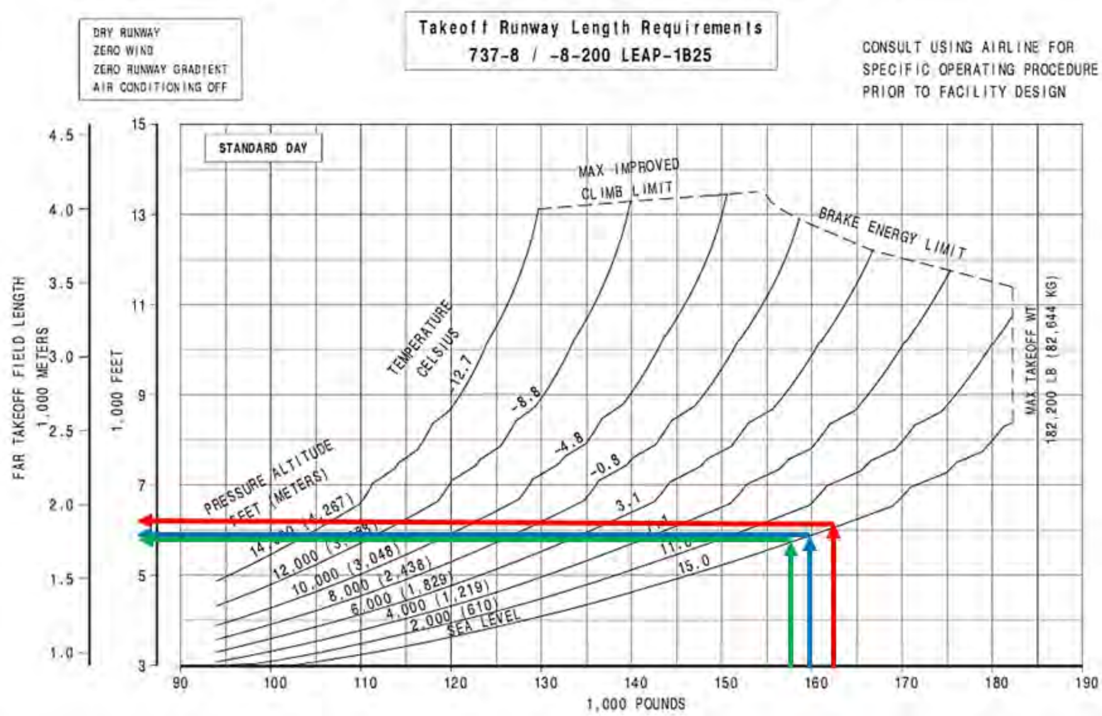
Model 737-8/-8-200 (Leap1B25 Engine)

100% Payload Results: 6,200’
95% Payload Results: 5,900’
90% Payload Results: 5,700’

3.3.9 FAA/EASA Takeoff Runway Length Requirements - Standard Day, Dry Runway: Model 737-8 / -8-200 (LEAP-1B25 Engine)



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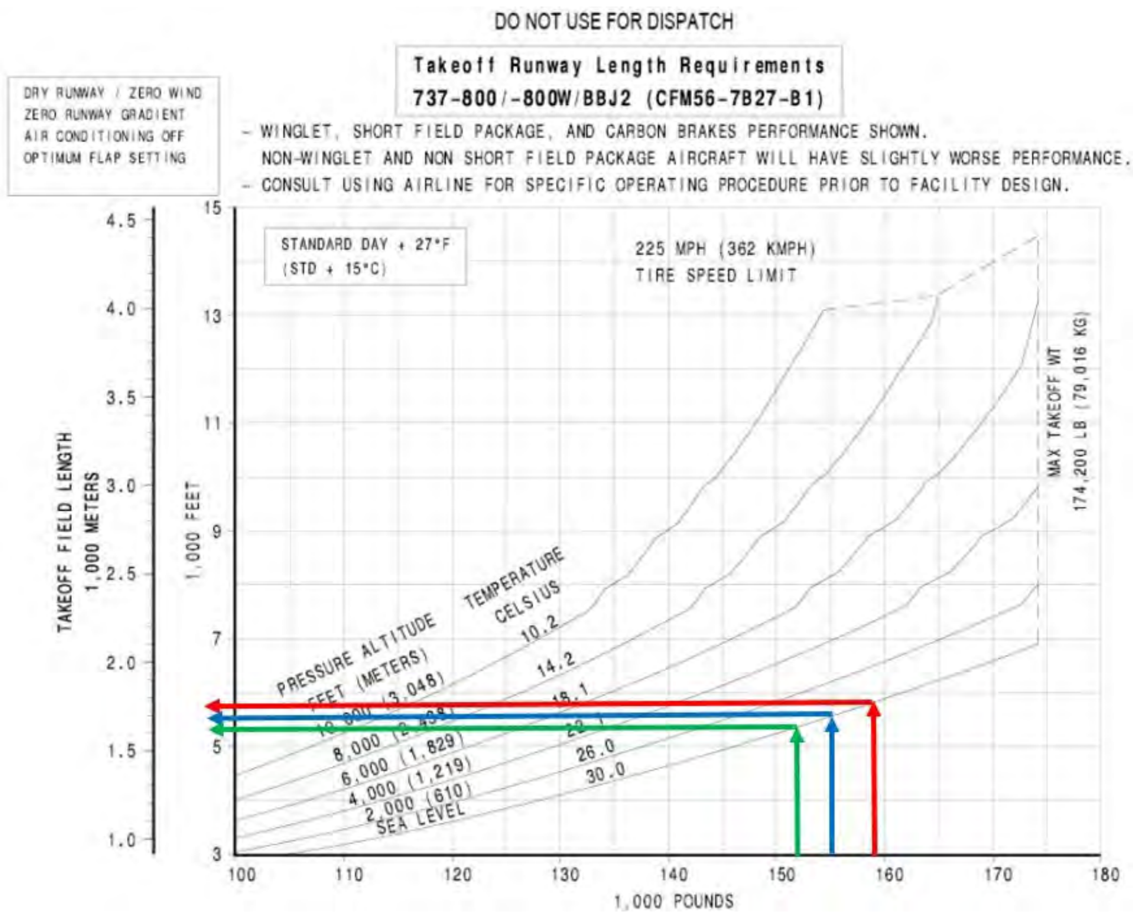
2.3.1.4 Takeoff Runway Length Requirements – 86° (Standard Day + 27°F)

Model 737-800, -800W, BBJ2, -800BCF (CFM56-7B27-B1 Engine)

100% Payload Results: 5,800’
95% Payload Results: 5,500’
90% Payload Results: 5,300’

3.3.26 FAA/EASA Takeoff Runway Length Requirements - Standard Day + 27°F (STD + 15°C), Dry Runway: Model 737-800, -800W, BBJ2, -800BCF (CFM56-7B27-B1 Engine at 26,000 LB SLST)



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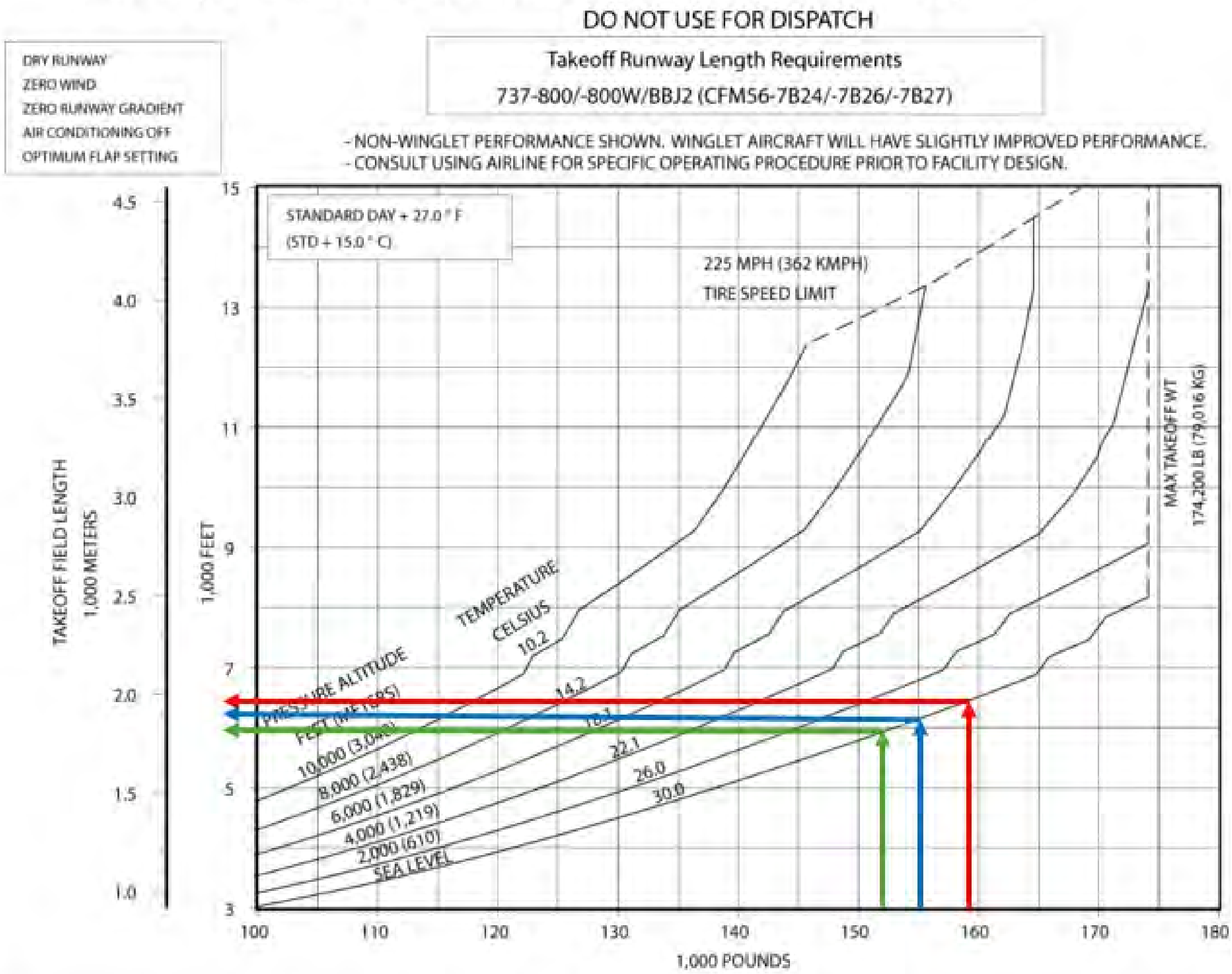
Model 737-800, -800W, BBJ2, - 800BCF (CFM56-7B24/-7B26/-7B27 Engines)

100% Payload Results: 6,500’
95% Payload Results: 6,200’
90% Payload Results: 6,000’

3.3.30 FAA/EASA Takeoff Runway Length Requirements - Standard Day + 27°F (STD + 15°C), Dry Runway: Model 737-800, -800W, BBJ2, -800BCF (CFM56-7B24/-7B26/-7B27 Engines at 26,000 LB SLST)



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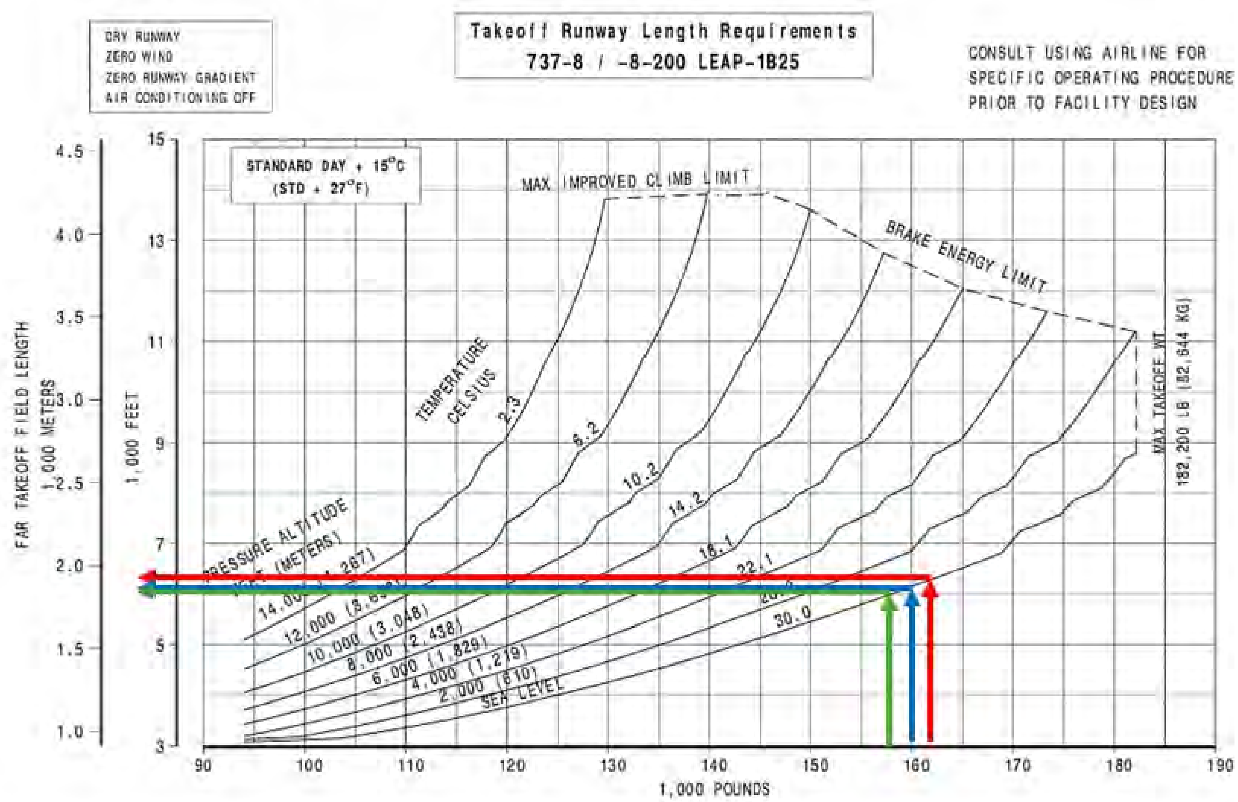
Model 737-8/-8-200 (Leap 1B25 Engine)

100% Payload Results: 6,300
95% Payload Results: 6,100
90% Payload Results: 6,000

3.3.10 FAA/EASA Takeoff Runway Length Requirements - Standard Day + 27°F (STD + 15°C), Dry Runway: Model 737-8 / -8-200 (LEAP-1B25 Engine)



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2.3.2 Landing Distance Requirements

To determine the required landing runway length for a 1,000 nautical mile mission, the procedure outlined in FAA Advisory Circular (AC) 150/5325-4B, Runway Length Requirements for Airport Design, was applied in conjunction with the Boeing Airplane Characteristics for Airport Planning (ACAP) charts. The steps are summarized as follows:

Chart Selection – Identify the landing chart corresponding to the highest flap setting available, with zero wind and zero effective runway gradient. Where wind and gradient conditions are not specified, they are assumed to be zero. For this analysis, the Flaps 30 chart was utilized.

Weight Selection – On the horizontal axis, select the value corresponding to the maximum certificated landing weight (MLW). This analysis was conducted at Maximum Landing Weight (MLW). If the wet runway requirement at MLW exceeded the available runway length, a reduced landing weight scenario was also evaluated to ensure compliance with operational limitations.

Elevation Adjustment – From the selected weight, move vertically to intersect the appropriate airport elevation (pressure altitude) curve. When both “dry runway” and “wet runway” curves are provided, the “wet runway” curve must be used, however dry runway was also evaluated in this analysis.

Runway Length Determination – From the wet runway curve, move horizontally to the length axis to determine the required landing runway length.

The following **Sections 2.3.2.1 and 2.3.2.2.** depict the chart analysis completed for the landing runway length component of the runway length determination study at HEF.

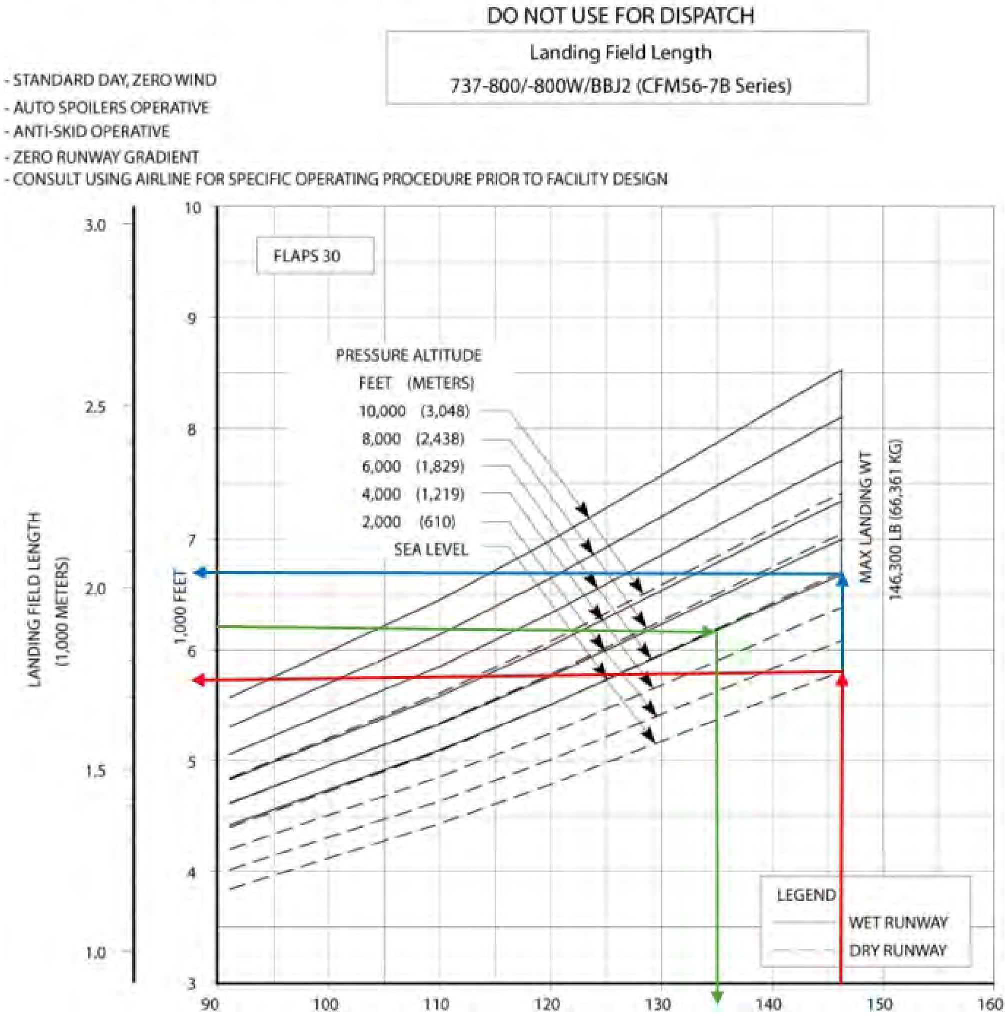
2.3.2.1 Model 737-800, -800W,-800BCF, BBJ2

MLW - Dry Runway Results: 5,800’

MLW - Wet Runway Results: 6,700’

6,200’ Wet Runway Results: Restricted to Landing Weight of 135,000lb

3.4.3 FAA/EASA Landing Runway Length Requirements - Flaps 30: Model 737-800, -800W, -800BCF, BBJ2



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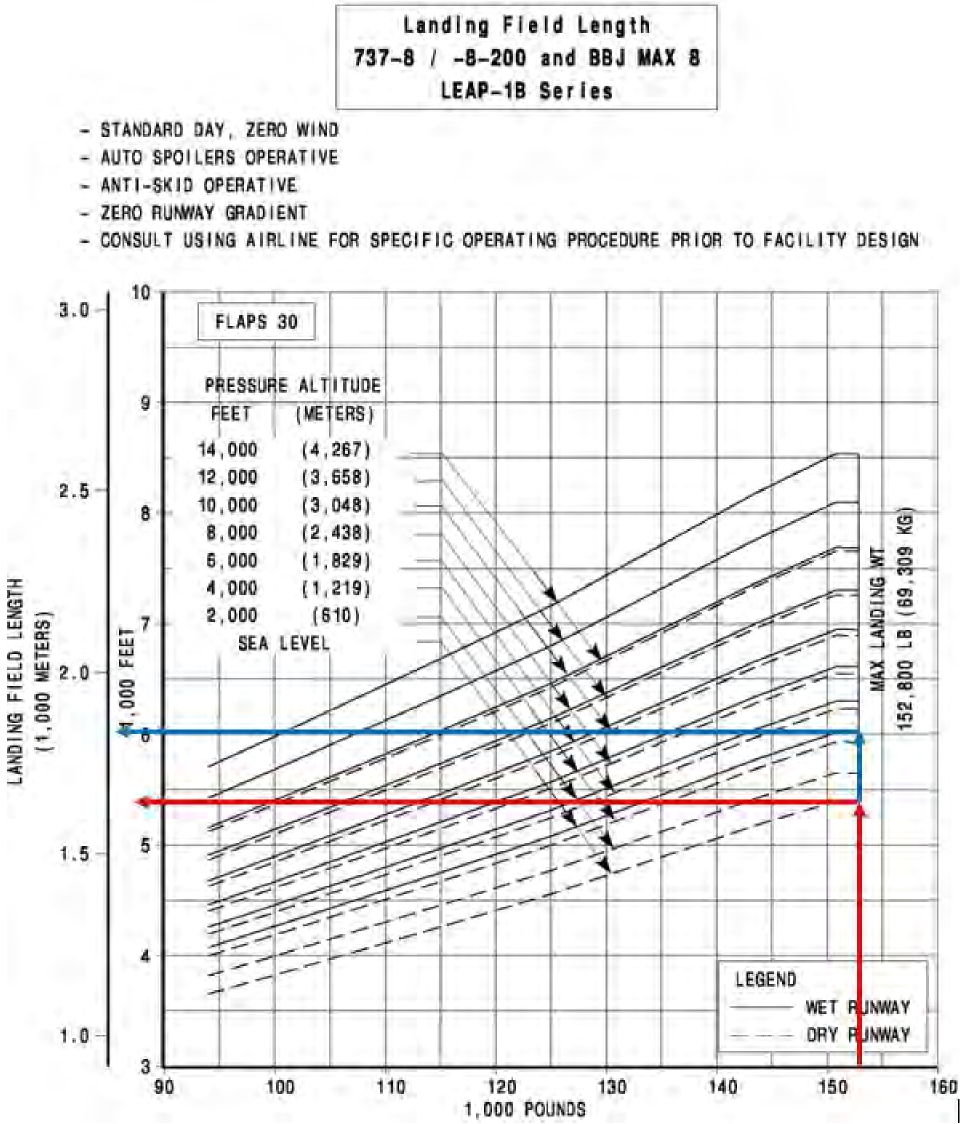
2.3.2.2 Model 737-8 / -8-200 / BBJ MAX 8

MLW - Dry Runway Results: 5,400’
MLW - Wet Runway Results: 6,000’

3.4.5 FAA/EASA Landing Runway Length Requirements - Flaps 30: Model 737-8 / -8-200 / BBJ MAX 8



D6-38A004

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3. References

AirNav. (2025, May 20). *AirNav.com*. Retrieved May 20, 2025, from Airport Information: https://airnav.com/airports/

Boeing Commercial Airplanes. (2024, December). *737 MAX - Airplane Characteristics for Airport Planning.* Retrieved May 20 , 2025, from Airplane Characteristics for Airport Planning: https://www.boeing.com/content/dam/boeing/boeingdotcom/commercial/airports/acaps/737MAX_Rev_J.pdf

Boeing Commercial Airplanes. (2024, December). *Next-Generation 737 - Airplane Characteristics for Airport Planning.* Retrieved May 20, 2025, from Airplane Characteristics for Airport Planning: https://www.boeing.com/content/dam/boeing/boeingdotcom/commercial/airports/acaps/737NG_REV_B.pdf

FAA. (2024, April 3). *AC 150/5300-13B - Airport Design - Change 1.* Retrieved May 20 , 2025, from Federal Aviation Administration: https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC-150-5300-13B-Airport-Design-Chg1-w-errata.pdf

FAA. (2024, December 10). *Part 139 Airport Certification*. Retrieved May 20, 2025, from Federal Aviation Administration: https://www.faa.gov/airports/airport_safety/part139_cert

Federal Aviation Administration. (2005, July 1). *AC 150/5325-4B - Runway Length Requirements for Airport Design.* Retrieved from Federal Aviation Administration: https://www.faa.gov/airports/resources/advisory_circulars/index.cfm/go/document.current/documentnumber/150_5325-4

Federal Aviation Administration. (2025, 04 23). *Part 139 Airport Certification Status List.* Retrieved 05 20, 2025, from Federal Aviation Administration: https://www.faa.gov/airports/airport_safety/part139_cert/part_139_airport_certification_status_list

National Centers for Environmental Information - NOAA. (2025, May 15). *U.S. Climate Normals Quick Access*. Retrieved from National Centers for Environmental Information - NOAA: https://www.ncei.noaa.gov/access/us-climate-normals/#dataset=normals-monthly&timeframe=30&location=CA&station=USW00024283