RUNWAY LENGTH
REQUIREMENTS ANALYSIS

DAYTON INTERNATIONAL AIRPORT
MASTER PLAN UPDATE

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I. Executive Summary

In accordance with FAA Advisory Circular 150/5325-4A and the aircraft manufacturers' characteristics manuals, an analysis was conducted to determine the runway length requirements for passenger air carrier, commuter, and cargo aircraft operating at Dayton International Airport (DAY). Based on 100% maximum takeoff weights (MTOW) of the existing and future aircraft fleet mix through year 2020, the following runway lengths are justified at DAY.

Justified Runway Lengths

Runway	Justified Runway Length (ft.)
6R-24L	13,900
6L-24R	13,900
18-36	11,120

These runway lengths are based on individual aircraft performance charts, and take into consideration the elevation and average temperature of the airport, runway conditions, and the operating weight and engine type of the aircraft. This initial runway length analysis did not take into consideration local conditions, such as, environmental, noise, topographical (except for runway gradient), physical, land use, political, and economic factors. However, these factors were taken into consideration for determination of the proposed runway lengths as depicted on the draft Future Airport Layout Plan (ALP) dated January 19, 2005.

The following are the results of the runway length requirements for the three existing runways at DAY:

- ***Runway 6R-24L*** – In accordance with Advisory Circular 150/5325-4A, parallel runways should have a length based on the airplanes that will use the runways and should also be approximately equal in length. Based on these criteria, the Runway 6R-24L takeoff length of 13,900 feet is justified since the theoretical 13,900-foot length of Runway 6L-24R is justified. This length would accommodate all of the existing and future aircraft fleet mix at 100% MTOW.

  Although justifiable at 13,900 feet, the draft Future ALP proposes a length of 9,500 feet for Runway 6R-24L due to various local factors as previously noted. The proposed runway length of 9,500 feet can accommodate the air carrier fleet with a 95% or greater MTOW, with the exception of the B-757-200, B-757-300, B-737-900, and DC-9-32 aircraft. The flight range distance for each aircraft is also adequate to serve the current commercial

markets at DAY. The proposed 9,500-foot Runway 6R-24L is based on the premise that both parallel 6-24 runways are in operation.

During peak arrival periods, the proposed 9,500-foot long Runway 6R-24L will be capable of accommodating all of the cargo aircraft for landing under wet conditions.

- ***Runway 18-36*** – In accordance with Advisory Circular 150/5325-4A, a crosswind runway should have a length of at least 80 percent of the primary runway length. Based on these criteria, Runway 18-36 is justified at a takeoff length of 11,120 feet, which is 80% of the justified 13,900-foot Runway 6L-24R length. It is anticipated that the air carrier and commuter aircraft will mainly use Runway 18-36, with use by cargo aircraft when wind and weather dictate. Based on recent radar data, the actual usage of Runway 18-36 is approximately 10.6% annually.

  The draft Future ALP proposed a length of 9,500 feet for Runway 18-36. This runway length is less than the justified length of 11,120 feet in accordance with FAA Advisory Circular due to various local factors as previously noted. The proposed runway length of 9,500 feet can accommodate the air carrier fleet with a 95% or greater MTOW, with the exception of the B-757-200, B-757-300, B-737-900, and DC-9-32 aircraft. In addition, the flight range distance for each aircraft is adequate to serve the current commercial markets at DAY.

- ***Runway 6L-24R*** – Due to the anticipated heavy use by cargo aircraft, the Runway 6L-24R takeoff length is justified at 13,900 feet to adequately serve all of the anticipated cargo aircraft at 100% MTOW. Also, all of the air carrier and commuter aircraft fleet would be able to use a 13,900-foot long runway at 100% MTOW. The draft Future ALP proposes a length of 12,600 feet for Runway 6L-24R. This runway length is less than the justified length of 13,900 feet in accordance with the FAA Advisory Circular due to various local factors as previously noted. The 24R threshold has been moved 1,478 feet to the west-southwest in order to provide a full 1,000-foot safety area, and construction of a parallel taxiway and service road on the west side of Runway 18-36. The 6L threshold has been extended 3,178 feet to the west-southwest such that US 40 could stay in its existing alignment.

  The proposed runway length of 12,600 feet can accommodate the cargo aircraft fleet at 100% MTOW, with the exception of the A300-B4, B-727-200, DC-10-30, and DC-8-62 aircraft. The worst case is the DC-8-62 aircraft with a 97.3% MTOW. Although, all of the cargo aircraft can takeoff with 100% payload weight, their flight range distances and markets that are reachable non-stop are limited.

Based on this runway length requirements analysis, it has been demonstrated that the runway lengths as depicted on the January 19, 2005 Future ALP are justified based on the existing and future aircraft fleet mix, and anticipated runway usage. As mentioned, the proposed runway lengths are less than what is justified per the FAA Advisory Circular planning standards due to local considerations such as land use, noise, and cost-benefits. These issues have been addressed in the Master Plan Study and other planning efforts. The proposed runway lengths will provide adequate aircraft takeoff and landing performance based on current markets being served from DAY. However, as future markets are added and travel distances increase, it may be necessary to increase one or more of the runway lengths to assure maximum efficiency and utilization of the airport runway system.

II. Introduction

In accordance with FAA Advisory Circular 150/5325-4A and the aircraft manufacturers characteristics manuals, an analysis was conducted to determine the theoretical runway length requirements for passenger air carrier, commuter, and cargo aircraft operating at Dayton International Airport (DAY). The runway length requirements were calculated using charts published in the aircraft manufacturers' characteristics manuals and the International Civil Aviation Organization (ICAO) Aerodrome Design Manual. Requirements were calculated by taking into consideration the elevation and average temperature of the airport, the performance characteristics of the individual aircraft, runway conditions, and the operating weight and engine type of the aircraft, which is dependent on the amount of fuel needed to reach the destination, and the amount of payload (passengers, baggage, and cargo).

FAA Advisory Circular 150/5325-4A, dated 1/29/90, "Runway Length Requirements for Airport Design", notes the following: "*Parallel Runways* should have a length based on the airplanes that will use the runways. Parallel runways should be approximately equal in length. A *Crosswind Runway* should have a length of at least 80 percent of the primary runway length." These criteria will be taken into consideration for the runway length analysis.

Also to be considered for this analysis is the Draft Advisory Circular 150/5325-4B, "Runway Length Requirements for Airport Design," currently out for review and comment. This draft AC makes the following recommendations: "When the MTOW of listed airplanes is over 60,000 pounds, the recommended runway length is determined according to *individual airplanes*. The design objective for the main primary runway is to determine a recommended runway length that serves all airplanes without operational weight restrictions. The design objective for the length of crosswind runways for scheduled transport service is to equal 100% of the primary runway."

In accordance with FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems (NPIAS)*, the following is noted regarding airport dimensional standards. "Airport dimensional standards (such as runway length and width, separation standards, surface gradients, etc.) should be selected which are appropriate for the critical aircraft that will make substantial use of the airport in the planning period. Substantial use means either 500 or more annual itinerant operations, or scheduled commercial service. The critical aircraft may be a single aircraft or a composite of the most demanding characteristics of several aircraft." This planning standard will be taken into consideration when determining the runway length requirements.

Dayton International Airport has a three-runway airfield system that consists of two parallel 6-24 runways, and a single 18-36 runway. Runway 6L-24R serves as the primary runway and has a length of 10,900 feet with Category II/III approach

capability on Runway 6L, and Category I approach capability on Runway 24R. Runway 6R-24L serves as the secondary parallel runway and has a length of 7,000 feet with Category I approach capability on Runway 24L, and a Non-Precision (non-directional beacon) approach capability on Runway 6R. Runway 18-36 serves as the cross-wind runway and has a length of 8,500 feet with Category I approach capability on Runway 18, and Visual approach capability on Runway 36. Runway 18-36 provides operations beyond that of a typical crosswind runway and is used approximately 10.6% of the time.

III. Forecast Aircraft Operations and Aircraft Fleet Mix

Based on the FAA approved February 20, 2004 Forecasts of Aviation Activity at DAY, total annual operations are to increase from approximately 125,217 in 2002 to 158,600 in 2020. This represents an average annual increase of 1.4 percent over the forecast period. **Table 1** summarizes the total annual aircraft operations forecast for Dayton International Airport.

Air carrier passenger operations are projected to grow 1.5% per year, beginning in 2004. The regional passenger operations are projected to grow 1.7% per year, beginning in 2004. In addition, the cargo operations are anticipated to grow 3.3% per year.

UPS has recently acquired (December 2004) the Menlo Worldwide Forwarding freight hub at DAY that currently has 34 daily flights. The following information was taken from the UPS pressroom web site:

> The acquisition *(Menlo)* reinforces UPS's strategy of providing broad supply chain solutions to enable global commerce. As a result of the acquisition, UPS will expand its global capabilities and add guaranteed heavy airfreight services around the world, enabling customers to reach the global marketplace faster. This also means UPS will introduce new time-definite products such as overnight, two-day and deferred heavy airfreight to North America. *www.pressroompups.com (10/5/04).*
>
> "Menlo Worldwide Forwarding's capabilities complement UPS's ability to manage customers' shipments of any size, anywhere and in virtually any time frame," said Bob Stoffel, UPS senior vice president, Supply Chain Group. Menlo Worldwide Forwarding services soon will be sold under the UPS brand, he added. *www.pressroomups.com (1/24/05).*

In addition, the following are excerpts from an article in the October 21, 2004, Dayton Daily News:

> "If you look at their *(UPS)* commitment to going into a heavy weight, global, time-definite product, our hub *(DAY)* has those capabilities," Trimarco said. The Menlo executive said he expects to sign on with the new owner. He also said that he expects Dayton hub employment to remain stable under UPS provided the economy continues to grow.

Based on these comments, it has been assumed that UPS will continue to operate and grow the DAY cargo hub as anticipated in the February 20, 2004 Forecast of Aviation Activity.

Based on this forecast, **Table 2** summarizes the anticipated passenger air carrier and commuter aircraft fleet-mix at DAY. The air carrier fleet mix is projected to remain a narrow-body fleet. Based on the proposed 2020 air carrier fleet mix, the Boeing 717-200 will represent approximately 57% of the fleet, the Airbus 320-200 will represent approximately 28%, and the Boeing 737-800/900 will represent approximately 15% of the air carrier fleet mix. Based on a total of 14,200 annual air carrier operations in year 2020, each of these aircraft type will exceed the 500 annual operations requirement.

The air carrier aircraft fleet-mix and engine types used in this analysis are presented in **Table 3**, and are grouped by aircraft weight classes for informational purposes only. ***Heavy*** – Aircraft capable of takeoff weights of more than 255,000 pounds, including the B757, whether or not they are operating at this weight during a particular phase of flight. ***Large*** – Aircraft of more than 41,000 pounds, maximum certificated takeoff weight, up to 255,000 pounds. ***Small*** – Aircraft of 41,000 pounds or less maximum certificated takeoff weight.

Today, the commuter aircraft fleet is dominated with 50-seat regional jets, and small turboprop aircraft. Over the forecast horizon, the regional carriers are expected to phase out virtually all of the turboprop aircraft in favor of regional jets ranging in size from 32 to 90 seats. The Canadair Regional Jet CRF-200/700 and the Embraer Regional Jet ERJ 135/140/145 will dominate the commuter aircraft fleet mix at approximately 86% of the fleet. Based on a total of 68,200 annual commuter operations in year 2020, each of these aircraft type will exceed the 500 annual operations requirement.

With the recent acquisition of Menlo Worldwide Forwarding by UPS (December 2004), it was assumed that all cargo aircraft types that have served the airport over the past five years, along with the current UPS aircraft fleet would be used in this analysis. **Table 4** summarizes the anticipated cargo aircraft fleet mix.

IV. Takeoff Runway Length Requirements

When aircraft operate during periods of high temperatures, the relative increased density altitude decreases an aircraft's operational performance. Loss in performance requires longer takeoff distances and faster ground speeds during landings, which results in longer runway length requirements. This section discusses the takeoff runway length requirements for the aircraft currently or projected to be in operation at Dayton International Airport throughout the planning horizon. Runway length requirements are identified for air carrier, commuter, and cargo aircraft.

Air Carrier Aircraft Requirements

Takeoff runway length requirements were determined from the "standard day" charts (59 degrees Fahrenheit) and a mean daily high temperature of 85 degrees Fahrenheit was used to determine the ultimate runway length requirements for air carrier and commuter aircraft. Based on an airport elevation of 1009 msl, the density altitude at 85^{o}F is approximately 3,000 feet. Density altitude is defined as pressure altitude corrected for nonstandard temperature. **Exhibit A-1** in **Appendix A** illustrates the calculation for density altitude. The density altitude is the altitude at which the density of the International Standard Atmosphere (ISA) is the same as the density of the air being evaluated. The temperature at ISA is 15 degrees Celsius (59^{o}F).

Exhibit 1 shows the takeoff runway length requirements for air carrier aircraft at 100% Maximum Takeoff Weight (MTOW) for each of the existing runways at DAY. The required lengths for each runway are slightly different due to the variation in their centerline slope. The "standard day" runway length has been increased 10 feet for every foot of difference in centerline elevation between the high and low points. The following table summaries the necessary runway length at 100% MTOW for some of the existing and future air carrier aircraft type that are anticipated to be in operation through the year 2020.

100% MTOW Runway Length

Aircraft Type	Runway Length (ft.)
B-717-200	7,600
A320-200	9,600
MD-80-83	10,600
B-757-300	12,000
B-737-900	12,800

Commuter Aircraft Requirements

Runway length requirements for commuter regional jets and turboprop aircraft were taken from the *Jane's All The World Aircraft* manuals based on maximum takeoff weight and standard day temperature (15 degrees Celsius). These runway length requirements were then adjusted for airport elevation, temperature, and runway slope as specified in the ICAO Aerodrome Runway Design Manual.

Exhibit 2 shows the standard day (Jane's) and adjusted (ICAO) runway lengths. For this analysis, the adjusted ICAO runway lengths were used to determine the optimum commuter aircraft takeoff runway length requirements because there is insufficient detailed data from the aircraft manufacturers. As shown, the commuter aircraft require between 5,000 feet and 9,350 feet of runway length at 100% MTOW. The majority of the commuter aircraft fleet will be comprised of regional jets that require the longer runway length.

Cargo Aircraft Requirements

Takeoff runway length requirements were determined from the "standard day" charts (59 degrees Fahrenheit) and a mean morning high temperature of 65 degrees Fahrenheit was used to determine the ultimate runway length requirements for cargo aircraft. The lower temperature was used for the cargo aircraft to reflect the typical morning hours in which these aircraft depart. Based on an airport elevation of 1009 msl, the density altitude at 65^{o}F is approximately 1,900 feet. Density altitude is defined as pressure altitude corrected for nonstandard temperature. **Exhibit A-2** in **Appendix A** illustrates the calculation for density altitude.

Cargo aircraft takeoff length requirements were calculated in the same manner as the air carrier aircraft and are presented in **Exhibit 3**. Likewise, it is desirable to accommodate 100% of the cargo aircraft payload for maximum revenue potential. As shown, the cargo aircraft will require a runway length ranging from 8,000 feet for the B-757-200 and 13,900 feet for the B-727-200 aircraft.

V. Landing Runway Length Requirements

Landing runway length requirements were also determined for the air carrier, commuter, and cargo aircraft at Dayton International Airport. **Exhibits 4, 5 and 6** depict the runway lengths necessary with maximum aircraft landing weight for wet and dry pavement conditions. All of the air carrier aircraft should be able to land on a 7,000-foot long runway, while

all of the commuter aircraft should be able to land on a 6,400-foot long runway under wet conditions. In addition, all of the cargo aircraft should be able to land on an 8,900-foot long runway under wet conditions. The landing runway lengths are not the critical metric for determining the optimum runway length requirements, because it requires less runway length to conduct aircraft landings. This information is provided for airport planning purposes and potential runway usage during peak arrival periods.

VI. Summary

Runway takeoff and landing length requirements were identified for air carrier, commuter, and cargo aircraft at Dayton International Airport in accordance with FAA Advisory Circular 150/5325-4A and the aircraft manufacturers' characteristics manuals. Based on 100% maximum takeoff and landing weights, the table below shows the runway lengths that are justified for use by the three aircraft groups.

Runway Length Requirements

Aircraft Type	Takeoff Length at MTOW (ft.)	Landing Length (ft.)(wet)
Air Carrier	12,800	7,000
Commuter	9,350	6,400
Cargo	13,900	8,900

These runway lengths are based on individual aircraft performance charts, and take into consideration the elevation and average temperature of the airport, runway conditions, and the operating weight and engine type of the aircraft. This initial runway length analysis did not take into consideration local conditions, such as, environmental, noise, topographical (except for runway gradient), physical, land use, political, and economic factors. However, these factors were taken into consideration for determination of the proposed runway lengths as depicted on the draft Future Airport Layout Plan (ALP) dated January 19, 2005.

The following are the results of the runway length requirements for the three existing runways at DAY:

- ***Runway 6R-24L*** – In accordance with Advisory Circular 150/5325-4A, parallel runways should have a length based on the airplanes that will use the runways and should also be approximately equal in length. Based on these criteria, the Runway 6R-24L takeoff length of 13,900 feet is justified since the theoretical 13,900-foot

length of Runway 6L-24R is justified. This length would accommodate all of the existing and future aircraft fleet mix at 100% MTOW.

Although justifiable at 13,900 feet, the draft Future ALP proposes a length of 9,500 feet for Runway 6R-24L due to various local factors as previously noted. The proposed runway length of 9,500 feet can accommodate the air carrier fleet with a 95% or greater MTOW, with the exception of the B-757-200, B-757-300, B-737-900, and DC-9-32 aircraft. **Table 7** shows the percent MTOW and maximum stage length (nautical miles) for each of the air carrier aircraft based on a 9,500-foot long runway. The flight range distance for each aircraft is also adequate to serve the current commercial markets at DAY as shown in Table 6. The proposed 9,500-foot Runway 6R-24L is based on the premise that both parallel 6-24 runways are in operation. However, if the airlines wish to add new markets with longer stage lengths, the 9,500-foot runway length may not be adequate for all aircraft types to serve these new markets with payloads that are economically viable for the airlines.

An additional analysis was conducted to determine the performance of the cargo aircraft on a 9,500-foot long runway. **Table 8** shows the percent MTOW and maximum stage length for each of the cargo aircraft. The flight range distance for each aircraft is less than those for the proposed 12,600-foot long Runway 6L-24R. The MTOW for all of the cargo aircraft are between 90% and 100% based on the 9,500-foot long runway.

The cargo aircraft could also use Runway 6R-24L primarily during peak arrival periods and will require a minimum landing length of 8,900 feet. The proposed 9,500-foot long Runway 6R-24L will be capable of accommodating all of the cargo aircraft for landing under wet conditions.

- ***Runway 18-36*** – In accordance with Advisory Circular 150/5325-4A, a crosswind runway should have a length of at least 80 percent of the primary parallel runway length. Based on these criteria, Runway 18-36 is justified at a takeoff length between 11,120 feet, which is 80% of the justified 13,900-foot Runway 6L-24R length. It is anticipated that the air carrier and commuter aircraft will mainly use Runway 18-36, with use by cargo aircraft when wind and weather dictate. Based on recent radar data, the actual usage of Runway 18-36 is approximately 10.6% annually.

  The draft Future ALP proposed a length of 9,500 feet for Runway 18-36. This runway length is less than the justified length of 11,120 feet in accordance with the FAA Advisory Circular due to various local factors as previously noted. The proposed runway length of 9,500 feet can accommodate the air carrier fleet with a 95% or greater MTOW, with the exception of the B-757-200, B-757-300, B-737-900, and DC-9-32 aircraft. Table 7 shows the percent MTOW and maximum stage length (nautical miles) for each of the air carrier aircraft based on a 9,500-foot long runway. The flight range distance for each aircraft is adequate to serve the current commercial markets at DAY as shown in Table 6. However, as previously noted, if the airlines wish to add new

markets with longer stage lengths, the 9,500-foot runway length may not be adequate for all aircraft types to serve the new markets with payloads that are economically viable for the airlines.

- ***Runway 6L-24R*** – Due to the anticipated heavy use by cargo aircraft, the Runway 6L-24R takeoff length is justified at 13,900 feet to adequately serve all of the anticipated cargo aircraft at 100% MTOW. Also, all of the air carrier and commuter aircraft fleet would be able to use a 13,900-foot long runway at 100% MTOW. The draft Future Airport Layout Plan (ALP) dated January 18, 2005 proposes a length of 12,600 feet for Runway 6L-24R. This runway length is less than the justified length of 13,900 feet in accordance with the FAA Advisory Circular due to various local factors as previously noted. The 24R threshold has been moved 1,478 feet to the west-southwest in order to provide a full 1,000-foot safety area, and construction of a parallel taxiway and service road on the west side of Runway 18-36. The 6L threshold has been extended 3,178 feet to the west-southwest such that US 40 could stay in its existing alignment.

  The proposed runway length of 12,600 feet can accommodate the cargo aircraft fleet at 100% MTOW, with the exception of the A300-B4, B-727-200, DC-10-30, and DC-8-62 aircraft. **Table 5** shows the percent MTOW and maximum stage length (nautical miles) for each of the cargo aircraft based on a 12,600-foot long runway. The worst case is the DC-8-62 aircraft with a 97.3% MTOW. Although, all of the cargo aircraft can takeoff with 100% payload weight, their flight range distances and markets that are reachable non-stop are limited. **Table 6** shows the current markets that are being served by UPS today (previous Menlo Worldwide Forwarding markets).

Based on this runway length requirements analysis, it has been demonstrated that the runway lengths as depicted on the January 19, 2005 draft Future ALP are justified based on the existing and future aircraft fleet mix, and anticipated runway usage at DAY. As mentioned, the proposed runway lengths are less than what is justified per the FAA Advisory Circular planning standards due to local considerations such as land use, noise, and cost-benefits. These issues have been addressed in the Master Plan Study and other planning efforts. The proposed runway lengths will provide adequate aircraft takeoff and landing performance based on current markets being served from DAY. However, as future markets are added and travel distances increase, it may be necessary to increase one or more of the runway lengths to assure Dayton International Airport's ability to competitively serve the existing and future cargo and passenger markets.

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Table 1 – Aircraft Operations Forecast

		Passenger					Annual
	Year	Air Carrier	Regional	Cargo	Other	Total	Change
Actual	1998	24,148	31,398	42,540	53,393	151,479 \1	
	1999	24,239	30,330	38,987	58,448	152,004 \1	0.3%
	2000	25,540	33,466	35,118	51,277	145,401 \2	-4.3%
	2001	21,795	40,114	22,706	47,994	132,609 \2	-8.8%
	2002	15,079	44,940	16,066	49,132	125,217 \2	-5.6%
Estimate	2003	11,000	51,500	14,700	47,100	124,300	-0.7%
Forecast	2004	12,200	54,400	14,800	47,300	128,700	3.5%
	2005	12,400	58,400	15,300	47,500	133,600	3.8%
	2006	12,600	59,600	15,800	47,700	135,700	1.6%
	2007	12,700	60,800	16,400	47,900	137,800	1.5%
	2008	12,900	62,000	17,000	48,100	140,000	1.6%
	2009	13,000	62,900	17,600	48,300	141,800	1.3%
	2010	13,100	63,500	18,200	48,500	143,300	1.1%
	2011	13,200	63,800	18,800	48,700	144,500	0.8%
	2012	13,400	64,200	19,500	48,900	146,000	1.0%
	2013	13,500	64,600	20,200	49,100	147,400	1.0%
	2014	13,600	65,000	20,900	49,300	148,800	0.9%
	2015	13,700	65,400	21,600	49,500	150,200	0.9%
	2016	13,800	65,900	22,400	49,700	151,800	1.1%
	2017	13,900	66,400	23,200	49,900	153,400	1.1%
	2018	14,000	67,000	24,000	50,100	155,100	1.1%
	2019	14,100	67,600	24,800	50,300	156,800	1.1%
	2020	14,200	68,200	25,700	50,500	158,600	1.1%
Average Annual Growth Rates							
	1998-2003	-14.6%	10.4%	-19.1%	-2.5%	-3.9%	
	2003-2010	2.5%	3.0%	3.1%	0.4%	2.1%	
	2010-2020	0.8%	0.7%	3.5%	0.4%	1.0%	
	2003-2020	1.5%	1.7%	3.3%	0.4%	1.4%	

Notes:

Other Operations includes military, non-commercial air taxi, and general aviation.

\1 Total from FAA TAF

\2 Total from Airport records

Table 2 – Future Annual Passenger Aircraft Fleet Mix

Air Carrier

Aircraft	Seats	2003	2005	2010	2015	2020
757	180	17.1%	5.9%	5.6%	0.0%	0.0%
739	177	0.0%	0.0%	0.0%	5.3%	5.1%
738	162	0.0%	0.0%	0.0%	10.7%	10.3%
320	144	0.5%	0.0%	0.0%	26.6%	27.8%
M80	142	23.3%	35.6%	39.8%	0.0%	0.0%
733	134	10.4%	5.9%	5.6%	0.0%	0.0%
M80	129	3.3%	11.9%	5.6%	0.0%	0.0%
319	126	0.2%	0.0%	0.0%	0.0%	0.0%
717	117	15.8%	28.9%	32.4%	46.7%	56.8%
735	116	6.3%	11.9%	11.1%	10.7%	0.0%
D9S	106	13.3%	0.0%	0.0%	0.0%	0.0%
100	87	9.4%	0.0%	0.0%	0.0%	0.0%
DC9	78	0.5%	0.0%	0.0%	0.0%	0.0%
Total		100.0%	100.0%	100.0%	100.0%	100.0%
Total Operations		11,152	12,400	13,100	13,700	14,200

Regional

Aircraft	Seats	2003	2005	2010	2015	2020
142/146 (NB)	85	1.0%	1.2%	2.3%	2.2%	2.1%
ARJ	82	0.2%	0.0%	0.0%	0.0%	0.0%
CR7	70	1.9%	2.3%	3.4%	4.5%	5.4%
CRJ/ERJ/ER4	50	40.6%	69.5%	69.4%	75.8%	80.9%
DH3 (TP)	50	0.6%	0.0%	0.0%	0.0%	0.0%
ATR (TP)	46	0.0%	0.0%	0.0%	0.0%	0.0%
ERD (RJ)	44	2.2%	1.1%	2.3%	3.0%	3.2%
DH8 (TP)	37	1.5%	2.5%	0.0%	0.0%	0.0%
ER3 (RJ)	37	4.0%	4.5%	4.6%	4.5%	4.1%
SF3 (TP)	34	12.3%	8.5%	8.0%	2.2%	0.0%
FRJ (RJ)	32	5.2%	4.7%	4.6%	4.5%	2.1%
EM2/SF3	30	0.0%	0.0%	0.0%	0.0%	0.0%
D38/J41	29	25.8%	3.8%	3.5%	3.3%	2.1%
BEH/BE1/J31	19	4.6%	2.0%	1.8%	0.0%	0.0%
Total		100.0%	100.0%	100.0%	100.0%	100.0%
Total Operations		52,234	58,500	63,500	65,400	68,200

Table 3 – Air Carrier Aircraft Fleet Mix Characteristics

Aircraft Type	Model	Engine Type	MTOW (pounds)
Heavy Aircraft			
Boeing 757	200	RB211-535E-4B	255,000
Boeing 757	200	PW2037	255,000
Boeing 757	300	RB211-535E-4B	270,000
Boeing 757	300	PW2043	270,000
Large Aircraft			
Boeing 737	300	CFM56-3B2	139,500
Boeing 737	500	CFM56-3B1	133,500
Boeing 737	800	CFM56-7B-24	174,200
Boeing 737	900	CFM56-7B-24	174,200
Airbus 320	100	CFM56-5A1	149,911
Airbus 320	200	CFM56-5A1	169,754
Airbus 319	112	CFM56-5B6	141,096
MD-80	83	PW-JT8D-219	160,000
MD-80	87	PW-JT8D-217C	140,000
DC-9	32	PW-JT8D-9	108,000
DC-9	51	PW-JT8D-17	121,000
Avro Regional Jet	70/85/100	ASE-LF507-1F	101,500
Fokker	100	RR-Tay 650	98,000
British Aerospace 146	100	ASE-ALF502R-5	84,000
British Aerospace 146	200	ASE-ALF502R-5	93,000
Boeing 717	200	RR-BR715	51,710
Embraer Regional Jet	145	AE3007-A1	42,328
Embraer Regional Jet	140	AE3007-A1/3	46,517
Embraer Regional Jet	135	AE3007-A1/3	44,092
Canadair Regional Jet	900	GE-CF34-8C5	80,500
Canadair Regional Jet	700	GE-CF34-8C1	72,500
Canadair Regional Jet	200	GE-CF34-3B1	51,000
De Havilland DHC8	300	PW123	43,000

Small Aircraft			
Saab	340	GE-CT7-5A2	28,000
British Aerospace Jetstream	41	ASE-TPE331-14GR	24,000
Beechcraft	1900D	PWC PT6A-67D	17,120
Fairchild Dornier 328	310	PWC-PW306B	34,524

MTOW=Maximum Takeoff Weight
Source: October 2003 Official Airline Guide

Table 4 – Cargo Aircraft Fleet Mix Characteristics

Aircraft Type	Model	Engine Type	MTOW (pounds)
Airbus 300	B4/203	CF6-50C2	363,756
Boeing 727	100C	JT8D-7	169,000
Boeing 727	200F	JT8D-15	209,500
Boeing 747	200C	JT9D-7Q	833,000
MD-11	11F	PW4460	602,500
DC-10	10CF	CF6-6D	440,000
DC-10	30CF	CF6-50C	555,000
Boeing 767	300	CF6-80A	350,000
Boeing 757	200	RB211-535E-4B	255,000
DC8-	62	JT3D-3B	350,000
DC8	73	CFM56-2	355,000
DC-9	41	JT8D-15	114,000

MTOW=Maximum Takeoff Weight
Source: 2001-2002 Cargo Landings from FAA Form 5100-108

Table 5 – Cargo Aircraft Takeoff Requirements (12,600' Runway)

Cargo Aircraft	Engine Type	Takeoff Weights (lbs.)				OEW Plus Payload (lbs.)	Max. Structural Payload (lbs.)	Loss in Payload (lbs.)	MTOW	Percent of Total Payload	Percent of MTOW
		Fuel	Payload	OEW	Total						
A300-B4/203	CF6-50C2	88,631	78,252	195,117	362,000	273,369	78,252	0	363,756	100.0%	99.5%
B-727-100C	JT8D-7	45,500	35,800	87,696	169,000	123,500	35,800	0	169,000	100.0%	100.0%
B-727-200F	JT8D-15	60,600	43,300	100,700	204,600	144,000	43,300	0	209,500	100.0%	97.7%
B-747-200C	JT9D-7Q	243,000	244,670	345,330	833,000	590,000	244,670	0	833,000	100.0%	100.0%
MD-11F	PW4460	151,200	202,733	248,567	602,500	451,300	202,733	0	602,500	100.0%	100.0%
DC-10-10CF	CF6-6D	105,000	119,556	215,444	440,000	335,000	119,556	0	440,000	100.0%	100.0%
DC-10-30CF	CF6-50C	160,000	152,964	238,036	551,000	391,000	152,964	0	555,000	100.0%	99.3%
B-767-300	CF6-80A	72,000	88,248	189,752	350,000	278,000	88,248	0	350,000	100.0%	100.0%
B-757-200	RB211-535E-4B	67,000	47,060	136,940	255,000	188,000	47,060	0	255,000	100.0%	100.0%
DC-8-62F	JT3D-3B	110,600	91,440	138,560	340,600	230,000	91,440	0	350,000	100.0%	97.3%
DC-8-73F	CFM56-2	94,000	111,800	149,200	355,000	261,000	111,800	0	355,000	100.0%	100.0%
DC-9-41	JT8D-15	21,000	31,665	61,335	114,000	93,000	31,665	0	114,000	100.0%	100.0%
									Average	100.0%	99.5%

1. Runway lengths calculated based on specific aircraft manufacturers manuals for standard day temperature (15 degrees C) at 1009 elevation and adjusted for density altitude.
2. Mean daily high temperature of 65 degrees F and a pressure altitude of 1,009 feet yields a density altitude of approximately 1,900 feet.

Table 6 – Takeoff Destination and Distance

Passenger Aircraft Markets		Cargo Aircraft Markets	
City	Distance (nautical miles)	City	Distance (nautical miles)
Dallas	747	Toronto	306
St. Louis	294	St. Louis	294
Chicago	209	New Orleans	664
Cleveland	141	Boston	615
New York	480	Kansas City	487
Houston	807	Montreal	566
Cincinnati	56	Rochester	352
Atlanta	376	Baltimore	352
Orlando	703	Nashville	255
Detroit	144	Charlotte	322
Minneapolis	498	Sacramento	1,713
Washington	339	Atlanta	376
Charlotte	322	Chicago	209
Pittsburgh	186	Monterrey, MX	1,163
Philadelphia	413	Dallas	747
Milwaukee	247	Denver	940
Ft. Lauderdale	593	Los Angeles	1,668
		Brussels, Belgium	3,566
		El Paso	1,176
		Austin	879
		Brownsville	1,069
		Wichita	632
		Ft. Lauderdale	593
		Portland, OR	1,837
		Salt Lake City	1,345

Table 7 – Air Carrier Aircraft Takeoff Requirements (9,500' Runway)

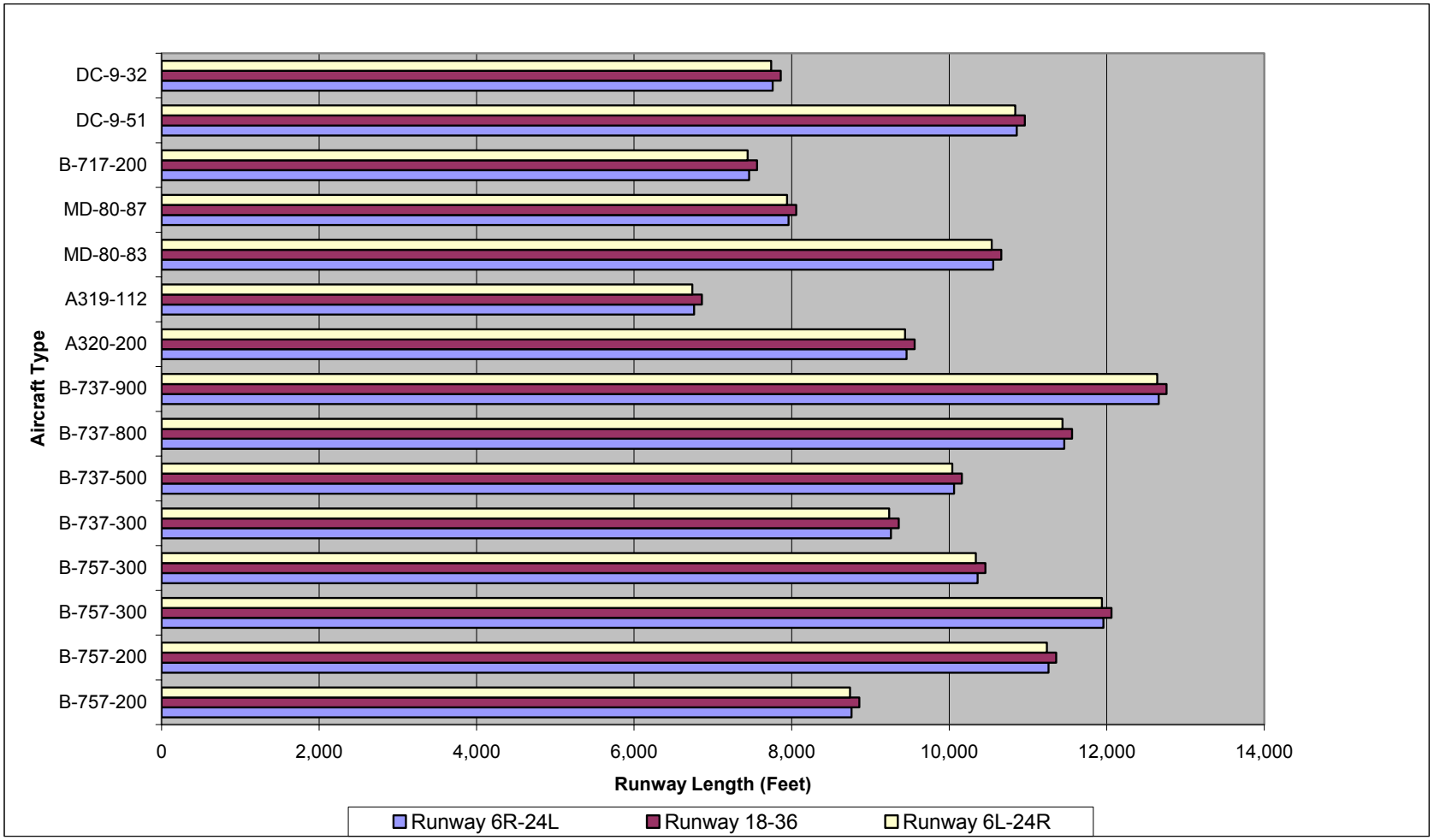
Air Carrier Aircraft	Engine Type	Takeoff Weights (lbs.)				OEW Plus Payload (lbs.)	Max. Structural Payload (lbs.)	Loss in Payload (lbs.)	MTOW	Percent of Total Payload	Percent of MTOW
		Fuel	Payload	OEW	Total						
B-757-200	RB211-535E-4B	37,000	47,060	136,940	225,000	188,000	47,060	0	255,000	100.0%	88.2%
B-757-200	PW2037	58,000	53,125	130,875	246,000	188,000	53,125	0	255,000	100.0%	96.5%
B-757-300	PW2043	57,000	68,200	141,800	267,000	210,000	68,200	0	270,000	100.0%	98.9%
B-757-300	RB211-535E-4B	42,500	67,650	142,350	252,500	210,000	67,650	0	270,000	100.0%	93.5%
B-737-300	CFM56-3B2	26,500	33,960	72,540	133,000	106,500	33,960	0	139,500	100.0%	95.3%
B-737-500	CFM56-3B-1	26,500	33,470	69,030	129,000	102,500	33,470	0	133,500	100.0%	96.6%
B-737-800	CFM56-7B-24	26,700	47,000	91,300	165,000	138,300	47,000	0	174,200	100.0%	94.7%
B-737-900	CFM56-7B-24	27,000	35,420	94,580	157,000	130,000	45,720	10,300	174,200	77.5%	90.1%
A320-200	CFM56-5A1	36,374	44,028	89,350	169,754	133,380	44,028	0	169,754	100.0%	100.0%
A319-112	CFM56-5B6	15,434	37,116	86,476	141,096	125,662	37,116	0	141,096	100.0%	100.0%
MD-80-83	PW-JT8D-219	32,187	42,127	79,686	154,000	121,813	42,127	0	160,000	100.0%	96.3%
MD-80-87	PW-JT8D-217C	28,000	38,726	73,274	140,000	112,000	38,726	0	140,000	100.0%	100.0%
B-717-200	RR-BR715	18,000	26,170	69,830	114,000	96,000	26,170	0	114,000	100.0%	100.0%
DC-9-51	PW-JT8D-17	19,000	33,825	64,675	117,500	98,500	33,825	0	121,000	100.0%	97.1%
DC-9-32	PW-JT8D-9	24,645	11,000	56,855	92,500	67,855	30,145	19,145	108,000	36.5%	85.6%
									Average	94.3%	95.5%

1. Runway lengths calculated based on specific aircraft manufacturers manuals for standard day temperature (15 degrees C) at 1009 elevation and adjusted for density altitude.
2. Mean daily high temperature of 85 degrees F and a pressure altitude of 1,009 feet yields a density altitude of approximately 3,000 feet.

Table 8 – Cargo Aircraft Takeoff Requirements (9,500' Runway)

Cargo Aircraft	Engine Type	Takeoff Weights (lbs.)				OEW Plus Payload (lbs.)	Max. Structural Payload (lbs.)	Loss in Payload (lbs.)	MTOW	Percent of Total Payload	Percent of MTOW
		Fuel	Payload	OEW	Total						
A300-B4/203	CF6-50C2	75,631	78,252	195,117	349,000	273,369	78,252	0	363,756	100.0%	95.9%
B-727-100C	JT8D-7	45,500	35,800	87,696	169,000	123,500	35,800	0	169,000	100.0%	100.0%
B-727-200F	JT8D-15	47,000	43,300	100,700	191,000	144,000	43,300	0	209,500	100.0%	91.2%
B-747-200C	JT9D-7Q	185,000	244,670	345,330	775,000	590,000	244,670	0	833,000	100.0%	93.0%
MD-11F	PW4460	108,700	202,733	248,567	560,000	451,300	202,733	0	602,500	100.0%	92.9%
DC-10-10CF	CF6-6D	88,500	119,556	215,444	423,500	335,000	119,556	0	440,000	100.0%	96.3%
DC-10-30CF	CF6-50C	115,400	152,964	238,036	506,400	391,000	152,964	0	555,000	100.0%	91.2%
B-767-300	CF6-80A	68,000	88,248	189,752	346,000	278,000	88,248	0	350,000	100.0%	98.9%
B-757-200	RB211-535E-4B	67,000	47,060	136,940	255,000	188,000	47,060	0	255,000	100.0%	100.0%
DC-8-62F	JT3D-3B	85,000	91,440	138,560	315,000	230,000	91,440	0	350,000	100.0%	90.0%
DC-8-73F	CFM56-2	69,000	111,800	149,200	330,000	261,000	111,800	0	355,000	100.0%	93.0%
DC-9-41	JT8D-15	21,000	31,665	61,335	114,000	93,000	31,665	0	114,000	100.0%	100.0%
									Average	100.0%	95.2%

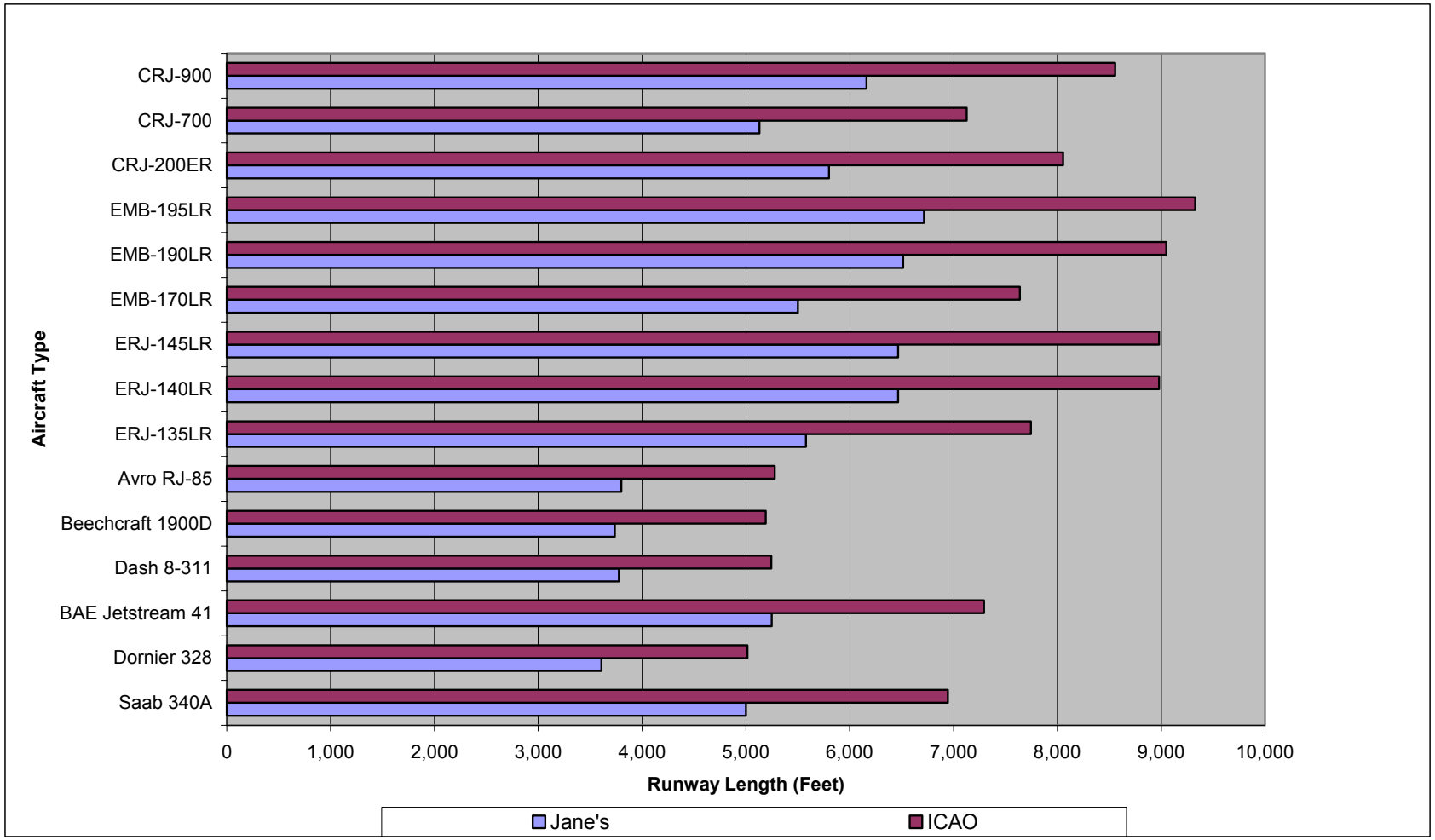
1. Runway lengths calculated based on specific aircraft manufacturers manuals for standard day temperature (15 degrees C) at 1009 elevation and adjusted for density altitude.
2. Mean daily high temperature of 65 degrees F and a pressure altitude of 1,009 feet yields a density altitude of approximately 1,900 feet.



Notes: 1. Mean daily high temperature of 85 degrees F and a pressure altitude of 1,009 feet yields a density altitude of approximately 3,000 feet.
2. Runway lengths calculated based on specific aircraft manufacturers manuals for standard day temperature (15 degrees C) and adjusted for density altitude.

Source: Aircraft Characteristic Manuals
H:\DAY\Runway Length\[Rwy 6R Length Analysis_12-04.xls]9,500' RW 01/27/05

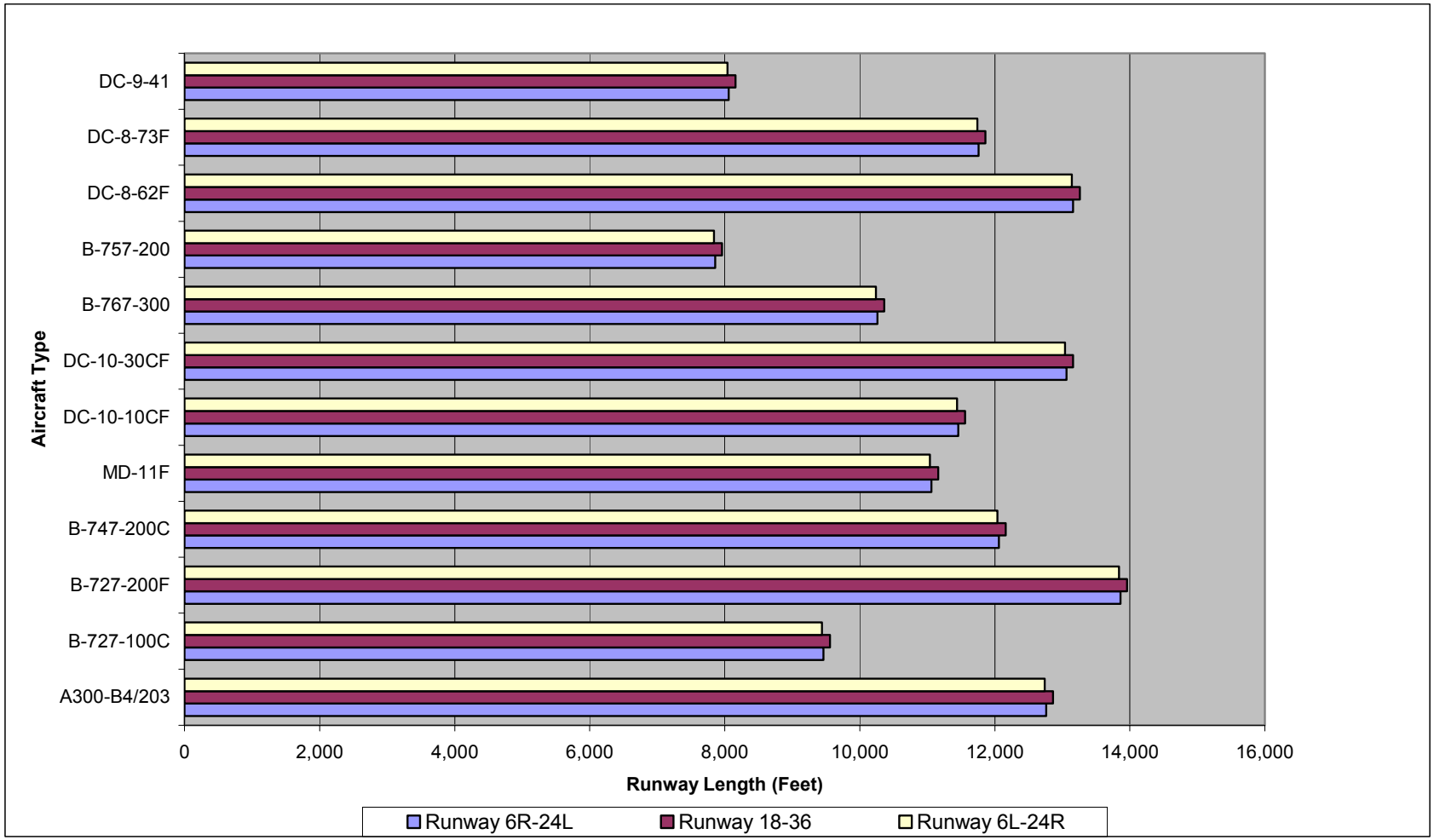
Dayton International Airport	Runway Takeoff Length Requirements Air Carrier Aircraft - 100% MTOW	Exhibit 1



Notes: 1. Mean daily high temperature of 85 degrees F and a pressure altitude of 1,009 feet yields a density altitude of approximately 3,000 feet.
2. Runway lengths calculated based on specific aircraft manufacturers manuals for standard day temperature (15 degrees C) and adjusted for density altitude.

Source: Aircraft Characteristic Manuals
H:\DAY\Runway Length\[Rwy 6R Length Analysis_12-04.xls]9,500' RW 01/27/05

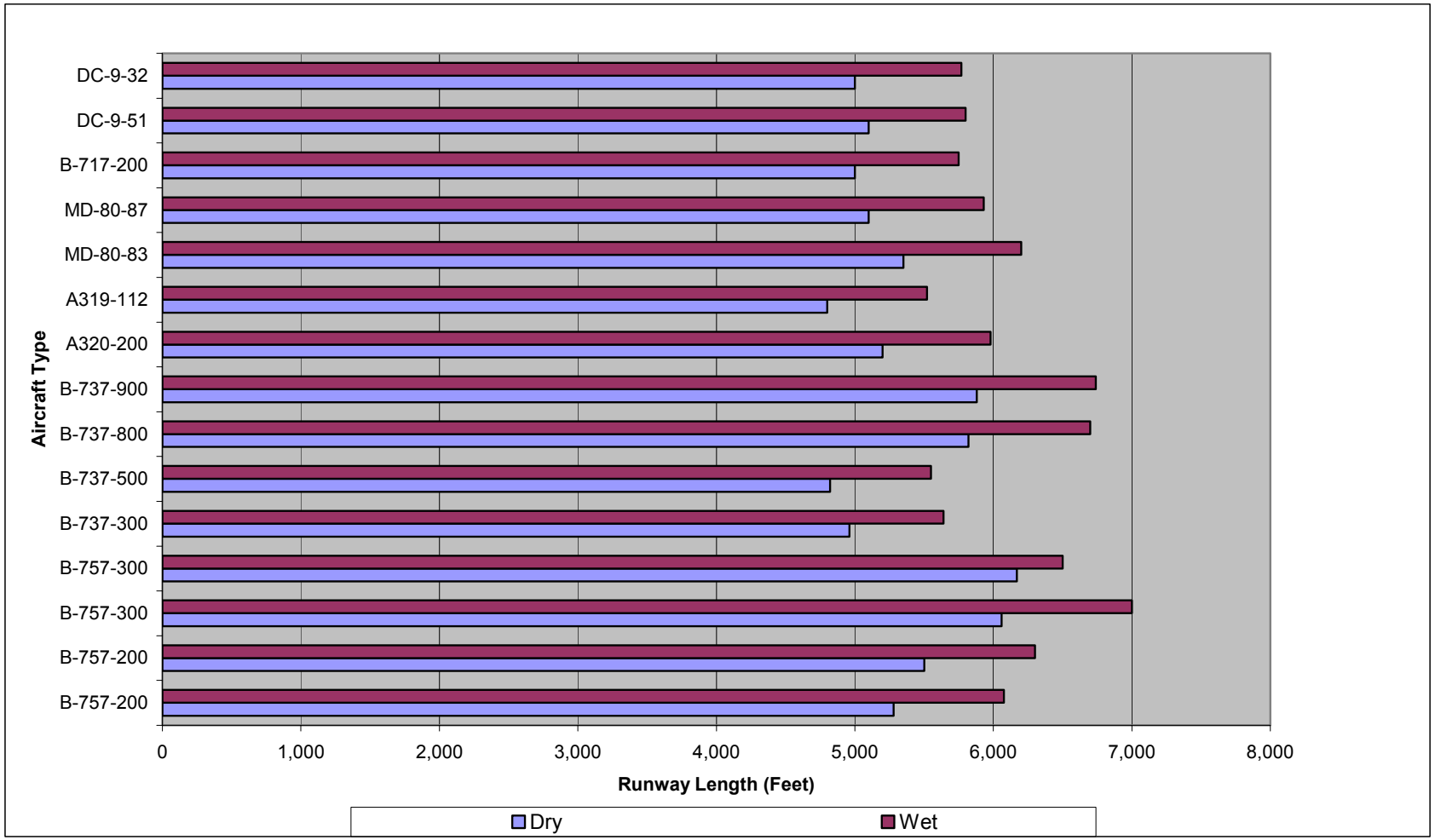
Dayton International Airport	**Runway Takeoff Length Requirements Commuter Aircraft - 100% MTOW**	**Exhibit 2**



Notes:
1. Mean daily high temperature of 65 degrees F and a pressure altitude of 1,009 feet yields a density altitude of approximately 1,900 feet.
2. Runway lengths calculated based on specific aircraft manufacturers manuals for standard day temperature (15 degrees C) and adjusted for density altitude.

Source: Aircraft Characteristic Manuals
H:\DAY\Runway Length\[Rwy 6R Length Analysis_12-04.xls]Cargo T-O Graph 01/27/05

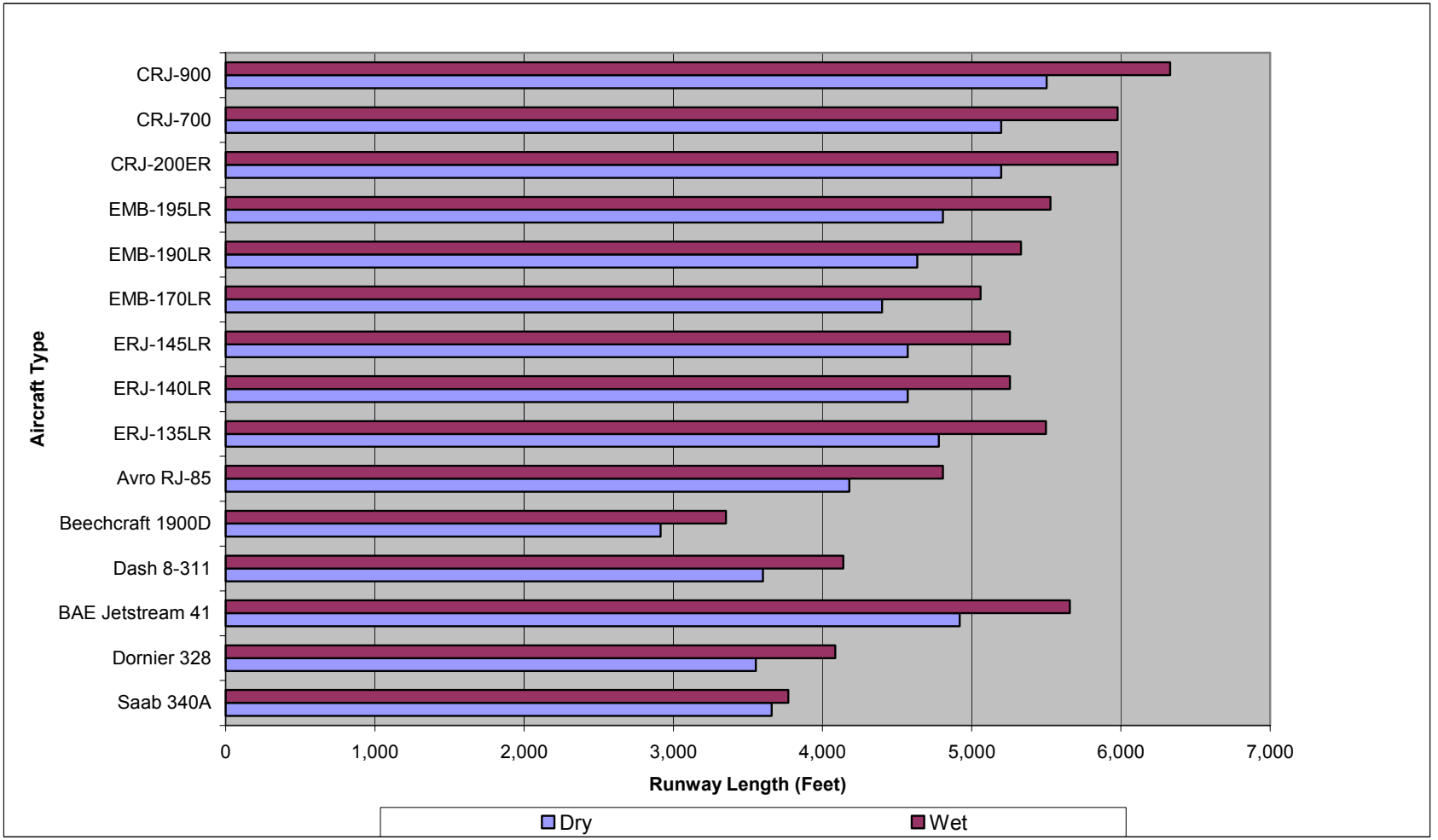
Dayton International Airport	Runway Takeoff Length Requirements Cargo Aircraft - 100% MTOW	Exhibit 3



Notes: 1. Mean daily high temperature of 85 degrees F and a pressure altitude of 1,009 feet yields a density altitude of approximately 3,000 feet.
2. Runway lengths calculated based on specific aircraft manufacturers manuals for standard day temperature (15 degrees C) and adjusted for density altitude.

Source: Aircraft Characteristic Manuals
H:\DAY\Runway Length\[Rwy 6R Length Analysis_12-04.xls]Cargo T-O Graph 01/27/05

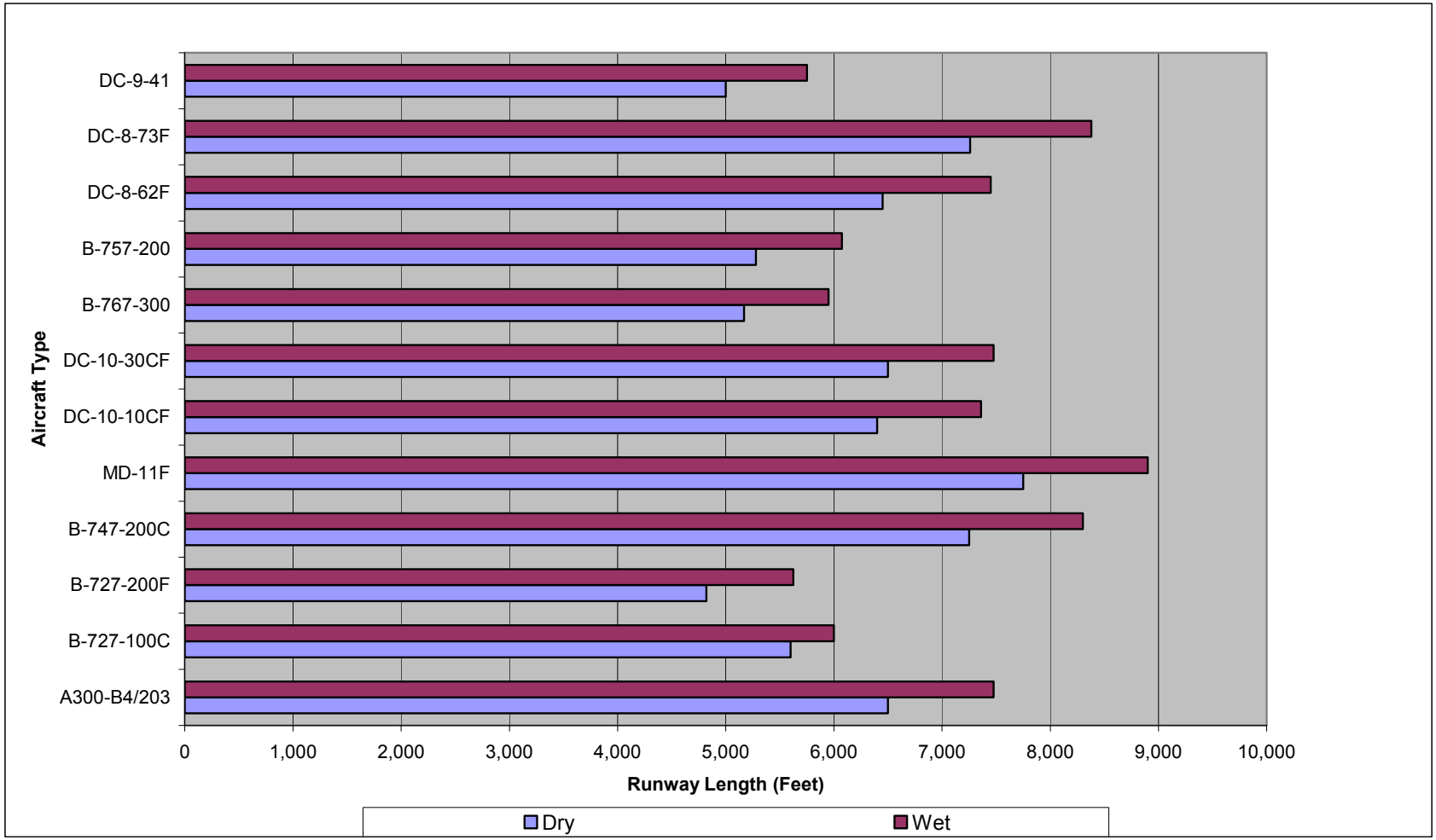
Dayton International Airport	**Runway Landing Length Requirements Air Carrier Aircraft**	**Exhibit 4**



Notes: 1. Mean daily high temperature of 85 degrees F and a pressure altitude of 1,009 feet yields a density altitude of approximately 3,000 feet.
2. Runway lengths calculated based on specific aircraft manufacturers manuals for standard day temperature (15 degrees C) and adjusted for density altitude.

Source: Aircraft Characteristic Manuals
H:\DAY\Runway Length\[Rwy 6R Length Analysis_12-04.xls]Cargo T-O Graph 01/27/05

DAYTON INTERNATIONAL AIRPORT	**Dayton International Airport**	**Runway Landing Length Requirements Commuter Aircraft**	**Exhibit 5**



Notes: 1. Mean daily high temperature of 65 degrees F and a pressure altitude of 1,009 feet yields a density altitude of approximately 1,900 feet.
2. Runway lengths calculated based on specific aircraft manufacturers manuals for standard day temperature (15 degrees C) and adjusted for density altitude.

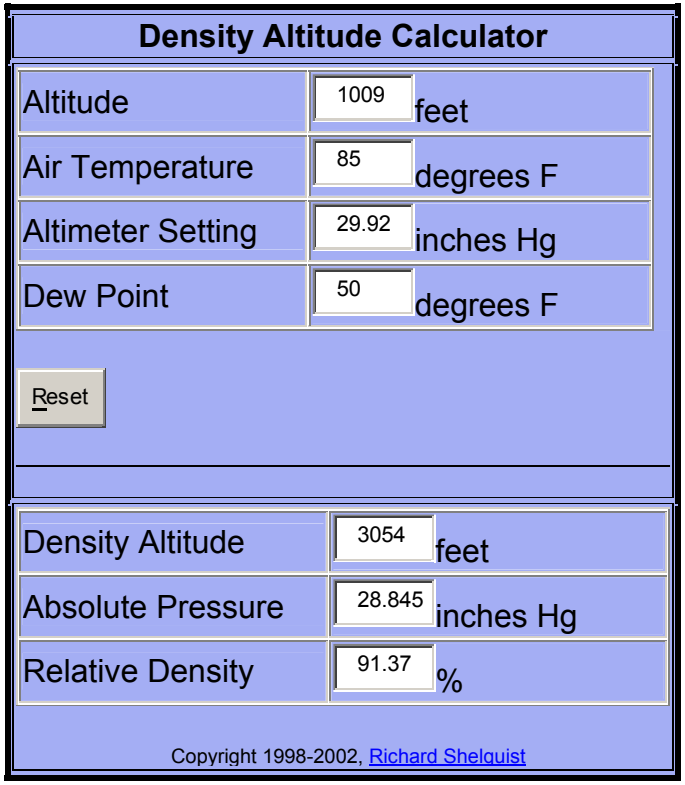
Source: Aircraft Characteristic Manuals
H:\DAY\Runway Length\[Rwy 6R Length Analysis_12-04.xls]Cargo T-O Graph 01/27/05

Dayton International Airport	**Runway Landing Length Requirements Cargo Aircraft**	**Exhibit 6**

APPENDIX A

Exhibit A-1: Density Altitude Calculator for Air Carrier Aircraft

Density altitude is defined as the altitude in the International Standard Atmosphere that has the same air density as the air being evaluated.



Density Altitude Calculator

Altitude	1009	feet
Air Temperature	85	degrees F
Altimeter Setting	29.92	inches Hg
Dew Point	50	degrees F

Reset

Density Altitude	3054	feet
Absolute Pressure	28.845	inches Hg
Relative Density	91.37	%

Exhibit A-2: Density Altitude Calculator for Cargo Aircraft

Density altitude is defined as the altitude in the International Standard Atmosphere that has the same air density as the air being evaluated.

Density Altitude Calculator

Altitude	1009	feet
Air Temperature	65	degrees F
Altimeter Setting	29.92	inches Hg
Dew Point	60	degrees F

Reset

Density Altitude	1867	feet
Absolute Pressure	28.845	inches Hg
Relative Density	94.65	%