APPENDIX B

Purpose and Need and Alternatives

Forecast Technical Memorandum

Charlotte Douglas International Airport Environmental Impact Statement

PREPARED FOR

FEDERAL AVIATION ADMINISTRATION

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Introduction

In accordance with FAA Order 1050.1F "Environmental Impacts: Policies and Procedures, an EIS requires a Purpose and Need section. In order to demonstrate part of the need for capacity-related components of the Project, a passenger and operations forecast ("EIS forecast") has been completed for Charlotte Douglas International Airport ("the Airport" or "CLT"). This technical memorandum covers analysis of the historical traffic at CLT as well as the methodology and results of the long-term traffic forecast. This long-term annual forecast was used as the basis of derivative forecasts (busy day, peak hour, design day schedules), which served as inputs into the simulation modeling. Summary forecast results are shown below in **Table 1-1**. The most recent calendar year of data available as of the writing of this memorandum is 2016; therefore, 2016 was selected as the base year for this EIS.

13In addition to showing the results of the EIS forecast, this memorandum also compares the EIS14forecast to the Federal Aviation Administration's (FAA) 2016 Terminal Area Forecast (TAF) and the15forecast completed by the Charlotte Aviation Department (the Department) in 2014 for the CLT16Master Plan (known as the Airport Capacity Enhancement Plan or ACEP).¹ The service and outlook17for CLT is now updated to reflect changing conditions since completion of the ACEP.

¹ The ACEP was released in February 2016; however, the latest full year of data shown in the report and used in the forecast is 2013.

1 Table 1-1 Summary of Charlotte Douglas International Airport Forecast

	Forecast				Compound Annual Growth Rates		
	Base	Base	Build	Build	Base	Build	Build
	Year	Year+1	Year	Year +5	Year+1	Year	Year +5
	2016	2017	2028	2033	2017	2028	2033
Passenger Enplanements							
Air Carrier	15,640,736	15,850,803	19,824,450	21,720,151	1.3%	2.0%	2.0%
Commuter	6,533,011	6,895,699	8,068,898	8,578,173	5.6%	1.8%	1.6%
Total	22,173,747	22,746,502	27,893,348	30,298,324	2.6%	1.9%	1.9%
Aircraft Operations							
Air Carrier	400,819	409,357	482,269	513,764	2.1%	1.6%	1.5%
Air Taxi	117,378	118,994	129,351	133,460	1.4%	0.8%	0.8%
Subtotal	518,197	528,351	611,620	647,224	2.0%	1.4%	1.3%
General Aviation	24,869	24,935	25,487	25,742	0.3%	0.2%	0.2%
Military	2,676	2,676	2,676	2,676	0.0%	0.0%	0.0%
Total Operations	545,742	555,962	639,783	675,643	1.9%	1.3%	1.3%
Peak Hour Operations	114	116	134	146	1.8%	1.4%	1.5%
Cargo/Mail							
Enplaned and Deplaned Tons	154,477	169,152	235,242	261,000	9.5%	3.6%	3.1%
Operational Factors							
Average Aircraft Size (seats)							
Air Carrier	144	144	148	150	0.0%	0.2%	0.2%
Air Taxi	59	59	62	63	0.0%	0.4%	0.4%
Average Enplaning Load Factor							
Air Carrier	83.6%	83.7%	84.3%	84.6%			
Air Taxi	80.2%	80.3%	81.4%	81.4%			

Source: FAA Operations Network (OPSNET); InterVISTAS analysis for forecast.

Note: This summary table shows is based on a Build Year of 2028. A similar version of this table reflecting Base Year + 5, 10 and 15 years is shown in the Appendix.

Note: The forecast does not reallocate air taxi operations to air carrier as the seating capacity increases; therefore, the average aircraft size (seats) for air taxi goes above 60 seats.

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Historical Traffic Analysis

This chapter presents background information on the Charlotte Douglas International Airport ("the Airport" or "CLT"), the economics of the surrounding catchment area, historical traffic growth, the relationship between local economics and airport traffic, as well as the Airport's role as a hub in the network of the dominant air carrier American Airlines.

2.1 Catchment Area

The Airport serves the 20-county Charlotte-Gastonia-Salisbury economic area, which includes
 portions of both North Carolina and South Carolina (Figure 2-1).² Included in this economic area is
 the Charlotte-Concord Combined Statistical Area (CSA), which in turn covers the 10-county
 Charlotte-Concord-Gastonia Metropolitan Statistical Area (MSA) and two micropolitan areas
 (Albemarle and Shelby). The largest county, Mecklenburg County in North Carolina, includes the
 City of Charlotte and the Airport itself.

² City of Charlotte, Official Statement, Bond Series 2017 A-C, May 19, 2017.

1 Figure 2-1 CLT Catchment Area



Source: County data from U.S. Census Bureau

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Within the United States, Charlotte was the 17th largest city and the 21st largest CSA (**Table 2-1**) in 2016.

Rank	c City	State	Population
1	New York City	New York	8,537,673
2	Los Angeles	California	3,976,322
3	Chicago	Illinois	2,704,958
4	Houston	Texas	2,303,482
5	Phoenix	Arizona	1,615,017
6	Philadelphia	Pennsylvania	1,567,872
7	San Antonio	Texas	1,492,510
8	San Diego	California	1,406,630
9	Dallas	Texas	1,317,929
10	San Jose	California	1,025,350
11	Austin	Texas	947,890
12	Jacksonville	Florida	880,619
13	San Francisco	California	870,887
14	Columbus	Ohio	860,090
15	Indianapolis	Indiana	855,164
16	Fort Worth	Texas	854,113
17	Charlotte	North Carolina	842,051
18	Seattle	Washington	704,352
19	Denver	Colorado	693,060
20	El Paso	Texas	683,080

Table 2-1 Top 20 U.S. Cities Ranked by Population, CY 2016

Source: United States Census Bureau, 2017.

While the Airport's entire catchment area represents approximately a two-hour drive time, the core of the Airport's catchment is the Charlotte-Concord CSA with a population of 2.6 million (**Table 2-2**).

Table 2-2 Population Comparison, CY 2016

Area	Counties	Population
City of Charlotte	n/a	842,051
Charlotte-Concord-Gastonia MSA	10	2,474,314
Charlotte-Concord CSA	12	2,632,249
Charlotte-Gastonia-Salisbury	20	3,179,393

Source: United States Census Bureau, 2017.

11Historically, the population of the Charlotte-Concord CSA has grown at a rate higher than that of12the United States (**Table 2-3**). In addition, the CSA population is estimated to grow at an average13annual rate of almost double that of the United States through 2050.

Year	United States	10-Yr CAGR	North Carolina	10-Yr CAGR	South Carolina	10-Yr CAGR	Charlotte- Concord CSA	10-Yr CAGR
Historical								
2000	282,162		8,082		4,024		1,883	
2010	309,347	0.9%	9,559	1.7%	4,636	1.4%	2,382	2.4%
2016	324,161		10,169		4,951		2,626	
Forecast								
2020	336,383	0.8%	10,723	1.2%	5,192	1.1%	2,807	1.7%
2030	368,644	0.9%	12,215	1.3%	5,836	1.2%	3,3007	1.7%
2040	399,419	0.8%	13,732	1.2%	6,475	1.0%	3,839	1.5%
2050	428,119	0.7%	15,246	1.1%	7,096	0.9%	4,393	1.4%
CAGRs								
2000-2016	0.9%		1.4%		1.3%		2.1%	
2016-2020	0.9%		1.3%		1.2%		1.7%	
2016-2050	0.8%		1.2%		1.1%		1.5%	

1 Table 2-3 Select Historical and Forecast Populations (in thousands)

Source: Complete Economic and Demographic Data Source (CEDDS), Woods & Poole Economics, Inc., 2017.

3 CAGR - Compound Annual Growth Rate

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Real per capita income in the Charlotte-Concord CSA is expected to grow at 1.1 percent annually over the period of 2016-2050 (**Table 2-4**). Comparatively, the United States anticipates similar annual real growth in per capital income over the same period (1.2 percent).

Table 2-4 Select Historical and Projected Per Capita Income (in 2009 USD)

							Charlotte-	
	United	10-Yr	North	10-Yr	South	10-Yr	Concord	10-Yr
Year	States	CAGR	Carolina	CAGR	Carolina	CAGR	CSA	CAGR
Historical								
1990	29,082		25,370		23,376		26,531	
2000	36,833	2.4%	32,719	2.6%	29,840	2.5%	34,205	2.6%
2010	39,622	0.7%	34,757	0.6%	31,638	0.6%	36,846	0.7%
2016	44,637		37,884		35,477		41,295	
Forecast								
2020	47,378	1.8%	40,272	1.5%	37,757	1.8%	43,677	1.7%
2030	54,339	1.4%	46,262	1.4%	43,450	1.4%	49,564	1.3%
2040	60,336	1.1%	51,212	1.0%	48,040	1.0%	54,367	0.9%
2050	66,890	1.0%	56,621	1.0%	53,055	1.0%	59,481	0.9%
CAGRs								
2000-2016	1.2%		0.9%		1.1%		1.2%	
2016-2020	1.5%		1.5%		1.6%		1.4%	
2016-2050	1.2%		1.2%		1.2%		1.1%	

9 Source: Complete Economic and Demographic Data Source (CEDDS), Woods & Poole Economics, Inc., 2017.

2.2 Background and Historical Passenger Traffic

One of the most important inputs into a traffic forecast is the historical traffic. This section shows historical data for enplaned passengers (including both Origin and Destination (O&D) passengers and connecting passengers) as well as discusses CLT's role as a hub for American Airlines.

2.2.1 Enplaned Passengers

Since 2002, the Airport has grown 4.6 percent annually on average in terms of enplaned passengers, reaching 22.2 million in 2016. During this period, average international growth (8.1 percent) almost doubled that of domestic growth (4.4 percent). As shown in **Figure 2-2** below, enplanements only dipped by 0.6 percent in 2009 following the 2008-2009 economic crisis – compared to a 7.2 percent drop in the United States as a whole.³ Traffic rebounded in 2010 with a rate of 10.7 percent. In 2016, traffic declined by 1.1 percent, driven by a decrease in domestic connecting passengers (O&D passengers increased). However, in the first half of 2017, enplaned passenger traffic was three percent higher than the first six months of 2016; international enplaned passengers are 20 percent higher than the same period in 2016.



Figure 2-2 Historical Enplaned Passengers at CLT, 2002-2016

3 FAA Aerospace Forecast, FY 2011-2031

Since 2002, domestic traffic has increased by an average of 4.4 percent annually and international traffic has increased by an average of 8.1 percent annually (**Table 2-5**).

Table 2-5 Compound Annual Growth Rates for Historical Enplaned Passengers at CLT

CAGRs	2002-06	2006-11	2011-16	2002-16	
Domestic	5.3%	5.6%	2.5%	4.4%	
International	17.7%	5.7%	3.5%	8.1%	
Total	5.9%	5.6%	2.6%	4.6%	
Source: CLT Monthly Activity Reports					

CAGR - Compound Annual Growth Rate

Among the 30 large hub airports in the United States, CLT accounts for the 10th most enplaned passengers (see **Table 2-6** below).

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Rank	Airport	Enplaned Passengers (millions)
1	Atlanta Hartsfield – Jackson International	50.5
2	Los Angeles International	39.6
3	Chicago O'Hare International	37.6
4	Dallas-Fort Worth International	31.3
5	NYC John F. Kennedy International	29.2
6	Denver International	28.3
7	San Francisco International	25.7
8	Las Vegas McCarran International	22.8
9	Seattle-Tacoma International	21.9
10	Charlotte/Douglas International	21.5
11	Phoenix Sky Harbor International	20.9
12	Miami International	20.9
13	Orlando International	20.3
14	Houston George Bush Intercontinental	20.1
15	Newark Liberty International	19.9
16	Minneapolis-St Paul International	18.1
17	Boston Logan International	17.8
18	Detroit Metropolitan Wayne County	16.8
19	NYC LaGuardia	14.8
20	Philadelphia International	14.6
21	Fort Lauderdale/Hollywood International	14.3
22	Baltimore/Washington International Thurgood Marshall	12.3
23	Ronald Reagan Washington National	11.5
24	Salt Lake City International	11.1
25	Chicago Midway International	11.0
26	Washington Dulles International	10.6
27	San Diego International	10.3
28	Honolulu Daniel K Inouye International	9.7
29	Tampa International	9.2
30	Portland International	9.1
<u>_</u>		

Table 2-6 Enplaned Passengers at Top 30 U.S. Airports, CY 2016

Source: FAA, Enplanements at All Commercial Service Airports (by Rank), October 10, 2017.

The ACEP was released in February 2016; however, the latest full year of data shown in the report is from 2013. In 2013, CLT accounted for the 8th most enplaned passengers in the U.S. airport;⁴ it has since been surpassed in the rankings by Las Vegas McCarran International Airport and Seattle-Tacoma International Airport.

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⁴ ACI, 2012 World Annual Traffic Report as shown in the ACEP

1 2.2.2 Current Service and Role as Hub

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17 18 Passenger traffic at CLT comprises of O&D traffic (travel to and from Charlotte) and connecting traffic (passengers making connections at CLT) as illustrated below. As can be seen in **Table 2-7**, connecting traffic comprises 71 percent of passenger movements and consists mostly of domestic connections.

Table 2-7 Charlotte Passenger Traffic CY 2016

Traffic Type	Share	
Domestic O&D	25.6%	
International O&D	3.2%	
Domestic Connecting	67.5%	
International Connecting	3.7%	
Total	100.0%	

Source: U.S. DOT O&D and T100 data, via Flight Global's Diio Mi database.

The high rate of connections at CLT reflects its role as a hub for American Airlines which accounted for 91 percent of seat capacity and passengers in CY 2016 (**Figure 2-3**).⁵ Of the remaining nine percent of passengers, Delta Air Lines serves the largest share at four percent, followed by United Airlines at two percent.

Figure 2-3 Airline Share of CLT Enplanements, CY 2016



Source: U.S. DOT T100 via Airline Data, Inc.; CLT Monthly Traffic Reports.

Before the merger of American Airlines and US Airways in 2013,⁶ Charlotte was the largest of US Airways' four hubs. Now, Charlotte is American Airlines' second largest hub after Dallas/Fort Worth, as illustrated in (**Table 2-8**) below. After carriers merge, it is typical for changes to be made

⁵ Innovata schedule data via Flight Global's Diio Mi database.

⁶ Although the merger was announced in 2013, the two airlines did not begin operating under one Air Operator's Certificate (AOC) until 2015.

to the hub structure in order to optimize operations. As an example, the largest international connect flow was the U.S. Northeast-Caribbean market. Some of this traffic has since shifted to American Airlines' largest Caribbean gateway, Miami (**Figure 2-4**).

Seat Rank	Airport	Markets Served	Daily Departures	Daily Seats
1	Dallas/Fort Worth	202	749	95,927
2	Charlotte	158	660	71,170
3	Chicago O'Hare	133	481	49,938
4	Miami	129	333	48,061
5	Philadelphia	114	379	37,549
6	Phoenix	86	253	33,557
7	Los Angeles	70	202	27,723
8	Washington DCA	72	239	20,654
9	New York JFK	46	93	13,225

Table 2-8 Overview of Capacity at American Airlines Hubs, CY 2016

Source: Airport Records, U.S. DOT, O&D Survey, via Flight Global's Diio Mi database.

Figure 2-4 American Airlines Hub Locations



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Source: Innovata schedule data via Flight Global's Diio Mi database, August 2017.

Flights from CLT reach 169 destinations; 135 of those in the United States (Table 2-9). These 135
 destinations account for 95 percent of weekly departing flights. International service connects
 Charlotte to 34 airports with the 50 percent of those located in the Caribbean. American Airlines'
 focus at Charlotte is on domestic connections as it connects the United States to Latin American via
 its hub at Miami; Europe via its hub at New York JFK; and Asia from Los Angeles.

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Region	Weekly Departures	Weekly Departing Seats	Number of Destinations
Domestic	4,893	509,388	135
Europe	63	16,926	8
Caribbean	112	16,876	17
Mexico	30	5,048	4
Canada	46	2,984	2
Central America	7	882	3
Total	5,150	552,104	169

Table 2-9 Weekly Frequencies from CLT by Region, August 2017

Source: Innovata Schedule Data via Flight Global's Diio Mi database, August 2017.

As noted above, the air service offerings at CLT has changed since the ACEP. In 2013, international flights accounted for 6.5 percent of total scheduled flights⁷ whereas in August 2017 they accounted for 5 percent. Of these international flights, 65 percent were to Latin America in 2013;⁸ this share has dropped to 57.8 percent in 2017.

Of the 5,150 weekly nonstop departures at CLT in August 2017, 67.8 percent are operated with narrowbody equipment **(Table 2-10**). Ten routes are operated with widebody aircraft.

Table 2-10 Weekly Frequency from CLT by Aircraft Type, August 2017

Aircraft Group	Weekly Departures	Weekly Departing Seats	Number of Destinations
Narrowbody	3,493	442,823	124
Regional Jet/Turboprop	1,584	89,985	90
Widebody	73	19,296	10
Total	5,150	552,104	N/A

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Source: Innovata Schedule Data via Flight Global's Diio Mi database, August 2017

12 2.2.3 Origin and Destination (O&D) Passengers

While connections account for 71.2 percent of passengers at CLT, O&D passengers play an
 increasing role at the Airport. Over the last 20 years, O&D passengers have increased by 4.7 percent
 annually on average (Table 2-11), with slightly larger growth in the international segment (see
 Figure 2-5). In 1996, international passengers accounted for 7.6 percent of total passengers; this
 share has increased to 11.1 percent in 2016. In 2016, both international and domestic O&D
 passengers grew, by 7.8 percent and 3.8 percent, respectively compared to 2015.

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⁷ OAG schedules as shown in the ACEP

⁸ Ibid.



Figure 2-5 Historical O&D Passengers at CLT, 1996-2016

Source: U.S. DOT O&D Survey via Flight Global's Diio Mi database.

Table 2-11 Compound Annual Growth Rates for Historical O&D Passengers at CLT

CAGRs	1996-06	2006-16	1996-16
Domestic	5.7%	3.3%	4.5%
International	9.5%	3.9%	6.7%
Total	6.0%	3.3%	4.7%

Source: U.S. DOT O&D Survey via Flight Global's Diio Mi database.

New York City (as represented by JFK, LaGuardia and Newark airports) is the largest O&D destination from CLT, followed by Chicago (O'Hare and Midway) (see **Table 2-12**).

Table 2-12 Top 10 O&D Destinations from CLT, CY 2016

Rank	City	O&D Passengers
1	New York City	1,514,506
2	Chicago	594,468
3	Boston	474,979
4	Dallas	422,592
5	Philadelphia	339,573
6	Orlando	281,049
7	Baltimore	274,187
8	Los Angeles	272,809
9	Washington D.C.	244,093
10	San Francisco	240,379

Source: U.S. DOT O&D Survey via Airline Data, Inc.

CAGR - Compound Annual Growth Rate

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1 2.2.4 Connecting Passengers at CLT

Since 2002, the number of connecting passengers at CLT has increased by 4.2 percent annually on average (**Figure 2-6** and **Table 2-13**), reaching 31.9 million passengers in 2016. International connections, which include connections between domestic and international flights have increased at a faster rate than domestic-to-domestic connections, likely due to the increase in the number of international flights.

Connecting traffic is a function of air carrier hubbing and network decisions (primarily American Airlines at CLT). While underlying demand can grow connecting traffic, it is American Airlines decision to flow traffic through specific hubs that will ultimately affect traffic volumes at CLT.

Figure 2-6 Historical Connecting Passengers at CLT, 2002-2016



Source: U.S. DOT O&D Survey via Flight Global's Diio Mi database

Table 2-13 Compound Annual Growth Rates for Historical Connecting Passengers at CLT

CAGRs	2002-06	2006-11	2011-16	2002-16
Domestic	2.9%	7.1%	1.7%	4.0%
International	20.5%	6.6%	3.8%	9.3%
Total	3.5%	7.1%	1.8%	4.2%

Source: U.S. DOT O&D Survey via Flight Global's Diio Mi database

Table 2-14 below shows the major domestic connecting flows (domestic-to-domestic) and **Table 2-15** shows international connecting flows (domestic-to-international and international-to-international) at CLT in 2016. The major domestic-domestic flows tend to be north-to-south in nature, particularly on the eastern side of the country. CLT is geographically well-positioned to continue to handle these flows within America Airlines' network, compared with the Airline's other major hubs.

Table 2-14 Charlotte Domestic Connecting Flows, CY 2016

Domestic Connecting Flows			
Northeast-to-Southeast	16.7%		
Florida-to-Northeast	14.1%		
Northeast-to-Southwest	7.5%		
Florida-to-Southeast	6.9%		
Great Lakes-to-Southeast	6.8%		
Florida-to-Great Lakes	6.0%		
Northeast-to-Pacific	5.3%		
Southeast-to-Southwest	5.0%		
Other	31.7%		
Total	100.0%		

Source: U.S. DOT, O&D Database via Airline Data, Inc.

As shown in **Table 2-15**, for international, nearly two thirds of the flows are to the Caribbean and Mexico, which overlaps with American Airlines' Miami hub. Similarly, the flows to Europe overlap with Dallas and American Airlines' hubs in the Northeast.

Table 2-15 Charlotte International Connecting Flows, CY 2016

International Connecting Flows			
Domestic-to-Caribbean	50.8%		
Domestic-to-Europe	23.6%		
Domestic-to-Mexico	15.7%		
Domestic-to-Canada	5.3%		
Domestic-to-Other	2.9%		
International-to-International	1.7%		
Total	100.0%		

Source: U.S. DOT, O&D Database via Airline Data, Inc.

In 2016, domestic connecting traffic at CLT accounted for 1.9 percent of total U.S. domestic passenger traffic, while international connecting traffic accounted for 1.5 percent of total U.S. international passenger traffic (see **Figure 2-7**).⁹ Both the international and domestic connecting share of CLT compared to the national aviation market have been declining since 2013. This decline is due to an industry-wide trend towards more direct services as well as a consolidation of American Airlines' connecting traffic at other hubs such as Miami and Dallas. As discussed in the next chapter, this is a trend that is expected to continue, and it serves as one of the inputs into the long-term passenger forecast prepared for this EIS.

^{9 &}quot;International" here includes U.S.-Transatlantic, U.S.-Latin American, and U.S.-Canadian markets



1.9%

1.5%

Figure 2-7 CLT Connecting Share of Total U.S. Traffic, 2006-2016

Source: U.S. DOT O&D Survey via Flight Global's Diio Mi database, FAA

2008

2009

Domestic

2010

2011

2012

- - International

2013

2014

2015

2016

2.3 Aircraft Operations

2006

2007

1.5%

1.0%

0.5%

0.0%

2.3.1 Types of Aircraft Operations

Aircraft operations can be divided into categories based on aircraft size or operation purpose. The following definitions are used in the FAA's annual TAF forecast and in this technical memorandum.

- 1. Commercial operations (those operated as a business) can be defined based on the size of the aircraft involved:
 - a. Air carrier "takeoffs or landings of commercial aircraft with seating capacity of more than 60 seats" 10
- b. Air taxi includes:
 - i. Commuter itinerant operations performed by commercial aircraft with seating capacity of 60 seats or less on scheduled flights
 - ii. On-demand itinerant operations performed by commercial aircraft with seating capacity of 60 seats or less on non-scheduled or for-hire flights

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2. Non-commercial operations

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- a. General Aviation (GA) "all civil aviation aircraft takeoffs and landings not classified as commercial or military"¹¹
- b. Military "takeoffs and landings by military aircraft"¹²

2.3.2 Historical Aircraft Operations at CLT

Overall commercial operations at CLT have increased by 1.7 percent on average annually since 2002, reaching 518,197 in 2016 (**Figure 2-8**).

Figure 2-8 Historical Commercial Operations at CLT, 2002-2016



10 Source: FAA OPSNET

This growth has been driven by increases in air carrier operations as air taxi operations have declined over this period by 2.9 percent per annum on average (**Table 2-16**). The number of both international and domestic air carrier operations have increased by 6.1 percent and 4.1 percent, respectively.¹³

Table 2-16 Compound Annual Growth Rates for Historical Commercial Operations at CLT

2002-06	2006-11	2011-16	2002-16
2.6%	4.9%	4.0%	3.9%
4.9%	-3.1%	-8.6%	-2.9%
3.6%	1.6%	0.2%	1.7%
	2002-06 2.6% 4.9% 3.6%	2002-06 2006-11 2.6% 4.9% 4.9% -3.1% 3.6% 1.6%	2002-06 2006-11 2011-16 2.6% 4.9% 4.0% 4.9% -3.1% -8.6% 3.6% 1.6% 0.2%

Source: CLT Monthly Activity Reports

CAGR - Compound Annual Growth Rates

11 FAA TAF, Appendix A: Description of Activity Measures, page 26.

12 Ibid.

13 U.S. DOT T100 via Airline Data, Inc.

In 2016, 73.4 percent of total aircraft operations were air carrier. Almost 22 percent of operations were air taxis; 4.6 percent were General Aviation (GA); and 0.5 percent were military (**Figure 2-9**). General Aviation operations have been steadily falling and represent 60 percent of the level in 2002. Military operations have typically remained within a band of 1,700-2,500 per year, increasing slightly to 2,676 in 2016.





Source: FAA OPSNET

2.4 Aircraft Fleet Mix

As is the case nationwide, average aircraft size at CLT has been increasing (Figure 2-10). However, the growth rate of these larger aircraft in the CLT fleet has been faster than the national rate over the last 10 years. Since 2006, the average number of scheduled seats per departure at CLT has increased from 91 to 107, an average annual growth rate of 1.6 percent or 1.6 seats per year. For comparison, among U.S. commercial carriers over the same period, average annual growth was 1.1 percent. The reason for faster growth at Charlotte is the historically large share of CLT departures operated by smaller, regional/commuter aircraft. In 2006, over 60 percent of CLT's departures were operated on regional/commuter aircraft; in 2016, this share has dropped to 53.2 percent; at the same time, the regional carriers have started operating larger regional jets, such as the CRJ 700 and Embraer 170, which typically have a capacity between 65 and 90 seats. Both these factors have contributed to an increasing aircraft size at CLT.



Figure 2-10 Average Seats per Departure at CLT (Scheduled), 2006-2016

Source: Airline Schedules, via Airline Data, Inc.

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2.5 Air Cargo

 Air cargo tonnage has averaged 2.1 percent growth since the financial crisis (2009-15 growth). Domestic cargo accounts for 81 percent of total cargo enplaned and deplaned at CLT, while international makes up the remaining 19 percent. Historically, Charlotte has been served primarily by FedEx and UPS (which serve the air freight/express mail market), which together carried nearly 100 percent of cargo on scheduled cargo flights between 2012 and 2015. Belly cargo (cargo carried in the hold of commercial passenger aircraft) accounts for 33 percent of total cargo at CLT. Cargo volumes increased by 14.4 percent in 2016 to 154,000 tons (**Figure 2-11** and **Table 2-17**) much of which can be attributed to Amazon, which contracted services with both ABX Air and Air Transport for cargo operations in and out of Charlotte. In 2016, 77.5 percent of cargo served at CLT was air freight/express mail.¹⁴



Figure 2-11 Historical Cargo at CLT (tons), 2006-2016

Source: CLT Monthly Activity Reports

Table 2-17 Compound Annual Growth Rates for Historical Cargo at CLT

CAGRs	2006-11	2011-16	2006-16
Air Freight/Express	-6.3%	4.6%	-1.0%
Air Mail	3.1%	1.0%	2.1%
International	1.4%	-8.5%	-3.6%
Total	-4.2%	2.3%	-1.0%

Source: CLT Monthly Activity Reports

¹⁴ Air freight/express mail includes all cargo that is not international or regular mail.

Traffic Forecast

3.1 Introduction

In the process of conducting this EIS, it is necessary to update the long-term traffic forecast for the Charlotte Douglas International Airport ("the Airport" or "CLT"). This updated forecast will be used as an input into several subsequent analyses completed for the Environmental Impact Statement (EIS) including (among others): aircraft delay modeling, noise modeling, establishment of the design aircraft type, and determination of the optimal runway length. This chapter first presents the methodology and results for projecting passengers, operations and cargo. The most recent calendar year of data available as of the writing of this memorandum is 2016; therefore, 2016 was selected as the base year for this EIS forecast. The two benchmark years chosen for this study are 2028 (the "Build Year," when the Project is expected to open) and the Build Year plus five years (2033). Both the passenger and operations forecasts are compared to both the Airport Capacity Enhancement Plan (ACEP) and the FAA's Terminal Area Forecast (TAF) to determine consistency. Where the EIS forecast differs from either the ACEP or TAF forecasts, explanations are discussed. The forecasts presented in this chapter for CLT have been submitted to the FAA's Airport District Office (ADO) for approval for use in the EIS study.

3.2 Passenger Forecast Methodology

19This section presents the separate approaches used to forecast Origin and Destination (O&D) and20connecting traffic.

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21 3.2.1 Origin-Destination Traffic Forecast Methodology
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The long-term passenger forecasts prepared for this EIS are based on an econometric model for domestic, Canada, the Caribbean (including Mexico and Central America), South America, trans-Atlantic, and trans-Pacific origin-destination passengers. Separate outbound (Charlotte residents) and inbound (overseas residents) models were developed using data sourced from the U.S. DOT. Various models were tested to explain traffic volumes in terms of: relevant GDP measures, population, air fares and fuel prices. The most robust models, in terms of statistical fit (adjusted r-squared and parameter t-statistics), were found to be those based on measures of real GDP (as well as dummy variables in 2001 and 2002 to capture the impacts of the events of September 11, 2001). For the domestic and outbound international models, Charlotte Combined Statistical Area (CSA) gross domestic product (GDP) was found to be the most effective explanatory variable, while the real GDP of the international regions were used for the inbound markets. The dependent variables used in the econometric analysis were in natural log terms. The key results from the econometric analysis are summarized in Appendix 1.

As the markets mature, the responsiveness of demand to economic growth is expected to decline. To capture this, the GDP elasticities were gradually declined by 25 percent by 2035 - this of level decline is based on expert judgement and reflects the expected maturing of the market. To generate forecasts of O&D traffic, the parameters were applied to projections of real GDP sourced from Woods & Poole¹⁵ for Charlotte GDP and the U.S. Department of Agriculture Economic Research Service.¹⁶

3.2.2 Connecting Traffic

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Connecting traffic at CLT is primarily a function of air carrier decisions (primarily American Airlines). While underlying demand can grow connecting traffic, it is carriers' decisions regarding flow traffic through specific hubs that will ultimately affect traffic volumes.

Connecting traffic was modelled as a function of national demand for travel and CLT's share of that 11 demand. In 2016, domestic connecting traffic at CLT accounted for 1.9 percent of total domestic 12 13 passenger traffic. The FAA forecasts that in the U.S., domestic traffic will increase by 1.7 percent per annum up to 2035. It is assumed that CLT's share of this traffic will decline by 10 percent over the 14 forecast period as new direct services reduce the need for connecting itineraries (CLT's share will 15 16 decline to 1.7 percent). As noted in Section 2.2.4, CLT's share of domestic connecting traffic has been declining in recent years, and this trend is expected to continue. This trend of declining 17 18 connecting share was broadly confirmed by interviews with American Airlines. As a result, domestic 19 connecting traffic is forecast to increase by 1.2 percent per annum (forecast values are shown in the 20 Appendix).

The forecasts of international connecting traffic were based on the FAA forecasts of traffic to/from Canada, Latin America and Trans-Atlantic. CLT's share of these total traffic flows is assumed to decline by 25 percent, due to the development of direct services and the increased concentration of connecting flows at other hubs. As with domestic connecting traffic, CLT's share of international connecting traffic has been declining and this trend is expected to continue. This results in average growth of 2.1 percent per annum over the forecast period (compared with 3.6 percent per annum growth in total demand). Forecast connecting passenger values are shown in the Appendix.

3.3 Passengers

The EIS passenger forecast projects passengers by route group (domestic and international) as well as type of passenger. The two types of passengers projected are O&D and connecting.

- O&D passengers at CLT are those beginning or ending their trip at CLT. An example of an O&D passenger would be someone traveling between Charlotte and New York City.
- 33 > Connecting passengers at CLT are those changing planes in the Airport on their way to another
 34 destination. An example of a connecting passenger would be someone flying from New York
 35 City to Charlotte and then to Dallas.

¹⁵ Complete Economic and Demographic Data Source (CEDDS), Woods & Poole Economics, Inc., 2017.

¹⁶ U.S. Department of Agriculture Economic Research Service, https://www.ers.usda.gov/

1 3.3.1 Passenger Forecast Assumptions

The next three sections describe the different assumptions used to create the Base, High, and Low forecasts. Although the Base Case is that used for the majority of EIS analyses, it is important to have High and Low cases in order to test the range of possible outcomes.

5 **3.3.1.1 Base Case**

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The following assumptions were made in creating the passenger forecast:

- The United States economy as well as Charlotte's local economy will experience moderate and steady growth between 2016 and 2035 in line with current forecasts;
 - No large demand shock, such as terrorism or war, will significantly affect demand for air travel in the U.S.;
- > No significant change in airfares from Charlotte will dramatically affect demand for air travel;
- No large change in jet fuel prices will dramatically affect the airlines' ability to serve Charlotte's
 from their respective bases;
- 14> The U.S. air traffic control system will be able to absorb incremental capacity throughout the15forecast period;
- 16 The airport's facilities will not constrain demand; and,
- CLT's share of the U.S. industry domestic connects is forecast to decline from 1.9 percent to 1.7
 percent while the share of international connections declines from 1.5 percent to 1.1 percent.
 This is an industry trend that reflects greater passenger volumes flying on a nonstop itinerary to
 reach their destination. Even though the CLT share of connecting passengers is declining, the
 actual volume of connecting passengers will increase.

22 3.3.1.2 High Case

In order to test the outer limit of the passenger forecast, a High Case was created. The following
 assumptions were made regarding the high forecast scenario for CLT:

- In an iterative process, O&D adjustments upward were made to the underlying independent variables in the regression analysis, i.e., economic growth rates forecast by Woods & Poole¹⁷
 and the U.S. Department of Agriculture Economic Research Service. The revised economic growth rates will drive changes to O&D passengers. In the High Case, the GDP growth rate increased by 0.1 percentage points.
- 30 > Connecting adjustments upward were made on the share of U.S. passenger growth that CLT
 31 connecting traffic represents. In the High Case, connecting shares of 1.9 percent for domestic,
 32 and 1.5 percent for international are held constant through the forecast period.

However, after review of the output, it was determined that a larger adjustment to the O&D forecast was necessary to reflect a more meaningful change in the underlying conditions. The GDP growth rate was then increased by +0.5 percentage points per annum throughout the forecast period. No change was made to initial assumptions for the connecting passenger forecast.

5 **3.3.1.3 Low Case**

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In order to test the lower limit of the passenger forecast, a Low Case was created. The following assumptions were made regarding the Low Case for CLT:

- > In the Low Case, the GDP growth rated was decreased by -0.1 percentage points per annum.
- > Connecting shares were decreased from 1.9 percent to 1.6 percent for domestic, and 1.5 percent to 1.0 percent for international over the forecast period.
- Similar to the high forecast, the results of the low forecast scenario were further analyzed and it was determined that an additional adjustment to the O&D passenger forecast was required. The GDP growth rate was adjusted to reflect a -0.5 percentage point change per year throughout the forecast period.
- A high/low variance range of 20-25 percent was assumed when reviewing the outputs of the scenarios above.

17 3.3.2 Annual Passenger Forecasts

18 For 2017, the number of enplaned/deplaned passengers is expected to increase 2.4 percent from 19 2016, which reflects anticipated seat capacity growth shown in the 2017 schedule data and the year-to-date passenger figures as of April 2017. Based on the methodology and assumptions 20 described above, the average growth rate is forecast to average 2.4 percent per annum between 21 22 2016 and 2020 (figures below Table 3-1). In the longer run, between 2016 and 2035, total 23 enplanements will increase at 1.8 percent per annum. Yearly passengers at Charlotte will reach 24 approximately 62.6 million by 2035, compared to 44.4 million in 2016. The resulting passenger 25 forecasts are presented in Table 3-1, Table 3-2, and Table 3-3 below.

Year	Domestic O&D	Int'l O&D	Connecting	Total
2005	6,762,157	899,855	20,544,040	28,206,052
2010	8,613,655	1,091,525	28,549,027	38,254,207
2011	8,752,758	1,193,081	29,097,869	39,043,708
2012	9,107,012	1,217,000	30,904,360	41,228,372
2013	9,513,203	1,266,955	32,676,733	43,456,891
2014	9,718,241	1,248,403	33,309,205	44,275,849
2015	10,353,573	1,343,355	33,173,903	44,870,831
2016	11,162,763	1,393,853	31,865,406	44,422,022
2017	11,547,629	1,491,064	32,454,311	45,493,004
2020	12,686,885	1,761,671	34,343,300	48,791,856
2025	14,615,653	2,285,876	36,120,282	53,021,811
2030	16,524,455	2,903,787	38,265,291	57,693,533
2035	18,378,400	3,621,209	40,604,915	62,604,524

Passenger Forecast – Base Case Table 3-1

Compound Annual Growth Rates (CAGRs)

•				
2005 – 2010	5.0%	3.9%	6.8%	6.3%
2010 – 2015	3.7%	4.2%	3.0%	3.2%
2016 – 2020	3.3%	6.0%	1.9%	2.4%
2020 – 2025	2.9%	5.3%	1.0%	1.7%
2025 – 2030	2.5%	4.9%	1.2%	1.7%
2030 – 2035	2.1%	4.5%	1.2%	1.6%
2016 – 2035	2.7%	5.2%	1.3%	1.8%

Source: Airport Statistics data for historical; U.S. DOT T100; InterVISTAS analysis for forecasts. Note: Data is reflected in calendar years

Passenger Forecast – High Case Table 3-2

Year	Domestic O&D	Int'l O&D	Connecting	Total
2005	6,762,157	899,855	20,544,040	28,206,052
2010	8,613,655	1,091,525	28,549,027	38,254,207
2011	8,752,758	1,193,081	29,097,869	39,043,708
2012	9,107,012	1,217,000	30,904,360	41,228,372
2013	9,513,203	1,266,955	32,676,733	43,456,891
2014	9,718,241	1,248,403	33,309,205	44,275,849
2015	10,353,573	1,343,355	33,173,903	44,870,831
2016	11,162,763	1,393,853	31,865,406	44,422,022
2017	11,612,917	1,506,527	32,616,771	45,736,215
2020	12,970,619	1,836,321	35,048,853	49,855,794
2025	15,335,467	2,508,638	37,877,975	55,722,080
2030	17,760,411	3,351,055	41,311,086	62,422,552
2035	20,196,602	4,387,422	45,223,392	69,807,416
Compound Annual Growth Rates (CAGRs)				

2005 – 2010	5.0%	3.9%	6.8%	6.3%
2010 – 2015	3.7%	4.2%	3.0%	3.2%
2016 – 2020	3.8%	7.1%	2.4%	2.9%
2020 – 2025	3.4%	6.4%	1.6%	2.2%
2025 – 2030	3.0%	6.0%	1.8%	2.3%
2030 – 2035	2.6%	5.5%	1.8%	2.3%
2016 – 2035	3.2%	6.2%	1.9%	2.4%

Source:Airport Statistics data for historical; U.S. DOT T100; InterVISTAS analysis for forecasts.Note:Data is reflected in calendar years

Year	Domestic O&D	Int'l O&D	Connecting	Total
2005	6,762,157	899,855	20,544,040	28,206,052
2010	8,613,655	1,091,525	28,549,027	38,254,207
2011	8,752,758	1,193,081	29,097,869	39,043,708
2012	9,107,012	1,217,000	30,904,360	41,228,372
2013	9,513,203	1,266,955	32,676,733	43,456,891
2014	9,718,241	1,248,403	33,309,205	44,275,849
2015	10,353,573	1,343,355	33,173,903	44,870,831
2016	11,162,763	1,393,853	31,865,406	44,422,022
2017	11,482,340	1,475,601	32,319,802	45,277,743
2020	12,407,831	1,689,593	33,762,591	47,860,015
2025	13,926,024	2,082,707	34,695,996	50,704,728
2030	15,368,749	2,517,566	35,829,682	53,715,997
2035	16,715,958	2,993,229	36,958,319	56,667,506
Compound Annual Growth Rates (CAGRs)				
2005 – 2010	5.0%	3.9%	6.8%	6.3%
2010 – 2015	3.7%	4.2%	3.0%	3.2%
2016 – 2020	2.7%	4.9%	1.5%	1.9%
2020 – 2025	2.3%	4.3%	0.5%	1.2%
2025 – 2030	2.0%	3.9%	0.6%	1.2%
2030 – 2035	1.7%	3.5%	0.6%	1.1%

Table 3-3 **Passenger Forecast – Low Case**

compound Anne	an Growth Rates	CAGR3)		
2005 – 2010	5.0%	3.9%	6.8%	6.3%
2010 – 2015	3.7%	4.2%	3.0%	3.2%
2016 – 2020	2.7%	4.9%	1.5%	1.9%
2020 – 2025	2.3%	4.3%	0.5%	1.2%
2025 – 2030	2.0%	3.9%	0.6%	1.2%
2030 – 2035	1.7%	3.5%	0.6%	1.1%
2016 – 2035	2.1%	4.1%	0.8%	1.3%

Source: Airport Statistics data for historical; U.S. DOT T100; InterVISTAS analysis for forecasts. Note: Data is reflected in calendar years

The figure below (Figure 3-1) reflects the high and low growth scenarios compared to the base case. Forecasted enplanements for the high case are 12 percent above the base case, reaching 33.8 million enplanements in 2035. As for the low scenario, enplanements are projected to be 28.3 million, nine percent below the base case scenario. The variance for the revised high/low forecast is 23 percent.



Figure 3-1 Enplanements Forecast – Base, High, Low Cases

Source: CLT statistics data for historical; U.S. DOT T100; InterVISTAS analysis for forecasts.

3.3.3 Comparative Enplaned Passenger Forecasts

Forecasts that are part of an EIS are required to be approved by the FAA. The FAA "must ensure that the forecast is based on reasonable planning assumptions, uses current data, and is developed using appropriate forecast methods."¹⁸ In addition, forecasts must be deemed to be consistent with the FAA's Terminal Area Forecast (TAF). The TAF is an annual forecast of passengers and aircraft operations produced by the FAA for all existing airports in the National Plan of Integrated Airport Systems¹⁹. The comparison shown below (**Figure 3-2**) shows the most recent version of the TAF, which uses FY 2016 as the base year and provides forecasts for FY 2017-2045. In addition to its baseline forecast, the TAF also shows optimistic and pessimistic scenarios. In order to be approved, this EIS forecast must fall within a defined, acceptable range of the baseline TAF forecast: ± 10 percent in the five-year forecast period and ± 15 percent in the 10-year forecast period.

As shown in the table below **(Table 3-4**), the EIS passenger forecast matches closely with the FAA TAF for the future forecast years.²⁰ The EIS forecast is 0.5 percent below the TAF base forecast by 2035, which is within the TAF consistency requirements required by the FAA. This forecast technical memorandum is accompanied by a letter to the FAA requesting approval for its use in this EIS process.

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¹⁸ FAA, Approval of Local Forecasts, 2008, page 1.

¹⁹ CLT is a large hub airport.

²⁰ The TAF forecast has been converted into calendar years for comparison purposes. Calendar year figures were determined by assuming 75 percent of operations in the base fiscal year and 25 percent of operations in the following fiscal year (i.e., for CY 2016: 75 percent of FY 2016 and 25 percent of FY 2017).



Figure 3-2 Historical and Forecast Enplaned Passengers – EIS, TAF and ACEP

Source: Airport statistics data for historical; U.S. DOT T100 data; InterVISTAS analysis for forecasts. FAA TAF: https://www.faa.gov/data_research/aviation/taf/ CLT Master Plan Update: Phase 1, Airport Capacity Enhancement Plan

Note: The forecast in the ACEP ends in 2033

Table 3-4 Historical and Forecast Enplaned Passengers Compound Average Growth Rates – EIS, TAF, and ACEP

Period	EIS	TAF	ACEP
2010 – 2016	2.5%	3.1%	4.2%
2016 – 2020	2.4%	2.1%	3.5%
2020 – 2025	1.7%	2.0%	3.4%
2025 – 2030	1.7%	1.9%	3.3%
2030 – 2035	1.6%	1.8%	3.3%
2016 – 2035	1.8%	1.9%	3.5%
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Source: Airport statistics data for historical; U.S. DOT T100; InterVISTAS analysis for forecasts. FAA TAF: https://www.faa.gov/data_research/aviation/taf/

CLT Master Plan Update: Phase 1, Airport Capacity Enhancement Plan

Note: ACEP Growth Rates are for 2030-2033, and 2013-2033

Note: Comparison is made between the baseline EIS and TAF forecasts.

The graph (**Figure 3-2**) and table (**Table 3-4**) above, also show a comparison of the EIS forecast to that in the ACEP. When compared to the enplanement forecast in the ACEP, both the EIS and TAF forecasts are 29.3 percent and 29.2 percent below the ACEP in 2033, respectively. The ACEP forecast used 2013 as a base year, while 2016 is the base year in the EIS forecast, and has overestimated enplanements in 2016 by over 2 million passengers.

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1		Since the ACEP forecast was completed, several of the assumptions used in the forecast have changed.
2 3 4 5 6		> At the time the ACEP forecast was created, the merger of American Airlines and US Airways had only recently been announced. The ACEP forecast assumed that the merger "is not expected to negatively affect passenger growth at CLT." ²¹ While the merger has not negatively affected passenger traffic at CLT as of yet, American Airlines has altered the role of CLT in its network, specifically in international routes.
7 8 9 10 11 12		> The ACEP assumed that "Growth in the Latin American economies will be the primary driver of continued growth in international air travel at CLT." ²² While Charlotte maintained service to the Caribbean, American Airlines shifted international service among its hub and withdrew its service from Charlotte to Sao Paulo and Rio de Janeiro in Brazil, instead relying on its flights from Miami to connect the U.S. to South America. In 2016, Charlotte had no flights to South America and American Airlines is not expected to add any in the near future according to the carrier's network planners.
13 14 15 16 17		In addition, the ACEP report states that "Domestic enplanements at CLT increased 4.8 percent annually between 1990 and 2013This was primarily driven by domestic connections" ²³ However, since the ACEP forecast was completed, domestic O&D passengers continued to grow, while domestic connections have grown more slowly or even decline (-1.1 percent on average per annum from 2013-2016).
18 19 20		> The ACEP "assumed that connecting domestic enplanements would account for 75.0 percent of the total domestic enplanements throughout the forecast period." ²⁴ Instead, the connecting share of passengers has declined to 71.7 percent in 2016.
21 22		> The ACEP assumed continued high fuel prices; however, fuel prices have plummeted in recent years, changing the economics of airline operations.
23 24		All of these factors/assumptions explain why the ACEP forecast is higher than that of the more recent TAF and EIS forecasts.
25	3.4	Operations
26 27		This section presents the methodology and results for projected aircraft operations at CLT for the 2017-2035 period.
28	3.4.1	Operations Forecast Assumptions
29		Forecasts of annual commercial passenger aircraft operations are based on forecast passenger
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29Forecasts of annual commercial passenger aircraft operations are based on forecast passenger30traffic demand. Passenger aircraft landings depend on the average aircraft size and average load31factor (i.e., average passenger per flight), as represented by the formula below:

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Passenger Aircraft Operations

= (Passenger Forecasts)/(Avg.Aircraft Size x Avg.Load Factor)

where Avg. Aircraft Size x Avg. Load Factor = Avg. Passengers per Aircraft Movement

- 21 CLT Master Plan Update: Phase 1, Airport Capacity Enhancement Plan
- 22 Ibid.
- 23 Ibid.
- 24 Ibid.

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Forecasts of average load factors were prepared (including marginal growth) and applied to the passenger figures (**Table 3-5**).

Table 3-5 Load Factor Assumptions

Region	2016	2035
Commuter – Domestic	80.2%	81.4%
Air Carrier – Domestic	84.0%	85.0%
Air Carrier – Canada	77.4%	82.0%
Air Carrier – Caribbean, Mexico, Central America	83.8%	85.0%
Air Carrier – South America	80.0%	82.0%
Air Carrier – Trans-Atlantic	75.1%	80.0%
Air Carrier – Trans-Pacific	80.0%	85.0%

Source: InterVISTAS assumptions.

Projections of passenger operations for Base, High and Low Cases were created by applying these load factor assumptions and assumptions regarding aircraft size (discussed in Section 3.4.5 below). Forecasts of annual general aviation and military operations were increased in line with the FAA TAF forecast.

11 3.4.2 Cargo Operations Forecasts

12In 2016, there were 2,696 air cargo operations at CLT, 0.5 percent of total aircraft operations. The13forecast of cargo aircraft operations was based on historical operations and forecast air cargo14tonnage. It was assumed that the proportion of air cargo that would be transported by cargo15aircraft (as opposed to passenger aircraft bellyhold), would remain at 2016 levels throughout the16forecast period. Furthermore, it was assumed that the tonnage per cargo aircraft would remain17constant over the forecast period.

18 **3.4.3 Annual Operations Forecasts**

19The resulting base case operations forecasts are presented in **Table 3-6** below. Air carrier aircraft20movements are forecast to increase by an average of 1.4 percent per annum, compared with21passenger growth of 1.8 percent per annum (the lower growth due to rising load factors and the22number of passengers per aircraft). Total operations for the base case forecasted are projected to23grow at an average annual rate of 1.2 percent.

Year	Air Carrier	Air Taxi	GA	Military	Total
2010	331,110	171,836	24,414	1,741	529,101
2011	329,680	184,122	24,131	1,909	539,842
2012	343,121	183,870	23,400	1,702	552,093
2013	356,079	175,051	25,426	1,392	557,948
2014	361,273	156,188	26,321	1,396	545,178
2015	363,667	152,215	25,639	2,423	543,944
2016	400,819	117,378	24,869	2,676	545,742
2017	409,357	118,994	24,935	2,676	555,962
2020	431,503	122,231	25,083	2,676	581,494
2025	464,250	127,137	25,335	2,676	619,399
2030	494,758	130,959	25,588	2,676	653,981
2035	526,759	135,135	25,845	2,676	690,415
Compound Annual Growth Rates					

Operations Forecast – Base Case – Charlotte Douglas International Airport Table 3-6

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2010 – 2015	1.9%	-2.4%	1.0%	6.8%	0.6%
2016 – 2020	1.9%	1.0%	0.2%	0.0%	1.6%
2020 – 2025	1.5%	0.8%	0.2%	0.0%	1.3%
2025 – 2030	1.3%	0.6%	0.2%	0.0%	1.1%
2030 – 2035	1.3%	0.6%	0.2%	0.0%	1.1%
2016 – 2035	1.4%	0.7%	0.2%	0.0%	1.2%

Source: Airport Statistics data for historical; U.S. DOT T100; InterVISTAS analysis for forecasts.

Note: Data is reflected in calendar years.

Note: The forecast does not reallocate air taxi operations to air carrier as the seating capacity increases; therefore, the average aircraft size (seats) for air taxi goes above 60 seats.

Year	Air Carrier	Air Taxi	GA	Military	Total
2010	331,110	171,836	24,414	1,741	529,101
2011	329,680	184,122	24,131	1,909	539,842
2012	343,121	183,870	23,400	1,702	552,093
2013	356,079	175,051	25,426	1,392	557,948
2014	361,273	156,188	26,321	1,396	545,178
2015	363,667	152,215	25,639	2,423	543,944
2016	400,819	117,378	24,869	2,676	545,742
2017	411,504	119,523	24,935	2,676	558,638
2020	440,726	124,439	25,083	2,676	592,925
2025	483,014	129,731	25,335	2,676	640,757
2030	531,968	138,249	25,588	2,676	698,481
2035	585,654	147,635	25,845	2,676	761,810
	anual Crowth Datas				

Table 3-7 Operations Forecast – High Case – Charlotte Douglas International Airport

Compound Annual Growth Rates

2010 – 2015	1.9%	-2.4%	1.0%	6.8%	0.6%
2016 – 2020	2.4%	1.5%	0.2%	0.0%	2.1%
2020 – 2025	1.8%	0.8%	0.2%	0.0%	1.6%
2025 – 2030	1.9%	1.3%	0.2%	0.0%	1.7%
2030 – 2035	1.9%	1.3%	0.2%	0.0%	1.8%
2016 – 2035	2.0%	1.2%	0.2%	0.0%	1.8%

Source: Airport Statistics data for historical; U.S. DOT T100; InterVISTAS analysis for forecasts.

Note: Data is reflected in calendar years

Note: The forecast does not reallocate air taxi operations to air carrier as the seating capacity increases; therefore, the average aircraft size (seats) for air taxi goes above 60 seats.

Year	Air Carrier	Air Taxi	GA	Military	Total
2010	331,110	171,836	24,414	1,741	529,101
2011	329,680	184,122	24,131	1,909	539,842
2012	343,121	183,870	23,400	1,702	552,093
2013	356,079	175,051	25,426	1,392	557,948
2014	361,273	156,188	26,321	1,396	545,178
2015	363,667	152,215	25,639	2,423	543,944
2016	400,819	117,378	24,869	2,676	545,742
2017	407,441	118,506	24,935	2,676	553,557
2020	423,357	120,210	25,083	2,676	571,326
2025	440,261	119,856	25,335	2,676	588,129
2030	459,150	121,963	25,588	2,676	609,377
2035	477,630	124,175	25,845	2,676	630,326

Table 3-8 Operations Forecast – Low Case – Charlotte Douglas International Airport

Compound Annual Growth Rates

2010 – 2015	1.9%	-2.4%	1.0%	6.8%	0.6%
2016 – 2020	1.4%	0.6%	0.2%	0.0%	1.2%
2020 – 2025	0.8%	-0.1%	0.2%	0.0%	0.6%
2025 – 2030	0.8%	0.3%	0.2%	0.0%	0.7%
2030 – 2035	0.8%	0.4%	0.2%	0.0%	0.7%
2016 – 2035	0.9%	0.3%	0.2%	0.0%	0.8%

Source: Airport Statistics data for historical; U.S. DOT T100; InterVISTAS analysis for forecasts.

Note: Data is reflected in calendar years

Note: The forecast does not reallocate air taxi operations to air carrier as the seating capacity increases; therefore, the average aircraft size (seats) for air taxi goes above 60 seats.

In the high growth scenario, total aircraft operations at Charlotte Douglas International will reach over 761,800 operations, with an average annual growth rate of 1.8 percent through 2035 (**Figure 3-3** and **Table 3-7**). While a period of low growth is projected to reach 630,300 operations in 2035 with an average annual growth rate of 0.8 percent (**Table 3-8**).



Figure 3-3 Operations Forecast – Base, High, Low Cases – Charlotte Douglas International Airport

Source: Airport Statistics data for historical; U.S. DOT T100; InterVISTAS analysis for forecasts.

3.4.4 Comparative Operations Forecasts

The chart (**Figure 3-4**) and table (**Table 3-9**) below provide a comparison with the FAA TAF forecasts and the ACEP forecasts. The EIS forecast is lower than the baseline FAA forecast, with forecast volumes in 2033 being 9.1 percent below that of the TAF, and 27.4 percent below the ACEP forecast in 2033.²⁵

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25 The ACEP forecast extended to 2033 only.





CLT Master Plan Update: Phase 1, Airport Capacity Enhancement Plan

					EIS vs.	EIS vs.
	Year	EIS	FAA TAF	ACEP	TAF	ACEP
Passenger Enplanem	ents					
Base Year	2016	22,173,747	21,900,456	24,408,300	1.2%	-9.2%
Base Year + 1	2017	22,746,502	22,231,446	25,266,400	2.3%	-10.0%
Build Year	2028	27,893,348	27,735,137	36,449,000	0.6%	-23.5%
Build Year + 5	2033	30,298,324	30,353,627	42,865,500	-0.2%	-29.3%
Commercial Operation	ons					
Base Year	2016	518,197	521,304	579,260	-0.6%	-10.5%
Base Year + 1	2017	528,351	532,647	594,800	-0.8%	-11.2%
Build Year	2028	611,620	655,739	783,220	-6.7%	-21.9%
Build Year + 5	2033	647,224	714,678	886,260	-9.4%	-27.0%
Total Operations						
Base Year	2016	545,742	548,653	616,400	-0.5%	-11.5%
Base Year + 1	2017	555,962	560,057	632,300	-0.7%	-12.1%
Build Year	2028	639,783	683,696	824,740	-6.4%	-22.4%
Build Year + 5	2033	675,643	742,889	930,080	-9.1%	-27.4%

Table 3-9 Historical and Forecast Operations– EIS, TAF and ACEP

Source: Airport statistics data for historical; U.S. DOT T100 data; InterVISTAS analysis for forecasts.

FAA TAF: https://www.faa.gov/data_research/aviation/taf/

CLT Master Plan Update: Phase 1, Airport Capacity Enhancement Plan

Note: A version of this table with Base Year +5,10,15 years is shown in the Appendix.

Note: Comparison is made between the baseline EIS and TAF forecasts.

3.4.5 Aircraft Fleet Mix

One of the other major assumptions required to convert the passenger forecast into aircraft operations is the average aircraft size, which includes assumptions regarding how the fleet of aircraft using CLT will change in the future. Forecasts of average aircraft size were prepared and applied, pointing to a trend of larger aircraft. In particular, the fleet orders of American Airlines which include large orders for the Airbus A321neo (starting in 2019) and the Boeing B737Max8 (starting in 2021), were included. The addition of these aircraft are expected to increase the average aircraft size at CLT (confirmed in interviews with American Airlines).

- Average Aircraft Size (Seats per Departure) Assumptions:
- Commuter commuter aircraft, including large and small regional jets, are assumed to increase from 59 seats in 2016 to 62 seats in 2022 and 64 seats by 2035. This increase assumes network carriers will continue retiring smaller regional jets and replace them with more efficient larger regional jets.
- Domestic seats per aircraft increase from 142 in 2016 to 145 in 2022 and 148 by 2035, as airlines
 upgauge; e.g., moving some operations from A319 to A320, and from A320 to A321Neo, etc.
- 22 > Canada seats per departure to Canada decreased following the 2008-2010 financial crisis.
 23 However, seats per departure have stabilized since 2013. Average seats are forecast to increase
 24 gradually from 62 seats in 2016 to 64 in 2022 and 67 in 2035.

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1 2		 Caribbean, Mexico, South America – seats per departures has stayed relatively flat for this region at 159 seats - assumed to be 162 seats by 2022 and 166 seats by 2035.
3 4		South America – US Airways previously serviced Brazil from 2009-2015, with average seats per departure of 204 in 2015. Service is assumed to resume by 2020, operating with 209 seats.
5		> Trans-Atlantic – seats per departures are projected to increase from 261 seats in 2016 to 265 in 2035.
6		> Trans-Pacific – does not currently have service, assumed this would remain the case through 2035
7	3.5	Cargo
8 9		This section presents the methodology and forecast results for cargo tonnage at CLT for the 2017-2035 period.
10	3.5.1	Cargo Forecast Assumptions
11		Cargo forecasts were prepared for Base, High and Low Cases, with differing assumptions for each
12		case. The cargo growth forecast is based on expert judgement.
13	3.5.1.1	Base Case
14		The continuation of activity is expected to spur growth in the short term, averaging 6 percent per
15		annum up to 2019. After that, cargo activity growth at the airport is expected to taper off in the
10		to support its growing fleet of Prime Air cargo planes. Cargo growth after 2020 is projected to
18		range from 2-3 percent per annum in line with historical levels. While the Department does not
19		currently have plans to expand its cargo facilities, the Department recently completed an expansion
20		of the cargo ramp, providing 12,000 square yards of additional space. Airport facilities are assumed
21		to accommodate future cargo activity levels.
22		The following assumptions were made concerning the cargo forecast at Charlotte:
23		> The U.S. economy as well as Charlotte's local economy will experience moderate and steady
24		growth between 2016 and 2041;
25		> Rapid growth due to Amazon will slow by 2019;
26		> Key integrated carriers (e.g., FedEx, UPS, etc.) will maintain their services at Charlotte airport;
27 28		 Passenger air carriers would continue to provide cargo services through their belly capacity; regional jets would provide limited cargo capacity
29 30		Long-term (2020-2035) growth is forecast to average 2.4 percent per annum, close to the average between 2011 and 2016 (2.3 percent per annum – see Section 2.5).
31	3.5.1.2	High Case
22		To well at a bight even who according an adjustment of 10 F percentage points upon mode to the accord

32To reflect a high growth scenario, an adjustment of +0.5 percentage points was made to the annual33cargo growth rate.

3.5.1.3 Low Case

For the low growth scenario, it was assumed Amazon growth in the early part of the forecast is curtailed, and an adjustment of -0.5 percentage points was made to the annual cargo growth rate.

3.5.2 Annual Cargo Forecasts

In the Base Case forecast, cargo tonnage is expected to grow an average of 3.0 percent per year reaching 270,215 tons in 2035, compared to 154,477 tons in 2016 (**Figure 3-5**). In the High Case forecast average annual growth increases to 3.5 percent per year, reaching 296,264 tons in 2035. While in the Low Case, cargo is projected to reach 246,346 tons by 2035, with an average annual growth rate of 2.5 percent.



Figure 3-5 Historical and Forecast Cargo Tonnage – Base, High, Low Cases – Charlotte Douglas International Airport

Source: Airport Statistics data for historical; U.S. DOT T100; InterVISTAS analysis for forecasts.

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3.6 Conclusion

The forecasts presented in this technical memorandum will be used as an input into several subsequent analyses in the EIS. The Base Case forecast serves as the most likely future demand scenario given no constraints on traffic growth at the Airport; the High and Low Cases serve as indicators of how actual demand could vary above/below the Base Case depending on changes in the economic environment or changes in strategic decisions made by American Airlines. The annual forecasts for 2028 (Build Year) and 2033 (Build Year + 5) will be converted into Design Day Schedules including details of individual flights. Such schedules are required to conduct the capacity delay analysis and evaluate delays in airspace, runway usage, taxi-in/out times, and gate

1usage. Simulation of a Design Day Schedule for 2016 (based on current OAG schedules) will2determine the presence and location of existing delays; the schedules for 2028 and 2033 will be3used as inputs to model future delays in the absence of the Project (No Action).

Appendix 1: Additional Data

Domestic O&D Traffic Parameter Estimates (1998-2016)

Variable	Parameter Estimate	T-Statistic
Constant	-22.53	-5.92
Ln (Charlotte GDP)	1.19	10.10
Ln (2001 Dummy)	-0.13	-1.41
Ln (2002 Dummy)	-0.17	-1.83
Adjusted-R ²	0.89	

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Canada O&D Traffic Parameter Estimates – Outbound (1998-2016)

Variable	Parameter Estimate	T-Statistic
Constant	-20.19	-5.09
Ln (Charlotte GDP)	0.97	7.91
Ln (2001 Dummy)	-0.05	-0.48
Ln (2002 Dummy)	0.17	1.72
Adjusted-R ²	0.79	

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Canada O&D Traffic Parameter Estimates – Inbound (1998-2016)

Variable	Parameter Estimate	T-Statistic
Constant	-43.24	-10.38
Ln (Canadian GDP)	1.93	13.00
Ln (2001 Dummy)	-0.07	-0.92
Ln (2002 Dummy)	0.01	0.10
Adjusted-R ²	0.91	

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Caribbean (including Mexico and the Caribbean) O&D Traffic Parameter Estimates – Outbound (1998-2016)

Variable	Parameter Estimate	T-Statistic
Constant	-73.08	-12.37
Ln (Charlotte GDP)	2.64	14.48
Ln (2001 Dummy)	-0.11	-0.78
Ln (2002 Dummy)	-0.03	-0.23
Adjusted-R ²	0.93	

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Variable	Parameter Estimate	T-Statistic
Constant	-87.26	-11.52
Ln (Regional GDP)	3.50	12.93
Ln (2001 Dummy)	-0.27	-1.74
Ln (2002 Dummy)	-0.22	-1.41
Adjusted-R ²	0.92	

Caribbean (including Mexico and the Caribbean) O&D Traffic Parameter Estimates – Inbound (1998-2016)

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South America O&D Traffic Parameter Estimates – Outbound (1998-2016)

Variable	Parameter Estimate	T-Statistic
Constant	-88.11	-8.93
Ln (Charlotte GDP)	3.03	9.94
Ln (Dummy 2001)	-0.01	-0.04
Ln (Dummy 2002)	-0.13	-0.55
Adjusted-R ²	0.87	

South America O&D Traffic Parameter Estimates – Inbound (1998-2016)

Variable	Parameter Estimate	T-Statistic
Constant	-97.56	-12.83
Ln (SAM GDP)	3.67	14.06
Ln (Dummy 2001)	0.10	0.48
Ln (Dummy 2002)	0.01	0.06
Adjusted-R ²	0.93	

Trans-Atlantic O&D Traffic Parameter Estimates – Outbound (1998-2016)

Variable	Parameter Estimate	T-Statistic
Constant	-27.81	-3.97
Ln (Charlotte GDP)	1.24	5.74
Ln (Dummy 2001)	0.08	0.47
Ln (Dummy 2002)	-0.36	-2.11
Adjusted-R ²	0.72	

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Trans-Atlantic O&D Traffic Parameter Estimates – Inbound (1998-2016)

Variable	Parameter Estimate	T-Statistic
Constant	-87.76	-7.27
Ln (EU-28 GDP)	3.27	8.26
Ln (Dummy 2001)	-0.06	-0.44
Ln (Dummy 2002)	-0.40	-2.93
Adjusted-R ²	0.84	

Variable	Parameter Estimate	T-Statistic
Constant	-69.67	-10.26
Ln (Charlotte GDP)	2.49	11.85
Ln (Dummy 2001)	0.06	0.34
Ln (Dummy 2002)	0.00	0.02
Adjusted-R ²	0.90	

Trans-Pacific O&D Traffic Parameter Estimates – Outbound (1998-2016)

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Trans-Pacific O&D Traffic Parameter Estimates – Inbound (1998-2016)

Variable	Parameter Estimate	T-Statistic
Constant	-37.41	-16.85
Ln (Asia GDP)	1.57	21.47
Ln (2001 Dummy)	0.04	0.51
Ln (2002 Dummy)	0.00	-0.04
Adjusted-R ²	0.97	

Historical Values of the Independent Variables

	CLT GRP Real 2009	Canada GDP Real 2010	Caribbean GDP Real 2010	South America GDP Real 2010	Trans- Atlantic GDP Real 2010	Trans- Pacific GDP Real 2010	2001	2002
Year	(\$mns)	(\$bns)	(\$bns)	(\$bns)	(\$bns)	(\$bns)	Dummy	Dummy
1998	79,625	1,211	297	3,742	14,627	9,932	0	0
1999	84,943	1,271	308	3,743	15,050	10,262	0	0
2000	86,498	1,337	318	3,887	15,634	10,741	0	0
2001	89,212	1,359	332	3,920	15,973	11,052	1	0
2002	92,383	1,397	341	3,933	16,178	11,465	0	1
2003	96,233	1,424	351	3,998	16,405	12,012	0	0
2004	102,951	1,469	362	4,245	16,834	12,685	0	0
2005	111,670	1,515	379	4,437	17,191	13,382	0	0
2006	122,351	1,555	399	4,675	17,785	14,223	0	0
2007	128,762	1,586	415	4,937	18,346	15,251	0	0
2008	137,250	1,605	423	5,127	18,456	15,808	0	0
2009	128,097	1,561	419	5,062	17,669	16,128	0	0
2010	116,819	1,614	427	5,354	18,038	17,399	0	0
2011	120,718	1,662	437	5,599	18,350	18,250	0	0
2012	129,882	1,694	446	5,760	18,278	19,140	0	0
2013	126,752	1,728	457	5,918	18,308	20,096	0	0
2014	131,396	1,771	470	5,975	18,547	20,986	0	0
2015	140,388	1,789	483	5,959	18,882	21,922	0	0
2016	144,331	1,829	499	6,013	19,264	22,867	0	0

Source: US Department of Agriculture Economics Research Centre; Woods & Poole 2017

Year	U.S. Domestic Traffic	CLT Share	CLT Domestic Connections
2016	718.7	1.9%	14.0
2017	738.0	1.9%	14.2
2020	791.4	1.9%	15.0
2025	847.6	1.8%	15.7
2030	917.9	1.8%	16.5
2035	998.0	1.7%	17.4
CAGR			
2016 – 2020	2.4%		1.9%
2020 – 2025	1.4%		0.8%
2025 – 2030	1.6%		1.0%
2030 – 2035	1.7%		1.1%
2016 – 2035	1.7%		1.2%
Total Change i	n CLT Share	-10.0%	

Summary of Domestic Connecting Traffic Forecast (millions)

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Summary of International Connecting Traffic Forecast (millions)

	U.S. International		CLT International
Year	Traffic	CLT Share	Connections
2016	102.3	1.5%	1.6
2017	105.2	1.5%	1.6
2020	118.3	1.5%	1.7
2025	142.7	1.4%	1.9
2030	169.9	1.2%	2.1
2035 201.3		1.1%	2.3
CAGR			
2016 – 2020	3.7%		2.3%
2020 – 2025	3.8%		2.4%
2025 – 2030	3.5%		1.9%
2030 – 2035	3.4%		1.7%
2016 – 2035	3.6		2.1%
Total Change in	CLT Share	-25.0%	

1 Summary of Charlotte Douglas International Airport Forecast – FAA Template

	Forecast					Compou	nd Annual	Growth Ra	tes
	Base Year 2016	Base Year+1 2017	Base Year+5 2021	Base Year+10 2026	Base Year+15 2031	Base Year+1 2017	Base Year+5 2021	Base Year+10 2026	Base Year+15 2031
Passenger Enplanemen	ts								
Air Carrier	15,640,736	15,850,803	17,411,598	19,089,474	20,951,150	1.3%	2.2%	2.0%	2.0%
Commuter	6,533,011	6,895,699	7,398,772	7,864,182	8,374,605	5.6%	2.5%	1.9%	1.7%
Total	22,173,747	22,746,502	24,810,370	26,953,656	29,325,755	2.6%	2.3%	2.0%	1.9%
Aircraft Operations									
Air Carrier	400,819	409,357	438,230	469,999	501,066	2.1%	1.8%	1.6%	1.5%
Air Taxi	117,378	118,994	123,291	127,823	131,798	1.4%	1.0%	0.9%	0.8%
Subtotal	518,197	528,351	561,520	597,822	632,864	2.0%	1.6%	1.4%	1.3%
General Aviation	24,869	24,935	25,134	25,386	25,639	0.3%	0.2%	0.2%	0.2%
Military	2,676	2,676	2,676	2,676	2,676	0.0%	0.0%	0.0%	0.0%
Total Operations	545,742	555,962	589,330	625,884	661,180	1.9%	1.5%	1.4%	1.3%
Peak Hour Operations	114	116	*	*	*	1.8%			
Cargo/Mail									
Enplaned and Deplaned Tons	154,477	169,152	195,221	224,125	251,111	9.5%	4.8%	3.8%	3.3%
Operational Factors									
Average Aircraft Size (se	ats)								
Air Carrier	144	144	146	147	149	0.0%	0.3%	0.2%	0.2%
Air Taxi	59	59	61	62	63	0.0%	0.7%	0.5%	0.4%
Average Enplaning Load	l Factor								
Air Carrier	83.6%	83.7%	83.9%	84.2%	84.5%				
Air Taxi	80.2%	80.3%	80.7%	81.2%	81.4%				

2 3 4

Source: Airport Statistics data for 2016; InterVISTAS analysis for forecast

Forecast peak hour was only estimated for 2028 (Build Year) and 2033 (Build Year +5). See Table 1-1.

A1-5 Appendix 1: Additional Data

Comparison of EIS and TAF Forecasts – FAA Template

	Year	EIS	FAA TAF	EIS vs TAF
Passenger Enplanements				
Base Year	2016	22,173,747	21,900,456	1.2%
Base Year + 1	2017	22,746,502	22,231,446	2.3%
Base Year + 5	2021	24,810,370	24,283,346	2.2%
Base Year + 10	2026	26,953,656	26,714,161	0.9%
Base Year + 15	2031	29,325,755	29,301,711	0.1%
Commercial Operations				
Base Year	2016	518,197	521,304	-0.6%
Base Year + 1	2017	528,351	532,647	-0.8%
Base Year + 5	2021	561,520	578,313	-2.9%
Base Year + 10	2026	597,822	632,765	-5.5%
Base Year + 15	2031	632,864	691,018	-8.4%
Total Operations				
Base Year	2016	545,742	548,653	-0.5%
Base Year + 1	2017	555,962	560,057	-0.7%
Base Year + 5	2021	589,330	605,921	-2.7%
Base Year + 10	2026	625,884	660,623	-5.3%
Base Year + 15	2031	661,180	719,127	-8.1%

Source: Airport statistics data for historical; U.S. DOT T100 data; InterVISTAS analysis for forecasts. FAA TAF: https://www.faa.gov/data_research/aviation/taf/

Note: TAF has been converted to Calendar Years for comparison.

Capacity/Delay Analysis and Airfield Modeling Technical Memorandum

Charlotte Douglas International Airport Environmental Impact Statement

PREPARED FOR

FEDERAL AVIATION ADMINISTRATION

Mr. Tommy Dupree Memphis Airport District Office

PREPARED BY



VHB Engineering NC, P.C.

IN ASSOCIATION WITH



TransSolutions

7/16/2018

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Summary of Findings

1.1 Introduction

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A comprehensive development program (Airport Capital Enhancement Plan, or ACEP) was initiated by the City of Charlotte, North Carolina (Aviation Department or the "Department") to address the existing and anticipated demand at Charlotte Douglas International Airport (CLT). A Consultant Team is evaluating the existing planning data and preparing an Environmental Impact Statement (EIS) at the direction of the Federal Aviation Administration (FAA), to satisfy requirements of the National Environmental Policy Act of 1969 (NEPA). TransSolutions, LLC performed the airfield capacity/delay analysis for the Existing Conditions (2016) based on the current airfield and aviation demand in 2016, and a future No-Action alternative based on the current airfield, improvements currently under construction, and forecast demand levels representing 2028 and 2033.

The airfield capacity/delay analysis was performed using ATAC Corporation's SIMMOD Plus!® 13 version 8.1 software, based on the FAA's Airfield and Airspace Simulation Model, SIMMOD. 14 15 Simulations were run for the four predominant operational configurations: South Flow Visual 16 Meteorological Conditions (VMC), South Flow Instrument Meteorological Conditions (IMC), North 17 Flow VMC, and North Flow IMC. As part of the EIS effort, the Consultant Team updated the operations and passenger forecasts that were originally documented in the ACEP in early 2016 to 18 19 reflect the merger of American Airlines and US Airways, as well as current trends. The Existing 20 Conditions traffic demand level (2016) was analyzed along with the two updated forecast demand 21 levels representing 2028 and 2033, years which reflect the construction phasing of the proposed airport improvements that are the subject of the EIS. 22

- 23 This summary provides findings of the following:
- 24 > Peak hour throughput and hourly capacity
- 25 Average aircraft taxi times and arrival airspace delay
- 26 > Average delay per operation
 - Average arrival gate and ramp delays
- 28 > Comparison to the ACEP

29	A description of the modeling methodology is presented in Section 2 and was previously reviewed
30	by the FAA and the Department. Detailed modeling results of each simulation scenario are

presented in Section 3 of this Technical Memorandum. Section 4 provides a brief discussion of the conclusions reached based on the modeling results.

1.2 Peak Hour Throughput and Hourly Capacity

Due to CLT's role as a major hub operation for American Airlines, peak hour demand and capacity are key determinants of the airport system's (airfield, terminal and landside components) ability to operate efficiently, including maintaining proper schedule integrity. American Airlines' hub operation currently each day serves a total of 18 "banks"¹, or periods of time during the day when there is heavy aircraft arrival activity coming into CLT (the hub) followed by periods of heavy departure activity leaving CLT. As shown in **Figure 1-1**, the banks consist of nine departure banks and nine arrival banks.

¹ Airport Capacity Enhancement Plan, Landrum & Brown, February 2016, Page 1-1



Figure 1-1 Hourly Departures and Arrival Demand (2016, 2028 and 2033)

Peak hour throughput is generally defined as the maximum number of aircraft operations that an airfield configuration can accommodate during a specified interval of time when there is a continuous demand for service (i.e., aircraft are always waiting to depart or land). The peak hour throughput is achievable under specific circumstances, but is not a good indication of the capacity that can be sustained for several hours. Thus the 90th percentile is often used as the measure of capacity.²

The simulation results were analyzed to obtain rolling hour airport throughput for individual days (iterations) in each operational configuration using the highest demand level (2033) in the simulation because it will likely have the highest throughput. The maximum hourly throughput for each operational configuration and hourly capacity (90th percentile of maximum throughput) is summarized by arrivals only, departures only and all operations. The average maximum hourly throughput and capacity is also provided based on the annualized average use of each operational configuration (Section 3.5).

Source: TransSolutions, LLC

² According to the Airport Capacity Enhancement Plan (Pg. 6-54), the DORA stakeholder group recommended that all throughput and capacity results from the ACEP simulation modeling analysis be weighted using the 90th percentile methodology, which yields a more conservative and sustainable runway throughput rate than the maximum throughput rate.

	Arrivals		Departures		Total Operations	
Operational Configuration	Maximum Throughput	Capacity	Maximum Throughput	Capacity	Maximum Throughput	Capacity
South VMC	84	72	78	65	141	130
South IMC	74	68	69	66	134	130
North VMC	77	68	78	65	138	131
North IMC	76	68	68	63	137	127
Annualized Average	80	70	76	65	139	130

Table 1-1 **Airport Peak Hour Throughput and Capacity**

Capacity based on the 90th percentile of peak hour throughput for 0700-2200 local time; Annualized average based Note: on annualized average use of each operational configuration (see Section 3.4)

Source: TransSolutions, LLC; Simmod PLUS!

1.3 Average Aircraft Taxi Times and Airspace/Ground Delays

The primary simulation metrics used in an airfield capacity/delay analysis are arrival airspace delay, taxi-in times, and taxi-out times. Arrival airspace delay is measured as the difference in the amount of time an aircraft lands on the runway and the time it would have taken to land on the runway if it were able to move unimpeded through the airspace. In the simulation analyses, most arrival delays at CLT occur when aircraft must maintain required separations and merge onto final approach, and on the airfield while waiting for a gate. While convective or adverse weather is a large source of delay in the National Airspace System (NAS), the modeling done for this project does not account for delays associated with such weather. Arrival taxi-in measures the time from when an aircraft lands on the runway until it taxis into its gate or parking position (including landing roll time on the runway, taxi time, and any taxiway or ramp delays). Taxi-out is associated with departures and measures the time from when an aircraft leaves its gate or parking position until it leaves the runway (including push-back from the gate, taxi time, departure queue wait time, and runway takeoff roll time).

19 The modeling results for arrival airspace delays and taxi-in times, and departure taxi-out times of 20 each operational configuration and the annualized average are provided in Table 1-2. Taxi-in times 21 increase uniformly from 2016 to 2033 in each operational configuration due to increased demand. 22 Airspace delays increase more rapidly in the South Flow IMC and the two North Flow operational configurations. Departure taxi-out times increase in the South Flow and North Flow IMC 23 24 operational configurations due to increased demand, resulting in ramp and taxiway congestion.

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		Arri	val	Departure
Operational Configuration	Year	Average Airspace Delay	Average Taxi-In Time	Average Taxi-Out Time
South Flow VMC	2016	2.2	10.3	13.6
	2028	3.3	12.8	13.4
	2033	4.5	15.4	14.8
South Flow IMC	2016	4.3	12.4	17.7
	2028	7.3	15.2	17.9
	2033	12.6	15.4	23.4
North Flow VMC	2016	3.8	10.2	14.8
	2028	7.8	13.9	14.6
	2033	10.9	14.9	15.4
North Flow IMC	2016	3.9	11.1	18.6
	2028	8.6	12.3	23.2
	2033	12.0	12.5	26.6
Annualized	2016	3.2	10.6	15.0
Average	2028	5.8	13.4	15.3
	2033	8.3	14.9	17.1

Table 1-2 Average Airspace Delay and Taxi Times (in minutes)

Note: Annualized average is based on annualized average use of each operational configuration (see Section 3.4) Source: TransSolutions, LLC; *Simmod PLUS*!

1.4 Average Arrival Gate and Ramp Delays

As noted previously in Section 1.2, demand at CLT is driven by the banking characteristics of the airline hub operations at the airport. Of the 18 daily banks, nine are arrival banks with heavy demand for gates in advance of each departure bank. At CLT, if the ramp is full of waiting aircraft, additional arriving flights will either wait on taxiways or arrival hold pads, which in turn affects arrival taxi-in times. The latter typically initiates a domino effect that results in a rolling increase in delay over time until the next bank begins.

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The simulation model tracked any arrival aircraft that must wait for a gate to become available after landing. **Table 1-3** summarizes 95th percentile ramp delay time (in minutes)³, the total time spent waiting for a gate each day, and the average number of daily flights. With the current (2016) traffic demand, an annualized average of 267 arrivals per day, or 34 percent of all modeled arrivals, must wait for an available gate. By 2028, an average of 472 arrivals per day, or 51 percent of all modeled arrivals, would wait for a gate, and this grows to an average of 575 arrivals per day, or 58 percent of all modeled arrivals by 2033.⁴

Operational Configuration	Year	95 th Percentile Waiting Time for a Gate (minutes)	Total Time Waiting for a Gate Each Day (minutes)	Average Number of Daily Flights that Wait for Gate
South Flow VMC	2016	5.9	470.1	237
	2028	8.0	1093.1	453
	2033	12.7	1862.7	519
South Flow IMC	2016	6.1	424.6	239
	2028	5.4	1095.1	472
	2033	6.7	1202.7	582
North Flow VMC	2016	6.0	636.1	292
	2028	6.4	940.8	453
	2033	5.4	1423.6	562
North Flow IMC	2016	5.6	577.9	260
	2028	6.2	993.6	434
	2033	6.2	1423.7	517
Annualized	2016	5.9	532.7	258
Average	2028	7.0	1033.1	453
	2033	9.0	1602.7	540

Table 1-3 Arrival Aircraft Waiting for Available Gates

Note: Annualized average is based on annualized average use of each operational configuration (see Section 3.4) Source: TransSolutions, LLC; *Simmod PLUS*!

Note that aircraft ramp waiting time increases more substantially in the South Flow VMC operational configuration (when arrival capacity increases due to the use of Runway 23) compared to all other scenarios with only the parallel runways in use. The increase in ramp waiting time is a function of more arrivals getting to the ramp and waiting for a gate due to the increase in runway capacity, which is evidence of an imbalance in airfield capacity and aircraft gate capacity. Also during the South Flow VMC operational configuration, the "hotspot" area near Taxiway F described in Section 1.3 causes gate waiting-related delays.

3 The 95th percentile is a reasonable indication of maximum wait times, without the extreme conditions that occur on rare occasions.

⁴ Percentage of modeled arrivals based on TransSolutions' analysis of Aerobahn© data between January 2015 and April 2017.

1.5 Average Delay per Operation

Average minutes of delay per operation is a general indicator of the capacity of an airfield to meet existing and forecast aviation demand. As noted in Section 1.2, CLT serves as a major hub operation for American Airlines. When average delays per operation reach approximately 4 to 6 minutes, the schedule integrity of a hub operation may not be maintained. Average delay of 10 minutes or more may be considered severe at some airports, and starts to increase exponentially beyond 10 minutes of average aircraft delay.⁵

As listed in **Table 1-4**, the minutes of average delay per operation was 7.4 minutes in 2016, and would increase to 9.1 minutes in 2028 and 12.0 minutes in 2033 with the current airfield facilities and gates (except for the additional Concourse A gates in 2028 and 2033 that are currently under construction). Average minutes of delay per day were 11,725 in 2016, and would increase to 16,854 in 2028 and 23,529 in 2033.

Table 1-4 Annualized Average Delay

Year	Delay per Operation (minutes)	Number of Daily Operations	Minutes of Delay per Day
2016	7.4	1,582	11,725
2028	9.1	1,857	16,854
2033	12.0	1,968	23,529

Source: TransSolutions, LLC; Simmod PLUS!; Aerobahn®, January 2015 – April 2017, analyzed by TransSolutions

1.6 Comparison to ACEP

Table 1-5 lists the annualized average delay per operation in minutes for the existing and future demand levels to show how Existing Conditions (2016) and modeled future No-Action conditions airfield modeling results have changed since the completion of the ACEP. It is important to note that the EIS simulations modeled lower aviation demand levels than the ACEP because of the revised forecast effort⁶, including:

- Two percent fewer aircraft operations in the EIS Existing Conditions (2016) compared to the ACEP Existing Conditions (2013), both in actual operations as well as simulated operations;
- > 13 percent fewer aircraft operations in the EIS first future year (2028) compared to the ACEP first future year (2023); and,

⁵ FAA Airport Benefit-Cost Analysis Guidance, Office of Aviation Policy and Plans, Federal Aviation Administration, December 15, 1999, Pg. 39

Forecast Technical Memorandum, Charlotte Douglas International Airport Environmental Impact Statement, VHB in association with InterVISTAS, November 10, 2017

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18 19 27 percent fewer aircraft operations in the EIS second future year (2033) compared to the ACEP second future year the second future year (2033), and 7.5 percent fewer aircraft operations compared to the ACEP first future year (2023).

As average delay levels per operation approach 10 minutes, increases in demand will increase delay exponentially. Therefore, the modeled ACEP delay results are much greater than the percentage differences in operations when compared to the EIS modeled delay results.

It is also important to note that the ACEP modeling analysis was conducted using an "unconstrained" level of aviation activity. Average delay per operation of 20 minutes represents the highest level of average delay realized in actual practice, even at highly congested airports. At that level growth in operations would be constrained. Therefore, differences between the ACEP and EIS delay modeling results would be much less in reality due to constrained operations because delay would not exceed 20 minutes.

AC	EP	EIS		
Number of Daily Operations	Delay per Operation (minutes)	Number of Daily Operations	Delay per Operation (minutes)	
1,610	8-9	1,582	7.4	
2,127	21-23	1,857	9.1	
2,679	118-143	1,968	12.0	
	AC Number of Daily Operations 1,610 2,127 2,679	ACEPNumber of Daily OperationsDelay per Operation (minutes)1,6108-92,12721-232,679118-143	ACEPElNumber of Daily OperationsDelay per Operation (minutes)Number of Daily Operations1,6108-91,5822,12721-231,8572,679118-1431,968	

Table 1-5 Annualized Average Delay – Comparison to ACEP

In addition to the differences in forecasts of operations, the EIS analysis considered the following items:

> Full implementation of FAA's Charlotte Metroplex Project⁷ (see Section 2.5) to improve airspace efficiency

7 A Metroplex is a geographic airspace area covering several airports, serving major metropolitan areas and a diversity of aviation stakeholders. FAA is focusing on airspace optimization at the Metroplex level, which provides solutions on a

1 2	>	Inclusion of the Concourse A Improvement Project that is currently under construction, resulting in eight more gates in the EIS future No-Action than modeled in the ACEP analysis
3	>	Observed ⁸ or actual data for the following modeling inputs:
4		 Varied final aircraft approach speeds based on weight category (Section 2.8)
5		Take-off and landing roll distances (Section 2.9)
6		Aircraft taxi speeds (Section 2.13)
7		Aircraft push-back times9 (Section 2.14)
8		Flight dependability10 (Section 2.16)
9	>	Assumption that, by Future Year 1, a system/technology will be implemented to eliminate miles-
10		in-trail (MIT) restrictions to/from CLT airspace.
11		

regional scale, rather than focusing on a single airport or set of procedures. The overall goal of FAA's NextGen Metroplex program is to improve the operational efficiency of the airspace serving large airports.

10 Flight dependability is the probability that a flight arrives or departs earlier or later than scheduled.

⁸ On-site observations at CLT Air Traffic Control Tower (ATCT) and interviews with the Air Traffic Manager, including subsequent TRACON personnel, conducted June 14-15, 2017.

⁹ Push-back is the time from when an aircraft leaves the gate to the time when the aircraft starts using its own power.

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Approach/Methodology

This section represents the approach and methodology used for the capacity/delay analysis. The operating assumptions are presented as well as the SIMMOD model calibration.

2.1 Objective

The objective of this analysis is to conduct an airfield capacity-delay analysis to establish an Existing Conditions and future No-Action Baseline at Charlotte Douglas International Airport (CLT) for current and future conditions, respectively. The delay analysis includes delays associated with runway use, airfield, airspace and terminal gates. This analysis does not consider any potential airfield or terminal gate improvements (aside from any that are already under construction) to enhance capacity and/or reduce delay.

2.2 Approach

ATAC Corporation's *SIMMOD Plus*!® version 8.1 was used to model the airspace/airfield operations for this analysis. The baseline in this study includes three demand levels – 2016 (Existing Conditions), 2028 and 2033 (future No-Action). For each of the three demand levels, there were two operational flows (South and North) and two weather conditions (Visual Meteorological Conditions [VMC] and Instrument Meteorological Conditions [IMC]) modeled. This analysis quantifies how the airport performs operationally under current and forecast traffic demand levels.

- Information and assumptions that were used in the SIMMOD models were compiled from previousanalyses and updated requirements including the following.
 - Airport Capacity Enhancement Plan (ACEP) Final Report (February 2016)¹¹ prepared by Landrum & Brown, specifically the following elements:
 - Airside demand/capacity operating assumptions.
 - ACEP Simmod input files.
 - > Aerobahn^{® 12} data provided by CLT for January 2015 through April 2017.

¹¹ Relevant sections of the ACEP "Chapter 3 Airside Demand/Capacity" include the Existing Airport Operating Assumptions.

¹² Aerobahn is a product by Saab Sensis Corporation for tracking aircraft movement. The data captured for each individual flight includes airline, flight number, aircraft type, runway, gate and time-stamps for runway use, gate arrival and gate departure.

1		> On-site observations at CLT Air Traffic Control Tower (ATCT) and interviews with the Air Traffic
2 3		Manager, Traffic Management Coordinators, and subsequent Terminal Radar Approach Control (TRACON) personnel, conducted June 14-15, 2017.
4 5		 Teleconference interview conducted with American Airlines CLT Ramp Tower Operations Manager and personnel on January 29th, 2018.
6 7		 Documents provided by CLT ATCT, such as noise abatement procedures, CLT-specific orders, ramp hand-off spot locations, etc.
8 9 10		 Documents provided by the City of Charlotte, Airport Department (the Department) including Letters of Agreement, terminal gate layouts, CLT Metroplex plans, and FAA Notices to Airmen (NOTAM) records.
11 12		All data, performance goals, runway use configurations, and descriptions of the runway planning are summarized in this chapter.
13	2.3	Runway Flow Usage
14 15		The CLT airfield consists of three parallel runways in the north/south direction (18-36) and a single crosswind runway (5-23), as depicted in Figure 2-1 .
16 17 18		Operational flows at CLT are split between North Flow and South Flow operations depending on prevailing wind conditions. The runway usage configurations during different flows are described below.
19		North Flow:
20		> Primary arrival Runways: 36L and 36R.
21		> Primary departure Runways: 36C and 36R.
22		> Runway 5-23 is typically used as a taxiway.
23		South Flow:
24		> Primary arrival Runways: 18R and 23.
25		> Primary departure Runways: 18C and 18L.
26		> In IMC, Runway 23 is not used.
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Table 2-1 summarizes runway use by operational flows with the primary arrival/departure runways highlighted. These percentages were used in the Existing Conditions and future No-Action baseline scenarios.

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Flow	Runway	Arrivals	Departures	Overall
	5	0.5%	0.9%	0.7%
NI 11	36C	11.9%	57.7%	34.1%
North	36L	51.9%	0.5%	26.9%
	36R	35.7%	40.9%	38.2%
	23	28.2%	0.6%	14.5%
Carath	18C	11.9%	46.6%	29.1%
South	18L	9.6%	52.6%	30.9%
	18R	50.3%	0.2%	25.5%

Table 2-1 Current Runway Usage

Source: Aerobahn®, January 2015 – April 2017, analyzed by TransSolutions.¹³

Figure 2-2 illustrates the runway usage at CLT since January 2015, including all 24 hours of each day. Note that in North Flow:

- The percentage of arrivals on Runway 36L has been steadily increasing as the other runways have reached capacity.
- The percentage of arrivals on Runway 36C has been steadily decreasing as more arrivals land on Runway 36L.
 - > Usage of specific departure runways has remained fairly consistent.

And in South Flow:

- > The percentage of arrivals on Runway 18R has been steadily increasing.
- > The percentage of arrivals on Runway 23 has been steadily decreasing. This is likely due to:
 - Runway 23 arrivals constrain Runway 18C departures with the current Converging Runway Operations (CRO) and Arrival Departure Window (ADW) procedural change that took effect in early 2015.
 - Runway 23 arrivals exit into the commercial ramp area causing additional congestion to the traffic already in that area.
 - During peak departure times, more departure capacity is needed than can be achieved during CRO conditions, whereas the airport then switches to an all parallel runway configuration to

¹³ Data was analyzed for all hours (24), including noise abatement periods (2300-0700 local time).
achieve more efficiency. The Runway 23 arrivals are then assigned to other runways so that departures can be better accommodated on Runway 18C.



1 Figure 2-2 Historical Runway Usage at CLT



South Flow – Departure

3 Source: Aerobahn®, January 2015 – April 2017, analyzed by TransSolutions

Note that a rehabilitation project of Taxiway C occurred in fall 2016, which closed Runway 5-23 for most of August, September, October and half of November. Periodic runway closures occurred throughout the winter. Runway 5-23 was closed all of March 2017 for boring work in the Runway Safety Area (RSA). When the crosswind Runway 23 is not used, arrivals that would typically land on Runway 23 instead land on Runway 18L. At the same time, there is a reduced use of Runway 18L for departures and an increased use of Runway 18C by departures.

Figure 2-3 illustrates the arrival and departure runway configurations for North Flow and South
 Flow.

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1 Figure 2-3 Arrival and Departure Runway Configurations

2.4 Additional Runway Usage Assumptions

The following section outlines the additional runway use assumptions that were used in the modeling effort.

6 2.4.1 Long-Haul Aircraft Operations

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Runway use is mostly assigned by the direction of flight. Using this approach, some heavy and long-haul departures to the West Coast require Runway 18C-36C. More specifically:

- > In North Flow, aircraft will depart Runway 36C with no arrivals on Runway 36C until the arrival peaks require that Runway 36C also be used for arrival traffic.
- In South Flow, aircraft will depart Runway 18C and arrive Runway 18L or 23 until the traffic peaks
 require that Runway 23 arrivals be re-assigned so that Runway 18L is used for arrival traffic with
 three parallel arrival runways.

1	2.4.2	General Aviation and Military Operations
2 3 4		In most circumstances, General Aviation (GA) and military flights primarily land/depart on Runway 18L-36R due to the proximity of their assigned ramps to this runway. In addition, Runway 23 is frequently utilized in South Flow conditions by GA and military arrivals. ¹⁴
5	2.4.3	Cargo Operations
6 7 8		In general, more than 50 percent of cargo flights operate on Runway 18C–36C due to its longer length compared to other runways. Another 25 percent of cargo traffic operates on Runway 18L–36R due to its proximity to the cargo ramps/facilities. ¹⁵
9	2.4.4	Noise Abatement Procedures
10 11 12		Noise abatement procedures are included in the simulation model, based on the FAA Order CLT ATCT 1050.1j, effective December 1, 2013. Noise abatement procedures are in effect from 2300 – 0700, local time. During this time, Runway 5-23 is preferred.
13 14		For noise abatement, jet and large four-engine props aircraft are assigned the following headings until two (2) Nautical Miles (NM) from the departure end of the following runways.
15 16 17		 Runway 18L, 18C, 23 and 5: runway heading. Runway 36R: 025 degrees. Runway 36C: 330 degrees.
18 19		 Runway 36L: 315 degrees. Runway 18R: 200 degrees.
20	2.5	Terminal Radar Approach Control (TRACON) Airspace
21 22		The air traffic control area managing arrivals to and departures from CLT is the TRACON. Simulation functions that direct the movement of aircraft through the airspace are described in this section.
23	2.5.1	Metroplex Airspace
24		A Metroplex is a geographic airspace area covering several airports, serving major metropolitan

A Metroplex is a geographic airspace area covering several airports, serving major metropolitan
 areas and a diversity of aviation stakeholders. Currently, the FAA is focusing on airspace
 optimization at the Metroplex level, which provides solutions on a regional scale, rather than
 focusing on a single airport or set of procedures. The overall goal of FAA's NextGen Metroplex

¹⁴ TransSolutions analysis of Aerobahn® data

¹⁵ TransSolutions analysis of Aerobahn® data

program is to improve the operational efficiency of the National Airspace System (NAS) in serving large airports.

The FAA implemented the Charlotte Metroplex airspace changes in three phases:

- 4 > Phase 1: October 2015.
 - > Phase 2: May 2016.

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14 15 > Phase 3: July 2016.

The Charlotte Metroplex includes CLT as well as Columbia Metropolitan Airport(CAE), Piedmont Triad International Airport (GSO), Greenville-Spartanburg International Airport(GSP), Concord Regional (JQF) Airport, and Raleigh-Durham International Airport (RDU). The Metroplex airspace includes new arrival and departure routings serving CLT as well as procedural improvements that take advantage of some NextGen technological developments. As described in the FAA's Finding of No Significant Impact (FONSI) and Record of Decision (ROD) for the CLT Metroplex, the airspace changes consist of 46 procedures, several of which utilize Area Navigation (RNAV).¹⁶ The airspace changes are described in detail in the FAA's Environmental Assessment (EA) of the Charlotte Metroplex.¹⁷

Figure 2-4 illustrates the Metroplex airspace. The Existing Conditions and future No-Action
 Baseline simulation models include the implemented Metroplex airspace in the SIMMOD model
 based on the latitude-longitude coordinates obtained from FAA National Flight Data Center
 (NFDC). Figure 2-5 depicts the simulated Metroplex airspace in south-flow conditions while
 Figure 2-6 depicts the simulated Metroplex airspace in north-flow conditions. In these figures,
 arrival routes are shown in blue while departure routes are shown in purple.

¹⁶ Finding of No Significant Impact (FONSI) and Record of Decision (ROD) For the Charlotte Optimization of the Airspace and Procedures in the Metroplex (CLT OAPM), FAA, May 19, 2015

¹⁷ Draft Environmental Assessment for Charlotte Optimization of Airspace and Procedures in the Metroplex, FAA, December 2014.

1 Figure 2-4 Metroplex Airspace



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1 Figure 2-5 Simulated Airspace for South-flow

2 Source: TransSolutions SIMMOD model



1 Figure 2-6 Simulated Airspace for North-flow

2 Source: TransSolutions SIMMOD model

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3 2.5.2 Airspace Separations

The airspace modeled in the future No-Action baseline scenarios encompasses the CLT Terminal Radar Control Facility (TRACON), which extends a maximum of 30 nautical miles from CLT. Aircraft separations in the SIMMOD model were maintained in the airspace based on the following:

- > Wake turbulence separation.
 - > Route separation.
 - > Departure separation.

The simulation models calculated the required separation for each of these and then applied the maximum separation between two aircraft. Each of these separations is described below.

1 2.5.2.1 Wake Turbulence Separations

The FAA wake turbulence recategorization (RECAT) separations, summarized in **Table 2-2** below, were applied to the simulation models in the study for aircraft operating directly behind or following another aircraft. Wake turbulence separations are maintained when different category aircraft follow one another. Smaller aircraft following larger aircraft may encounter wake turbulence (vortices generated by an aircraft's wingtip) generated by larger aircraft — creating a potentially hazardous situation. Because of this, additional separation between aircraft may be required for a trailing aircraft to avoid the larger aircraft's wake turbulence. The wake turbulence separation defines the separation between arrivals to the same runways.

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		I railing Aircraft							
		Upper Heavy (A332, B777)	Lower Heavy (B763)	Upper Medium (A320, E190)	Lower Medium (AT72, CRJ9)	Small (GA prop)			
ading Aircraft	Upper Heavy	3.0	4.0	5.0	5.0	7.0			
	Lower Heavy	3.0	3.0	3.5	3.5	6.0			
	Upper Medium	3.0	3.0	3.0	3.0	4.0			
	Lower Medium	3.0	3.0	3.0	3.0	3.0			
Le	Small	3.0	3.0	3.0	3.0	3.0			

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11 Table 2-2 FAA RECAT Specifications (NM)

12 Source: Federal Aviation Administration Order 7110.659A

- 13 2.5.2.2 Route Separations
- 14 The future No-Action Baseline will use the route separations in the ACEP SIMMOD models namely:
- 15 > South VMC and IMC: 3 NM.
- 16 > North VMC and IMC: 2.5 NM.
- 17The route separation defines the minimum distance between flights that are assigned the same18flight path consecutively, one after another.
- 19 **2.5.2.3 Departure Separations**
- 20In the airspace surrounding CLT, consecutive departing aircraft are required to maintain departure21separations for take-off from the same runway. Table 2-3 summarizes the standard aircraft22separations for consecutive departures that were used in the ACEP and were incorporated in the23simulation models. These define the separation between departures from the same runways. In24addition, lateral separation was achieved within the SIMMOD model by ensuring these same25separations are provided between the various aircraft routings.
 - Table 2-3
 Runway Departure Separations (in seconds)

	Lead Aircraft Category						
Trail Aircraft	Heavy	B757	Large	Small			
Heavy	90	120	120	120			
B757	90	90	90	120			
Large	¹ 60/72	¹ 60/72	¹ 60/72	¹ 60/72			
Small	¹ 60/72	¹ 60/72	¹ 60/72	¹ 60/72			

VMC/IMC in-trail separations

Source: ACEP Final Report, Table 3-4, February 2016

To replicate variability in actual air traffic operations, the SIMMOD models will incorporate separation multipliers (both arrivals and departures) which vary the distance between aircraft on the same route. In VMC, the multipliers range from 0.55 to 1.55, which adjust a 3.0 nautical mile (nmi) separation to vary between 1.65 nmi to 4.65 nmi, with an average separation of 3.24 nmi. In IMC, the lowest multiplier is 0.978, which may reduce the 3.0 nmi separation to 2.93 nmi separation.

2.5.3 Enroute Assignments and Metering

Flights are assigned to specific arrival routes based on their originating airport, and are assigned specific departure routes based on their destination airport. A few representative airports along with the assigned arrival and departure route are provided in **Table 2-4**.

Table 2-4 Arrival and Departure Route Assignment Examples

City/Airport	Direction	Arrival Route	Departure Route
Albany, NY (ALB)	NE	CHSLY	KILNS, BARMY
Atlanta, GA (ATL)	WSW	FILPZ	BOBZY
Augusta, GA (AGS)	SSW	BANKR	BEAVY
Boston, MA (BOS)	E	MILLET	BARMY
Buffalo, NY (BUF)	NNE	CHSLY	KILNS, KRITR
Canton/Akron, OH (CAK)	Ν	CHSLY	JOJJO, WEAZL, KRITR
Charleston, SC (CHS)	SSE	STOCR	KWEEN
Columbus, OH (CMH)	NNW	PARQR	WEAZL
Dallas/Fort Worth (DFW)	W	FILPZ	ESTRR, BOBZY
Des Moines, IA (DSM)	WNW	FILPZ	BOBZY
Frankfurt, Germany (FRA)	ENE	CHSLY	BARMY
Houston (IAH)	W	FILPZ	ESTRR, BOBZY
Indianapolis, IN (IND)	NW	PARQR	OIIO
Los Angeles, CA (LAX)	W	FILPZ	ESTRR, BOBZY
Miami, FL (MIA)	S	STOCR, BANKR	KWEEN, ICONS, BEAVY

Myrtle Beach, SC (MYR)	SE	MILLET	LILLS
Mexico City, Mexico (MEX)	SW	JONZE	BEAVY
Nashville, TX (BNA)	W	FILPZ	ESTRR, BOBZY
New York (JFK/LGA)	E	MILLET	BARMY
Philadelphia, PA (PHL)	E	MILLET	BARMY
Washington, DC (DCA)	E	MILLET	BARMY
Wilmington, NC (ILM)	ESE	MILLET	LILLS

Source: Aerobahn, analyzed by TransSolutions

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While flights can get to any route from any runway, typically arrivals at CLT from the west land on Runway 18R-36L, and flights from the east land on Runway 18L-36R or Runway 23. Departures to the west typically depart Runway 18C-36C while departures to the east typically depart Runway 18L-36R. Some logical adjustments were made in the SIMMOD model to the directional assignments in order to coincide with the runway usage noted in Table 2-1.

7 In 2017, CLT began testing the Airspace Technology Demonstration 2 (ATD-2) specifically for departures to the enroute airspace of Washington Air Route Traffic Control Center (ARTCC), or 8 9 Washington Center. Previously, departures to the northeast over the BARMY and KILNS fixes often 10 had a miles-in-trail (MIT) restriction to handoff from the CLT airspace to Washington Center. With 11 ATD-2, the flights going into Washington Center are assigned a take-off time prior to pushing-back 12 from the gate, thus metering the departures into the airspace. Operating with ATD-2 has eliminated the MIT restrictions except in the event of convective weather. Based on feedback from the FAA 13 14 ATC staff at CLT, it was assumed that ATD-2 or a system/technology providing a similar capability 15 will remain in place at CLT, hence, the baseline simulations for future years did not include MIT 16 separations. Note however that the 2016 baseline simulation assumed a 15-nmi in-trail restriction 17 to routes departing CLT airspace into the Washington Center.

- 18 **2.6 Runway Separations and Dependencies**
- 19 Due to the crossing runway configurations at CLT, certain operations are subject to Converging Runway Operations (CRO) procedures in South Flow as described below. 20 21 Converging Runway Operations (CRO) Arrival Departure Window (ADW) on Runway 23. 22 When arrivals to Runway 23 are within 1.8 NM of landing, departures are blocked from 23 Runway 18C until the arrival aircraft is 0.2 NM beyond the Runway 23 threshold (i.e., after 24 the arriving aircraft crosses over Taxiway D). 25 This configuration operates with 3.0 NM between arrivals to get a Runway 18C departure 26 between each pair of arrivals. When arrivals to Runway 23 are within 2.0 NM of landing, departures are blocked from 27 > 28 Runway18L until the arrival aircraft crosses Runway 18L.

1 2	Due to the runway separation, operations on the parallel runways are independent in both VMC and IMC.
3	> South Flow VMC/IMC: Runways 18R, 18C, and 18L are independent.
4	> North Flow VMC/IMC: Runways 36L, 36C, and 36R are independent.
5	Table 2-5 shows the time between consecutive operations on the same runway observed from the
6	Aerobahn® data from January 2015 to April 2017. Note that this analysis included consecutive
7	operations less than 2.5 minutes, since operations with separations greater than that are likely not
8	during a high demand period. This data provided the basis for the simulation model runway
9	procedures.
10	

Operations	Flow	Runway	5 th Percentile (min)	Avg (min)
		36L	1.1	1.5
	N a set la	36C	1.3	1.8
	North	36R	1.3	1.9
		Overall	1.1	1.6
Arrival - Arrival		23	1.2	1.7
		18L	1.4	1.9
	South	18C	1.3	1.9
		18R	1.1	1.5
		Overall	1.1	1.6
		36L	0.7	1.3
	N	36C	0.7	1.3
	North	36R	0.7	1.5
Deventure Deventure		Overall	0.7	1.4
Departure - Departure		18L	0.6	1.3
	South	18C	0.8	1.4
		18R	0.7	1.4
		Overall	0.6	1.4
		36C	0.4	0.8
	North	36R	0.3	0.5
Aminal Damaster		Overall	0.3	0.6
Arrival - Departure		18C	0.4	0.8
	South	18L	0.5	0.8
		Overall	0.4	0.8
		36C	1.4	1.9
	North	36R	1.3	1.7
Deve entrume Anniu I		Overall	1.3	1.7
Departure - Arrival		18C	1.5	1.9
	South	18L	1.1	1.6
		Overall	1.1	1.7

Table 2-5 Aerobahn® Runway Separation Observations

Source: Aerobahn®, January 2015 – April 2017, analyzed by TransSolutions

1 2.7 Aircraft Final Approach Speed

Aircraft final approach speeds are specified in the ACEP report as 140 knots for all aircraft types. In reference to FAA guidelines, aircraft final approach speeds that will be used in the Existing Conditions and future No-Action Baseline simulation models are summarized in **Table 2-6** below.

Table 2-6 FAA Aircraft Characteristics

SIMMOD Aircraft Category	Avg. Final Approach Speed (knots)	
Upper Heavy ¹	140	
Lower Heavy ²	140	
Upper Medium ³	130	
Lower Medium ⁴	110	
Small ⁵	105	
 ²Includes: A300F, A306, DC10, DC10F ³Includes: 752 ⁴Includes: 319, 320, 321, 32A, 32N, 3N1, 7 CRA, CRJ, DH3, DH8, E70, E75, E ⁵Includes: B350, BE20, BE30, BE40, BE58, CS1, E50P, E55P, EM2, F2TH, F90 LJ60, LR60, P180, PA27, PA34, P 	717, 733, 737, 738, 739, 73G, 73H, 73J, 73W, 71 7W, E90, ER4, ERJ, M88, M90 BE9L, C210, C25A, C25B, C303, C510, C550, C5 00, FA50, G150, G280, GALX, GL5T, GLEX, GLF4 C12, SR22, SW3, SW4, TBM7, TBM8, TBM9	M7, 7M8, 7M9, C130, CR2, CR7, CR9, 60, C56X, C750, CL30, CL35, CL60, , GLF5, GLF6, H25B, J328, LJ35, LJ45,
Aircraft Take-Off and	Landing Roll	
The ACEP take-off distance distri	bution inputs were used as follows.	

- - All other aircraft types: 5,000-6,600 feet.

20The Existing Conditions and future No-Action Baseline simulation uses the take-off rolls observed21in June 2017, and was supplemented by the ACEP inputs when no data were recorded, as shown in22**Table 2-7**. Note that while take-off rolls are required input to the SIMMOD model, this specific23parameter has no significant effect or impact on the SIMMOD model results as the runway24departure separations detailed above in **Table 2-4** primarily control departure operations.

Table 2-7 Take-Off Roll Distances

Туре	Avg. Distance (ft.)			
Turboprop	3,385			
Regional Jets	5,350			
Narrow Body	6,640			

Source: Data collected at CLT, 77 observations recorded June 14-15, 2017.

The Existing Conditions and future No-Action Baseline simulation model landing rolls used runway exit percentages obtained from Aerobahn® data. Note that the analysis of the Aerobahn® data shows a difference in runway exit location designations after January 2016, and the details of the previous data labels are not available. Thus, **Table 2-8** summarizes the runway exit percentages analyzed from Aerobahn® for February 2016 – April 2017, which were used in this study.

North Flow								South Flo	w		
Runway	Exits	T-Prop	RJ	NB	WB	Runway	Exits	T-Prop	RJ	NB	WB
36L	W7	100%	97%	76%	73%	18R	W4	99%	95%	69%	54%
	W8	0%	3%	24%	27%		W3	1%	5%	31%	46%
36C	S	21%	0%	0%	1%	18C	E6	7%	2%	1%	0%
	E6	71%	52%	19%	13%		V4	24%	12%	4%	0%
	V5*	5%	25%	37%	33%		E5	45%	45%	20%	6%
	E8	2%	22%	38%	43%		S	4%	22%	17%	5%
	Ν	0%	1%	5%	5%		E4	19%	19%	56%	83%
	E9	0%	0%	1%	5%		E3	0%	0%	2%	6%
36R	D4	14%	0%	0%	0%	18L	C9	2%	0%	0%	0%
	D5	7%	0%	0%	0%		D7	3%	0%	0%	0%
	R	37%	22%	45%	24%		R	22%	0%	0%	0%
	D6	19%	0%	0%	0%		C8	21%	7%	3%	0%
	C9	1%	4%	6%	11%		D5	32%	0%	0%	0%
	А	5%	8%	19%	15%		C7	1%	2%	2%	0%
	М	0%	2%	27%	29%		D4	5%	0%	0%	0%
	C10	13%	57%	3%	18%		C6	5%	61%	42%	28%
	C11	1%	3%	1%	1%		C5	0%	12%	13%	12%
	С	2%	4%	0%	0%		D3	9%	0%	0%	0%
							C4	0%	16%	37%	58%
							C3	0%	0%	1%	2%
						23	С	3%	0%	0%	0%
							R	6%	0%	0%	0%
							G	6%	0%	0%	0%
							В	52%	46%	29%	12%
							A4	28%	0%	0%	15%
							M2	0%	5%	3%	1%
							F	5%	48%	68%	72%

Table 2-8 Runway Exit Usage by Aircraft Type 1

2 3 4 Source: Aerobahn[®], February 2016 – April 2017.

Note that over 30% of Runway 36C arrivals indicated exiting at Taxiway E7, which is a reverse exit; the SIMMOD model assumed * these arrivals use exit Taxiway V5.

1	2.9	Ramp Areas
2		The current aircraft ramps are divided into four types:
3		> Commercial Passenger.
4		> General Aviation.
5		> Cargo.
6		> Military/Air National Guard.
7 8		The location of each type is shown on the map in Figure 2-5 .

9 Figure 2-5 Aircraft Ramps



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2.10 Ramp Entry and Exit

Figure 2-6 illustrates aircraft entry and exit points at the ramp.

Figure 2-6 Ramp Entry and Exit Points



Source: CLT Air Traffic Control, 2017

Aerobahn[®] data were analyzed to determine the usage of each entry and exit point at the ramp. The data also indicated a change in operations or airfield configuration after January 2016 where certain entry and exit points were no longer used or available. **Table 2-9** summarizes the ramp entry and exit points for the operations from February 2016 to April 2017.

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Ramp _	N	orth	Sc	outh
Entry/Exit	Arrivals	Departures	Arrivals	Departures
8	4%	0%	1%	4%
9	52%	0%	0%	41%
10	2%	0%	0%	2%
11	4%	0%	45%	0%
12	0%	16%	12%	0%
22	0%	6%	20%	0%
27	5%	3%	5%	8%
28	6%	1%	6%	0%
13S,14S,13N,14N	1%	7%	5%	0%
23S,23N	0%	62%	5%	0%
24S,24N	13%	1%	0%	0%
25N,25S	4%	0%	0%	26%
29E,29W	9%	4%	1%	19%
Total	100%	100%	100%	100%

Table 2-9 Ramp Entry and Exit Point Usage

Source: Aerobahn®, February 2016 – April 2017

3 2.11 Airline Gate Assignment

Figure 2-7 shows the current terminal locations, number of gates, and the airlines assigned.

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Source: Charlotte Douglas International Airport

As observed during the Project Team's site visit at the CLT Air Traffic Control tower, a waiting area on the ramp was included in the simulation model in the southwest area of the commercial ramp (south of Concourse A) so that flights can hold there until the assigned gate becomes available. While this is predominantly used by American Airlines, all flights may wait in this area for an available gate.

For the future demand levels, additional remote stands were modeled at Concourse E for American Eagle flights to account for:

- > The heavy traffic and fast turn-around times for American Eagle flights.
- The arrival/departure distribution applied to each flight that varies each flight's simulated times from the scheduled times.
- The new pier currently being constructed at Concourse A (additional eight gates) was included in the SIMMOD model for the future No-Action traffic demands.
- 14 2.12 Aircraft Taxi Speeds

15 16	Aircraft taxi speeds used in the ACEP are summarized in Table 2-10 .
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Table 2-10 ACEP Taxi Speeds

Area of Airfield	Speed (knots)
Outer Perimeter Taxiways (Arrivals)	25 knots
Runway Crossings	10 knots
Ramp Area Taxiways	12 knots
Ramp Area Taxilanes	10 knots
Gate Power-In	5 knots
Source: ACEP Final Report, Table 3-6, February 2016	

The Existing Conditions and future No-Action Baseline used a combination of the ACEP and the onsite observations of taxi speeds collected at CLT on June 14-15, 2017, as shown in **Table 2-11** and illustrated in **Figure 2-8**.

Table 2-11 2017 Taxi Speeds

Area of Airfield	Speed (knots)
Runways	70
Rapid Exit Taxiways (Angled Exits)	32
Perpendicular Runway Exits	15
Taxiways N and S (between Runways 18C-36C and 18R-36L)	20
Taxiways	15
Ramp Areas	10
Runway Crossings	18
Source: Data collected at CLT, 381 observations recorded, June 14-15, 2017	

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Figure 2-8 Different Taxi Speeds in the Airfield

2.13 Aircraft Pushback Times

The pushback time begins when an aircraft starts moving from its gate, and the pushback time ends when the aircraft starts to taxi using its own power. Note that during aircraft pushback, the majority of aircraft parked in adjacent gates are able to pushback independently, However, there are a few areas near the terminal where adjacent aircraft are blocked from pushing back if the pushback paths overlap. In addition, heavy aircraft pushing back from the north side of Concourse D block pushbacks from the southeast side of Concourse E.

The ACEP applied a three (3) minute pushback time to all passenger flights.

- The Existing Conditions and future No-Action Baseline will use the 2017 observed pushback times, shown in **Table 2-12**. The simulation will apply the on-site observed pushback times, as follows.
 - Pushback times vary from 2 to 5.5 minutes, shown in Figure 2-9.
 - The average time is 3.6 minutes, shown in **Table 2-12**.

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Source: TransSolutions analysis, 2017

• The same pushback distribution will be used for all commercial passenger aircraft types as they are not significantly different across different aircraft types.

Table 2-12 Average Pushback Time

Туре	Avg. Times (min)
T-Prop	3.2
RJ	3.8
NB	3.6
Total	3.6

Source: Data collected at CLT, 60 observations recorded, June 14-15, 2017

Figure 2-9 2017 Observed Pushback Times



Source: Data collected at CLT, June 14-15, 2017

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1 2.14 Taxiflows

2 3 4 The Existing Conditions and future No-Action Baseline used both the ACEP and 2017 observed taxiflows, illustrated in **Figure 2-10**.

5 Figure 2-10 North and South Taxi Flows – Integrated ACEP and 2017 Observations



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Source: TransSolutions analysis of ACEP and observations

2.15 Flight Dependability

The probability that a flight arrives/departs earlier or later than scheduled is applied in the SIMMOD model to create a realistic arrival and departure profile. Negative values indicate flights that arrive or their scheduled time, while positive values indicate flights that arrive or depart after their scheduled time.

12Flight dependability varied for both arrivals and departures by 30 minutes (60 minutes in North IMC13configuration) in the ACEP. The Existing Conditions and future No-Action Baseline used the data14analyzed from Aerobahn®, shown in Figure 2-11, since this provided more detailed information.





Source: Aerobahn®, January 2015 - April 2017

2.16 Model Calibration

A necessary step in any simulation analysis is to ensure that the simulation model is an accurate representation of the actual operations. SIMMOD model calibration is accomplished by comparing results of the simulation to actual data for the same traffic demand. Typically, simulation results should be within 10 percent of the actual data for the SIMMOD model to be calibrated.

Calibration was performed for both the North Flow and South Flow models with the 2016 traffic demand in VMC. The simulation model was calibrated to reflect current operational conditions of the following elements:

> 90 percent maximum hourly runway throughput for arrivals and departures.¹⁸

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¹⁸ According to the *Airport Capacity Enhancement Plan* (Pg. 6-54), the DORA stakeholder group recommended that all throughput and capacity results from the ACEP simulation modeling analysis be weighted using the 90th percentile methodology, which yields a more conservative and sustainable runway throughput rate than the maximum throughput rate. In some calibration comparisons, both 90th and 95th percentile are presented to show the complete range of related values.

Hourly airport throughput for arrivals and departures.
 Average arrival taxi-in times.
 Average departure taxi-out times.
 Runway and airport throughput was also calibrated for both North Flow and South Flow in IMC.

Runway and airport throughput was also calibrated for both North Flow and South Flow in IMC. The IMC calibration did not include taxi time comparisons due to the variety of weather conditions at both CLT and other airports in IMC that can affect taxi times.

7 2.16.1 VMC Calibration

The first calibration comparison presented is hourly runway throughput. Aerobahn® data provided by CLT was analyzed for the peak month of May 2016 to obtain the hourly runway throughput on the major arrival and departure runways. The 90th-percentile hourly throughputs from Aerobahn® were compared to the simulation model's 90th-percentile hourly runway throughput. **Table 2-13** summarizes the calibrated major arrival and departure runway throughput of the simulation model in VMC. The simulation model produced runway throughputs within 10 percent of the actual data from Aerobahn®, thus demonstrating that the runway throughput of the simulation model was appropriately calibrated.

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Table 2-13 Hourly Runway Throughput Calibration in VMC

Flow	Operations	Main Runway	Aerobahn®*	Simulation
South	Arrivals	18R	33	33
	Departures	18C	32	31
	Departures	18L	38	35
North	Arrivals	36L	35	32
	Departures	36C	38	37
	Departures	36R	29	28

Analysis of Aerobahn® data, May 2016

In addition, the simulated throughputs for both South- and North-flow operations were compared to the FAA called rates and to the overall hourly traffic counts, analyzed for calendar years 2016 and 2017. The FAA called rates, or facility reported rates, provide an indication of CLT's ability to accommodate that number of hourly flights as the rates are used by FAA in traffic flow and metering. The analysis of ASPM data is presented in **Table 2-14** when the same configuration was operational:

- South: Arriving 18R, 23, 18C and 18L | Departing 18L and 18C
 - > North: Arriving 36L, 36R, and 36C | Departing 36C and 36R

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Note: a variety of called rate values were found in ASPM for a particular runway configuration. The most frequent called rate for each configuration is included in the table. For comparison purposes, the ACEP throughputs are also provided.

		ASPM ¹ Simulation ² A		CEP ³				
	Flow	Operations	Called Rate*	Maximum Operations*	95 th % Operations*	Maximum Operations	95 th % Operations	Peak Hour
	South	Arrivals	92	78	66	77	69	71
		Departures	82	81	70	78	66	73
	North	Arrivals	92	79	67	73	66	72
		Departures	69	82	71	78	67	73
6 7 8 9 10 11	2 Si 3 Ar	mulation single day CEP Table 3-11 on p The FAA's a throughpu [,] 95 th percen	of 2016 bage 3-34 acceptance o t of the simu itiles.	r called arrival ra lated single day	ates are much h is very similar te	igher than actu o the ASPM ho	al hourly count urly counts, esp	s. The hourly ecially for the
12 13 14		Overall, the Table 2-15	e simulated h 6 for the 90 th	ourly airport thr percentile.	oughput for arr	ivals and depa	tures together	is presented in
15		Table 2-15	5 VMC Hou	Irly Throughput	Calibration –	Total Operatio	ons	
			ASPM		Simul	ation		
			90 th %		90 th	י %		
			121		12	21		
			121		11	8		
16 17		Note: Anal	ysis of ASPM da	ata, 2016-2017				
18		Another pr	imary calibra	tion comparison	in VMC is taxi-	in and taxi-out	times. While th	e simulation
19		model prod	duces unimp	eded travel time	s, taxi delays an	nd departure qu	ieue delays, the	only
20		operationa	l statistic for	comparison is th	ne overall taxi ti	mes, which incl	ude all delays e	encountered
21		taxiing bet	ween the gat	te and the runwa	iy. For CLT, the t	taxi times comp	pare favorably, v	within ten

percent of the actual taxi times from Aerobahn®. Table 2-16 summarizes the comparison of the

4 Table 2-14 VMC Hourly Throughput Calibration by Operation Type

Table 2-16 2017 Average Taxi Times

calibrated taxi times of the simulation model in VMC.

		Aerobahn ® ¹	
Flow	Operation	(min)	Simulation (min)
South	Arrival	11.0	10.3
	Departure	12.5	13.6
North	Arrival	10.5	10.2
	Departure	13.7	14.8

Analysis of Aerobahn® data, May 2016

2.16.2 **IMC** Calibration 2

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The IMC calibration includes both hourly runway throughput and overall hourly airport throughput. The runway throughput is obtained from Aerobahn® for the January - August 2016 to obtain the hourly runway throughput on the major arrival and departure runways: arrivals on Runway 18R-36L, and departures on Runways 18C-36C and 18L-36R. Note that additional months were analyzed to obtain adequate amount of IMC hours for comparing to the simulation. The 90th-percentile hourly throughputs from Aerobahn® were compared to the simulation model's 90th-percentile hourly runway throughput in Table 2-17.

Table 2-17 Hourly Runway Throughput Calibration in IMC

Flow	Operations	Main Runway	Aerobahn ^{® 1}	Simulation
South	Arrivals	18R	34	35
	Departures	18C	28	29
	Departures	18L	32	34
North	Arrivals	36L	35	32
	Departures	36C	35	35
	Departures	36R	27	26
1 An	alvsis of Aerobahn® da	ta, January - August 2016		

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Analysis of Aerobahn® data, January - August 2016

The simulated throughputs for both South Flow and North Flow operations IMC were compared to the FAA called rates and to the overall hourly traffic counts, analyzed for calendar years 2016 and 2017. Analysis is presented in Table 2-18 of ASPM data when the same configuration was operational as is being simulated:

- > South: Arriving 18R, 18C and 18L | Departing 18L and 18C
- North: Arriving 36L, 36R, and 36C | Departing 36C and 36R >

20 While several called rate values are found in ASPM for a particular runway configuration, the most 21 frequent called rate for each configuration is presented below. In addition to maximum counts, the 95th percentile is also provided for 0700 – 2200 local time. For comparison purposes, the ACEP 22 23 throughputs are also provided. The hourly throughput of the simulated single day is very similar to

the ASPM hourly counts, especially for the 95th percentiles.

Table 2-18 IMC Hourly Throughput Calibration by Operation Type

			ASPM ¹		Simulation ²		ACEP ³
Flow	Operations	Called Rate*	Maximum Operations*	95 th % Operations*	Maximum Operations	95 th % Operations	Peak Hour
South	Arrivals	75	77	68	74	66	65
	Departures	65	74	64	68	62	68
North	Arrivals	75	76	68	73	66	65
	Departures	65	79	66	68	61	65

1 Analysis of ASPM data, 2016-2017

2 Simulation single day of 2016

3 ACEP Table 3-11 on page 3-34

The simulated hourly airport throughput for arrivals and departures combined is presented in **Table 2-19** for the 90th percentile.

Table 2-19 IMC Hourly Throughput Calibration – Total Operations

	ASPM	Simulation 90 th %	
Flow	90 th %		
South	112	114	
North	114	116	
Note: Analysis	of ASPM data, 2016-2017		

All simulation outputs compared for the 2016 calibration are within 10 to 11 percent of the actual data analyzed from FAA ASPM and Aerobahn for all four runway configurations: South Flow VMC, North Flow VMC, South Flow IMC and North Flow IMC.

1 Simulation Findings 2 3.1 Introduction 3 4 This section documents the findings of the airfield capacity/delay analysis for the Existing Conditions and future No-Action alternatives. This is followed by analysis of the simulation results 5 for the current and anticipated demand for the Environmental Impact Statement (EIS) requirement 6 7 for current and future conditions. The analysis years considered are the 2016 baseline year (Existing 8 Conditions) for which a full year of data is available, 2028 when the project elements will be in 9 place, and 2033, which is five years after the full implementation of the Project. This simulation 10 estimates what the future would be like, without the proposed projects, and will ultimately serve as 11 a comparison to the proposed project alternatives. 12 The primary simulation metrics used in an airfield capacity/delay analysis are the following. > Airfield/Runway throughput: Hourly throughput reports the maximum number of arrivals and 13 14 departures that use the runways in a given hour. Sustainable hourly capacity is the 90th percentile of the maximum hourly throughputs. 15 16 Arrival airspace delay: Delay is measured as the difference in the amount of time an aircraft > 17 actually lands on the runway and the time it would have taken to land on the runway if it were 18 able to move unimpeded through the airspace. The majority of the arrival delay occurs when 19 aircraft must maintain separations and merge onto final approach. Taxi times: 20 > 21 Arrival taxi-in time ("on-to-in") - Taxi-in time measures the time from when the aircraft 22 lands on the runway until it taxies into its gate or ramp. It includes runway landing roll time, 23 airfield taxi time, and any taxiway or ramp delays. 24 Departure taxi-out time ("out-to-off") – Taxi-out time measures the time from when the 25 aircraft departs its gate or ramp until it leaves the runway. It includes the time for push-back 26 from the gate, airfield taxi time, departure queue wait time, and runway takeoff roll time. 27 > Airfield delays: Taxi delay is measured as the difference between the time an aircraft taxis 28 between the runway and gate compared to the time it would have taken if it were able to move 29 unimpeded on its airfield taxiing path. Departure ground delay includes the time in departure 30 queue awaiting clearance to take-off. (Note that this airfield delay measure is included in the

taxi times above.)

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Ramp delays waiting for gates: Ramp delay measures the amount of time an aircraft waits on the airfield for its assigned gate to become available. This indicates that additional gates are required to meet the traffic demand being simulated. (Note that this ramp or gate waiting delay measure is included in the airfield delays above.)

3.2 Existing Conditions and Future No-Action Modeling Analysis

In South Flow operations, arrivals primarily land on Runways 18R and Runway 23, adhering to the Converging Runway Operations (CRO) procedures with the required Arrival-Departure Window (ADW) for departures on Runway 18C. During peak arrival times, more arrival capacity is needed than can actually be achieved during CRO, in this case the Charlotte Douglas International Airport (CLT) air traffic controllers move to an all-parallel runway configuration to achieve more efficiency. The Runway 23 arrivals then are assigned to other runways so that both arrivals and departures can be accommodated on Runway 18C. As the traffic demand grows in the forecast flight schedules, there are limited opportunities to arrive on Runway 23 since the three simultaneous runway procedures are needed more frequently throughout the day. **Table 3-1** summarizes the average South Flow Visual Meteorological Conditions (VMC) airspace delays and taxi times for the current and future demands.

	Arrival		Departure	
Year	Average Airspace Delay	Average Taxi-In Time	Average Ground Delay	Average Taxi-Out Time
2016	2.2	10.3	4.5	13.6
2028	3.3	12.8	4.5	13.4
2033	4.5	15.4	5.4	14.8

Table 3-1 South Flow VMC Average Delay and Taxi Times (in minutes)

Source: TransSolutions, LLC; Simmod PLUS!

21The arrival airspace delay increases by 50 percent from 2016 to 2028 and doubles from 2016 to222033, increasing from 2.2 minutes in 2016 to 4.5 minutes in 2033.

Taxi times increase with higher demand from 2016 to 2033: average taxi-in time increases by
50 percent, while taxi-out time increases by 9 percent.

25 **Figure 3-1** illustrates the average taxi times in hourly increments for South Flow VMC.



Figure 3-1 South Flow VMC Hourly Average Taxi Times





Source: TransSolutions, LLC; Simmod PLUS!

3.2.1 South Flow Instrument Meteorological Conditions (IMC)

During Instrument Meteorological Conditions (IMC) operations, Runway 23 is not used in South Flow. **Table 3-2** summarizes the average South Flow IMC airspace delays and taxi times for the current and future demands.

	Arrival		Departure	
Year	Average Airspace Delay	Average Taxi-In Time	Average Ground Delay	Average Taxi-Out Time
2016	4.3	12.4	8.3	17.7
2028	7.3	15.2	8.6	17.9
2033	12.6	15.4	13.1	23.4

Table 3-2 South Flow IMC Average Delay and Taxi Times (in minutes)

Source: TransSolutions, LLC; Simmod PLUS!

Arrival airspace delay is nearly three times higher in 2033 than in 2016. Average taxi-in time increases by 24 percent and average taxi-out time increases by nearly 32 percent from 2016 to 2033. The average departure ground delays increase 4 percent from 2016 to 2028, and another 52 percent from 2028 to 2033.

Figure 3-2 illustrates the average taxi times in hourly increments for South Flow IMC.



Figure 3-2 South Flow IMC Quarter-Hour Average Taxi Times



Source: TransSolutions, LLC; Simmod PLUS!

1 **3.2.2 North Flow VMC**

In North Flow operations, the arrivals and departures use only the parallel runways so that Runway 5 is used as a taxiway. Often, departure aircraft taxi from their gates to Runway 36C on Runway 5. **Table 3-3** summarizes the average North Flow VMC average air delay and taxi times for the current and future demands.

	Arrival		Departure	
Year	Average Airspace Delay	Average Taxi-In Time	Average Ground Delay	Average Taxi-Out Time
2016	3.8	10.2	4.4	14.8
2028	7.8	13.9	4.1	14.6
2033	10.9	14.9	4.8	15.4

Table 3-3 North Flow VMC Average Delay and Taxi Times (in minutes)

Source: TransSolutions, LLC; Simmod PLUS!

In general, taxi-in times are similar to South Flow but taxi-out times are longer because the departure runway ends are further from the terminals. In North Flow VMC:

> Average airspace delays nearly double from 2016 to 2028 and nearly triple from 2016 to 2033.

- > Average taxi-in time increases by 46 percent from 2016 to 2033.
- > Average taxi-out time increases by 4 percent from 2016 to 2033.
- Average departure ground delays decreased by 7 percent from 2016 to 2028 as next generation
 (FAA NextGen) equipment is assumed to be in place by 2028, reducing the required departure
 separations. However, average departure ground delays increased by 17 percent from 2028 to
 2033 due to the increase in traffic demand.

Figure 3-3 illustrates the average taxi times in hourly increments for North Flow VMC.

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Figure 3-3 North Flow VMC Hourly Average Taxi Times





Source: TransSolutions, LLC; Simmod PLUS!
1 3.2.3 North Flow IMC

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North Flow IMC delay and taxi times are summarized in **Table 3-4** for the current and future demands.

Table 3-4 North Flow IMC Average Delays and Taxi Times (in minutes)

	Arri	ival	Departure		
Year	Average Airspace Delay	Average Taxi-In Time	Average Ground Delay	Average Taxi-Out Time	
2016	3.9	11.1	7.3	18.6	
2028	8.6	12.3	11.5	23.2	
2033	12.0	12.5	15.0	26.6	

⁶ Source: TransSolutions, LLC; Simmod PLUS!

- > Average airspace delay doubles from 2016 to 2028, and triples from 2016 to 2033.
- > Average departure ground delay doubles from 2016 to 2033.
- Average taxi-out time increases by 25 percent from 2016 to 2028, and by 43 percent from 2016 to 2033.

Figure 3-4 illustrates the average taxi times in hourly increments for North Flow IMC. Note that the
 y-scale of the graphs is increased to 40 minutes to display the quarter-hour average taxi-out times.

In North Flow IMC operations:









Source: TransSolutions, LLC; Simmod PLUS!

3.3 Hourly Airport Capacity (Peak Hour Throughput)

The simulation results were analyzed to obtain rolling hour airport throughput for individual days (iterations) in each wind/weather configuration. This analysis used the highest demand level (2033) in the simulation since it will likely have the highest throughput. The maximum hourly throughput is achievable under specific circumstances, but is not a good indication of the capacity that can be sustained for several hours. Thus the 90th percentile is often used as the measure of capacity. In **Table 3-5**, the hourly throughput for each wind/weather configuration is summarized by arrivals only, departures only and all operations, with 90th percentile calculated for 7:00 AM to 10:00 PM local time.

Flow /	Arrivals		Departures		Total Operations	
Weather	Maximum	Capacity	Maximum	Capacity	Maximum	Capacity
South VMC	84	72	78	65	141	130
South IMC	74	68	69	66	134	130
North VMC	77	68	78	65	138	131
North IMC	76	68	68	63	137	127

Table 3-5 Airport Peak Hour Throughput

Source: TransSolutions, LLC; Simmod PLUS!

- In VMC, the simulated overall capacity is approximately 130 operations, with 130 operations in South Flow and 131 in North Flow.
- > In IMC, the simulated overall capacity is 126-130 operations.

These hourly capacity estimates are depicted with the rolling-hour flight schedule in Figure 3-5
 below. Both arrival and departure capacity is already exceeded during peak departure times; by
 2033, the capacity will be exceeded during most of the airline banks.







3.4 Arrival Gate and Ramp Delays

The simulations in this analysis were run with the gate expansions currently under construction incorporated, including an additional pier at Concourse A and a few more parking positions for American Eagle. With all the domestic non-American flights parking at Concourse A, these airlines were allowed to park at any Concourse A gate.

While the simulations ran without any additional gates, more aircraft wait for an available gate as the traffic demand increases from 2016 through 2033. **Table 3-6** summarizes the number of flights and amount of time spent waiting for an open gate after landing for each simulated scenario.

Operational Configuration	Year	95 th Percentile Waiting Time for a Gate (minutes)	Total Time Waiting for a Gate Each Day (minutes)	Average Number of Daily Flights that Wait for Gate
South Flow	2016	5.9	470.1	327
VMC	2028	8.0	1093.1	453
	2033	12.7	1862.7	519
South Flow	2016	6.1	424.6	239
IMC	2028	5.4	1095.1	472
	2033	6.7	1202.7	582
North Flow	2016	6.0	636.1	292
VMC	2028	6.4	940.8	453
	2033	5.4	1423.6	562
North Flow	2016	5.6	577.9	260
IMC	2028	6.2	993.6	434
	2033	6.2	1423.7	517

Table 3-6 Arrival Aircraft Waiting on Ramp for an Available Gate

Source: TransSolutions, LLC; Simmod PLUS!

Note that with aircraft arriving on Runway 23 in South Flow, the gate waiting time increases significantly, compared to all other scenarios with only the parallel runways in use. The arrival runway throughput is higher when Runway 23 is used so that more arrivals get to the ramp and must wait for a gate.

16 With the current number of gates, there is not enough ramp space for the arrival flights to wait for 17 an open gate. If the ramp is full of aircraft waiting for a gate, additional arriving flights will wait on 18 the taxiways and may back-up to the runways, indicating that ramp capacity is being exceeded.

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1 3.5 Summary of Simulated Results

The results from all simulation scenarios are analyzed together to provide a summary of the overall CLT operations. **Figure 3-6** illustrates the average taxi times for all operational scenarios. While taxi-in times increase rather steadily from 2016 to 2033, the most notable increase occurs from 2028 to 2033 in south VMC. In general, taxi-out times increase faster from 2028 to 2033 compared with the increase from 2016 to 2028.

Annualized average times are calculated to succinctly analyze the delays and taxi times for each demand level. The FAA Aviation System Performance Metrics (ASPM) data was analyzed for 14 years, 2003 through 2017. The data excludes the hours when only the crosswind Runway 5-23 is used, North Flow is used for 44 percent of the operations and South Flow for 56 percent of the operations. IMC is used during approximately 21 percent of the operations, almost equally split between North and South Flow. **Table 3-7** summarizes the percentage of the operations, 2003 through 2017, that occurred in each particular configuration (excluding the time when only the crosswind Runway 5-23 is used).

Table 3-7 Annual Use of Runway Configurations

Flow	Weather	Percent of Operations ¹⁹
North	IMC	10.7%
	VMC	33.3%
South	IMC	10.4%
	VMC	45.7%
Source: ASPM, ar	nalyzed by TransSolutions	

¹⁹ Note that ACEP included configuration use for 2013 only, resulting in slightly different percentage use.











Figure 3-7 illustrates the average airspace delays for all operational scenarios. The lowest airspace delays are experienced in South Flow VMC. Similar to the taxi-out times, the arrival airspace delays increase faster from 2028 to 2033 compared with the delays increase from 2016 to 2028.



Figure 3-7 Average Airspace Delays



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Source: TransSolutions, LLC; Simmod PLUS!

The average delay per operation is illustrated in Figure 3-8 for each operational scenario modeled.



Figure 3-8 Average Delay per Operation (in minutes)

Source: TransSolutions, LLC; Simmod PLUS!

Applying the annual use of each runway configuration, a weighted average is calculated for the arrival airspace delays and for the overall taxi delays, as depicted in **Figure 3-9**.

6 Figure 3-9 Annualized Average Airspace and Ground Delays



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3-16 Simulation Findings

CLT EIS Capacity/Delay Analysis and Airfield Modeling Technical Memorandum



Source: TransSolutions, LLC; Simmod PLUS!

The annualized average delays per operation, depicted in **Figure 3-10**, increase over 60 percent from 2016 to 2033.

Figure 3-10 Annualized Average Delay per Operation (in minutes)





Source: TransSolutions, LLC; Simmod PLUS!

1 2	These average delays per operation result in the following daily total delays for the average day peak month:
3	> 2016 – 1,582 operations with a total of 11,725 minutes of delay per day.
4	> 2028 – 1,857 operations with a total of 16,854 minutes of delay per day.
5	> 2033 – 1,968 operations with a total of 23,529 minutes of delay per day.

1 Conclusions 2 3 Based on the Existing Conditions and future No-Action simulation analyses and findings detailed in this Technical Memorandum, the following conclusions can be made: 4 5 > Hourly capacity of the airfield system is regularly exceeded by the arrival and departure demand of the airline hub banking periods. 6 7 > During Visual Meteorological Conditions (VMC), taxi-in times (including ramp delays due to 8 aircraft waiting for a gate) increase more rapidly than in Instrument Meteorological Conditions 9 (IMC), since arrival runway operations exceed gate/ramp capacity, which in turn cause more 10 ramp congestion. Imbalance of arrival runway capacity and aircraft gate capacity, particularly during the 11 > 12 predominant operational configuration of the airport (South flow VMC), results in high taxi-in delays (due to aircraft waiting on the ramp for a gate). 13 14 Based on the modeling results and other information, the Consultant Team will develop a Purpose 15 & Need Technical Report. The Technical Report will compare the capacity (annual and hourly) of 16 the airfield system at Charlotte Douglas International Airport (CLT) with existing and forecast 17 demand, and will also describe the delay analysis results in the context of the National

18 Environmental Policy Act (NEPA) requirements for Purpose & Need.

FINAL

Gating Analysis

Charlotte Douglas International Airport Environmental Impact Statement

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Gating Analysis Approach and Assumptions

The objectives of this study were to quantify the gate requirements for the CLT EIS flight schedule forecasts for 2016, 2028 and 2033 and to verify if the number of gates identified in the Airport Capital Enhancement Program (ACEP) is still valid. This memo documents the assumptions and approach used in the gating analysis.

1.1 Approach

TransSolutions utilized a gating tool, GatePlan® for this study. Gate characteristics such as aircraft size constraints, assigned airlines, and flight origin (domestic and international) were considered and implemented into the tool. Each flight was gated, adhering to the parameters built into GatePlan[®], producing a gateboard similar to that shown in **Figure 1-1**, with gates from top to bottom and the time or hours from left to right. As flights are assigned to gates, they appear in the gateboard, displaying the flight arrival time and departure time.

Parameters used included gate buffer times between flights, minimum gate occupancy times based 14 on domestic versus international flights, splitting flights that have 3 hours or more of ground time to free up contact gates and use hardstand positions. These are described in more detail in the sections below.

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Figure 1-1 Sample of GatePlan Gateboard



For this gating analysis, the gates were categorized as regional jet, narrow-body aircraft and widebody aircraft so that the gate requirements could be quantified regardless of the specific terminal layout. Gate requirements were also identified as international-only, domestic-only, or swing gates capable of accommodating both international and domestic arrivals.

1.2 Flight Demand

The flight demands that drive this study are based on the 2028 and 2033 forecasts developed for the Environmental Impact Statement (EIS). **Table 1-1** summarizes the Average Day Peak Month (ADPM) current and projected commercial passenger flights at CLT in the future.

Table 1-1 Current and Projected Daily Commercial Passenger Operations

Forecast Years Operations				
2016	2028	2033		
737	880	937		
737	880	937		
	2016 737 737	Forecast Years Operation 2016 2028 737 880 737 880		

Source: CLT 2035 Activity Forecast, InterVISTAS, June 2017

 Table 1-2 summarizes the commercial passenger flight schedule fleet mix for 2016, 2028, and 2033.

Table 1-2 Current and Projected ADPM Commercial Passenger Fleet Mix (Daily Operations Count)

	2016		2028		2033	
Aircraft Group	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures
Regional Jet	398	398	481	481	494	494
Narrow-body	330	330	388	389	431	432
Widebody	9	9	11	10	12	11
Total	737	737	880	880	937	937

17 Source: CLT 2035 Activity Forecast, InterVISTAS, June 2017

Figure 1-2 illustrates the rolling 60-minute commercial passenger arrival and departure operations at CLT.

Figure 1-2 Rolling 60-Minute Commercial Passenger Flight Profile



Source: TransSolutions analysis of EIS forecasts CLT EIS Study, 2018

The majority of the flights in the design day flight schedules were routed, meaning that the arriving and departing flights were paired, or matched. For flights with less than three hours' ground time, the average ground time was 62 minutes (58 minutes for regional and 68 minutes for mainline operations). Approximately 15-percent of the flights have a ground time longer than 3 hours.

1.3 Assumptions

To quantify the number of gates required to accommodate the flight schedules, the analysis assumed there are no adjacency constraints between nearby gates.

International flights must be programmed to arrive at an international-capable gate, while international departure flights may depart from any gate. Note that arrivals from airports with United States (U.S.) preclearance facilities do not require an international gate. In the CLT flight schedules, there are flights from the preclear airports of Aruba (AUA), Bermuda (BDA), Dublin (DUB), and Montreal (YUL).

For domestic flights, a minimum of 15 minutes "buffer" time was used so that at least 15 minutes was planned between the departure from a gate and the subsequent arrival to the gate. For international flights, American Airlines Operations at CLT identified that the "buffer" time used should be at least 20 minutes (email received from Rodney Frascht, April 3, 2019).

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To maximize utilization of each gate, flights with longer than three (3) hours of ground time were assumed to be towed to a hardstand as necessary. For the flights that were not matched, or those that were towed to/from a hardstand, the gate occupancy times in **Table 1-3** were used. These times were confirmed with American Airlines Operations personnel at CLT.¹

	Domest	ic Flights	International Flights		
Aircraft Type	Originating/ Pull	Terminating/ Push	Originating/ Pull	Terminating/ Push	
Regional Jet	50	35	55	50	
Narrowbody	65	40	85	55	
Widebody	70	50	130	75	

Table 1-3 Gate Occupancy Times (in minutes)

Source: American Airlines Operations, CLT.

8 1.4 Gating Scenarios

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Gate requirements were quantified for both 2028 and 2033 schedules for two gate assignment policy scenarios as described below. A scenario (Scenario 1: All Gates Shared), where all gates would be shared (common use) for all carriers, was identified but not analyzed as it was not considered to be a realistic planning option.

Predominant carrier – domestic and international. In this scenario (Scenario 2: AA Gates Dedicated; OA Gates Shared), each gate was used by the primary carrier American Airlines (AA) or by other airlines (OA). Results estimated the number of gates for these 12 categories:

- 16 AA Widebody international
- 17 > AA Widebody domestic
- 18 > AA Narrowbody international
- 19 > AA Narrowbody domestic
- 20 > AA Regional international
- 21 > AA Regional domestic
 - AA Widebody international
- 23 >> OA Widebody international
- 24 >> OA Widebody domestic
- 25 >> OA Narrowbody international
- 26 >> OA Narrowbody domestic
- 27 >> OA Regional international
- 28 > OA Regional domestic

If the international gates could be used for domestic flights at other times of day such that the overall domestic gate requirement is reduced, the international gates were designated as swing gates.

¹ Email received from Rodney Frascht, FAA, April 4, 2019.

Dedicated airline gates – domestic and international. In this scenario (Scenario 3: All Gates Dedicated), each gate was dedicated for an individual airline; no sharing of gates by multiple airlines was allowed. The results show the number of gates for the same categories as above, but the "OA" gates were split for each airline forecasted to operate at CLT. As in the above scenarios, international gates were designated as swing gates if it reduced the overall gate requirements.

 Table 1-4 summarizes the gating scenarios considered in this study.

Table 1-4 Gating Scenarios

Scenario	Dedicated Gates by Airline	Domestic/ International	Aircraft Type (NB, WB, Reg)	Demand Year
Scenario 2: AA Gates Dedicated; OA Gates Shared (Predominant carrier – domestic or international operations)	Only for AA	~	~	2028 2033
Scenario 3: All Gates Dedicated (Dedicated airlines – domestic or international operations)	\checkmark	✓	\checkmark	2028 2033
NB: Narrowbody WB: Widebody Reg: Regional				

The total number of contact gates and hardstands required to accommodate the ADPM flight schedules are reported in **Chapter 2**. The requirements ensure that all flights are gated, with the most efficient gate assignments, in other words using the fewest number of gates such that all flights are assigned to a gate. All gates used at any point in the day are counted in the totals. The requirements are reported by aircraft type and by airline (if relevant), along with number of operations or turns per gate per day for each of the two different scenarios.

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2 Gating Analysis

2.1 Gating Solutions

The gating solutions from GatePlan[®] showing the total number of contact gates required by each of the defined 12 categories are summarized below in **Table 2-1**. Note that the solution for AA was the same in both scenarios.

8 Table 2-1 Gating Solution Summaries

Scenario 2: AA Gates Dedicated; OA G	Gates Shared
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			AA G	ates					OA G	ates			
		Internation	al		Domestic			Internation	al		Domestic	:	
Planning	Wide	Narrow		Wide	Narrow		Wide	Narrow		Wide	Narrow		Total
Year	body	body	Regional	body	body	Regional	body	body	Regional	body	body	Regional	Gates
2016	6	6	0	0	40	50	1	0	0	0	5	5	113
2028	6	8	0	0	43	61	1	0	0	0	6	8	133
2033	6	8	0	0	46	62	1	1	0	0	10	6	140

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			AA G	ates					OA G	ates			
		Internation	al		Domestic			Internation	al		Domestic		
Planning	Wide	Narrow body Regiona		Wide	Narrow	Pagional	Wide	Narrow	Pagional	Wide	Narrow	Pagional	Total Cator
Teal	bouy	bouy	Regional	bouy	bouy	Regional	bouy	bouy	Regional	bouy	bouy	Regional	Gales
2016	6	6	0	0	40	50	1	0	0	0	8	9	120
2028	6	8	0	0	43	61	1	0	0	0	10	11	140
2033	6	8	0	0	46	62	1	1	0	0	17	9	150

Scenario 3: All Gates Dedicated

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11In each of the scenarios, one swing gate was used for AA's DUB arriving flight, which was gated at12an international gate even though it is from a TSA Preclearance airport and could be13accommodated at a domestic widebody gate. No other domestic flights were accommodated at

international gates.

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The number of operations per gate in each scenario for each year is shown in **Table 2-2** below.

	N	mber of Operations Per Ga	ate
Planning Year	Scenario 2: AA Gates Dedicated; OA Gates Shared	Scenario3: All Gates Dedicated	Difference Between Scenarios
2016	7.13	6.69	0.44
2028	7.27	6.96	0.31
2033	7.32	6.85	0.47

Table 2-2 Operations Per Gate

As part of the gating analysis approach, some flights that were on the ground for more than three (3) hours were designated to be towed to a hardstand position. Additionally, for any gates that had multiple terminating flights, the earlier arriving terminating flights were accounted for at hardstand positions. Similarly, for any gates that had multiple originating flights, the later departing flights were accounted for at hardstand positions. A summary of the total number of hardstand positions needed for these two scenarios is summarized in **Table 2-3**.

Table 2-3 Total Position Requirements

			Total Position	ons Required		
	AA Gates [Scenario 2: Dedicated; OA G	ates Shared	Α	Scenario 3: Il Gates Dedicate	ed
Planning Year	Contact Gates	Hardstand Positions	Total Positions	Contact Gates	Hardstand Positions	Total Positions
2016	113	33	146	120	32	152
2028	133	36	169	140	35	175
2033	140	32	172	150	29	179

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19 20 Note: Each hardstand positions were assumed to be able to accommodate any size aircraft.

The number of hardstand positions changes as the number of contact gates change due to a change in the fleet mix which alters the aircraft remaining overnight that can be accommodated at contact gates rather than at hardstands. Additionally, under the All Gates Dedicated scenario, fewer flights with ground times of more than 3 hours need to be split and moved to hardstand positions.

15 2.2 Gate Assignment – Gateboards

The gateboards showing the gate assignments for each scenario are included in Appendix A.

The following bullets provide information needed to interpret that gateboards,

- The gate names on the far left are for labeling purposes only and do not identify any actual current or future gates. The yellow gates represent domestic gates and the blue gates represent international gates.
- > The gate assignments are separated by solid black lines; each grouping represents one of the following.
- 21 AADO AA Domestic
- 22 AAIN AA International
- 23 OADO OA Domestic

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1		OAIN – OA International
2		HS - Hardstands
3		> For the individual flight pucks, the following color scheme applies.
4		 Blue – Regional Jets + Turbo props
5		 Green – Narrow body
6		 Orange – Widebody
7	2.3	Conclusion
8 9 10		The gating analysis shows that the number of contact gates and total positions required consistently grows as both the schedule grows and as the more restrictive requirements are applied in the All Gates Dedicated scenario.
11 12		For the 2033 schedule, in the All Gates Dedicated scenario, 150 contact gates are required as well as an additional 29 hardstand positions for a total of 179 positions.
13 14		The number of operations per gate is notably higher in the scenarios that allows sharing between airlines with between 0.3 and 0.5 more operations per gate per day in the less restrictive scenarios.
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Appendix A: Gateboard Scenarios

CLT 2016 Gating Scenario 2

	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
						ntulutu		ոհվոր	$\left[\prod_{i=1}^{n} \prod$														ատեսիս	որորութ
AADO							bu d	1742	-11/D	500	b.cov		- Inn	nor	100	177 T		1			P1 1			
A21							AA 39 6:36 45	96 320 A 50 7:30 7	475 AA 560	320 9:20	AA 10:24	624 311 710 11:50	AA 726 12:06 790	321 AA 13:10 13:28	808 320 890 14:50	AA 905 320 15:05 959 15:59	aj	SW LOLE BWI	AA 18:39	1119 1220	320 20:20	MSD 1051 DV	<u>م</u>	
A22							OUTSC	14 DEM	AA 8:28	508 FLL 590 320 9:50	10:34	⁶⁷⁹ 11:19		AA 798 13:18 865	320 14:25		A 1	(A) = 1015 + 320 = 320		(ATI	C AT	AA 1264 32 21:04 1325 22:0	.0	
A23							6:45	ÖRIG ^{DI W} 450 7:30	AA 50 8:20 57	00 115 320 75 9:35	AA 6 10:12 6	12 320 35* 11:25	AA 722 12:02 792	320 AA 13:12 13:30 8	10 320 70 14:30	MCP 000	peud	hall ATI		AA 19:02 1225	320 20:25	AA 1276 21:16 1330 2:	1349 320 2:10 TERM	
A24									8:29 8:29	9:14	AA 10:20	620 A0A 690* 11:30	AA 7 12:30 8	50 CON PP 320 A. 10* 13:30 13	832 BWI 52 890 14:50	AA 925 15:25 985	320 16:25	17:15 ¹⁰⁷⁰ 17:15 ¹⁰⁷⁰	LCA	AA 1134 1 18:54 1205 20	AA 122 AA 122 20:29 127	9 320 AA 9 21:19 21:50	1310 KD0 321 0 1365 22:45	
A25									AA 2 8:28 4	508 AIL 320 413 9:35	AA 611 10:11 663	MSY 319 11:03	AA 724 12:04 800	321 13:20	oppl	AA 903 15:03 984	321 AA 16:24 16:44	1004 PHA 321 1065 17:45	AA 1082 MSY 320 18:02 1135 18:55	AA 1152 19:12 1220	320 20:20	LAS 1280 AA 1280 21:26 1790	5 321 5 22:25	
A26							LAS 3 AA 6:10 6	570 LAS 558 8:00	AIL 501 AA 501 8:21 560	320 9:20	DCA AA 10:32	632 KS 715 11:	55 55	MIA AA 13:35	815 0RD 2080 14:50	AA 15:27 7	27 LAX 25 16:40	AA 1017 16:57 1100	321 18:20			AA 128 21:26 134	6 22:26	
A27							AA 37 6:15 47	75 SAN 321 70 7:50	1PA AA 8:41	521 BWI 580 9:40	AA (10:00 7	600 PLS 00* 321 11:40	DEN 723 IF AA 723 32 12:03 782 13:0	A OKD 8 21 AA 8 02 13:23 8	03 PHX 321 75 14:35	AA 15:25	025 LAS 321 537 16:45	1PA 1 AA 1 17:20 1	1040 1074 1120 18:40	AA 1135 88W AA 1200 20:00		AA 1281 21:21 1340	321 22:20	
A28							AA 369 6:09 460	321 7:40	493 PUSH	9:10 595 9:55	AA 10:	0 638 IND 38 690 11:30	AA 717 PHD AA 717 32 11:57 780 13:00				pund	17:4	PULL DFW ORL AA 45 565 18:30 18:4	5 1125 125 125 125 125 125 125 125 125 1	AS SJU 321 AA :05 20:23	1223 D 1330 21	321 2:10	
A29						ALTON DOW	AA 374 6:14 465	4 1PA 321 5 7:45	AA 481 8:01 585	1 1 AX 321 9:45	AA 10:19	619 MIA 705 11:45	AA 726 12:06 789 1	321 AA 13:09 13:37	817 MCO 321 885 14:45	AA 900 15:00 975	321 16:15		10	hu	AA 20:40	1240 472	22:15	
A1						5:15 ³⁶⁰ 6:00	AA 6:26	386 0kD 475 7:55	6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	00 PHX 321 80 9:40	AA 6 10:05 69	05 MBJ 0* 321 11:30	t t bere	AA 13:45	825 PHL 885 321 14:45	AA 900 91 15:00 559 16:0	L SFO 21 AA 15 16:46	1006 0K 5 1908 18:0	21 00	PHL 1145 AA 19:05 844	321 A/ 20:27 20	A 1252 A 1335	321 22:15	
A3							AA 362 6:02 408	321 7:30	AA 482 8:02 565*	321 9:25	AA 10:3	635 FI 5 715 11:	AA 734 121 AA 734 12:14 1878	DFW D. 321 A. 13:15 13	832 JFK 52 895 14:55	AA 92 15:24 99	4 911 5 16:35	AIL 1017 AA 1090	18:10			AA 1262 21:02 1340	321 22:20	
A5							AA 364 6:04 450	321 7:30	AA 5 8:22 5	502 SEA 321 580 9:40	AA 10:32	632 POD 321 710* 11:50	DFW 74 AA 74 12:27 80	7 AIL 321 4 13:24		DFW 920 AA 920 15:20 984	321 A 16:24 10	A 1014 6:54 1085 11	321 AA 8:05 18	1129 01 49 1205 20	321 :05	LGA 1264 AA 1264 21:04 557	321 22:20	
A7							AA 370 6:10 1993	LAX 321 7:35	DFW AA 8:34	514 SJU 321 590 9:50	MIA AA 10:29	629 DEN 321 521 11:45	MCO 724 MCO AA 724 32 12:04 781 13:0	0 LA 11 AA 11 13:	x 830 1PA 321 50 890 14:50	PHX AA 15:35	935 SFO 321 705 16:40	BOS 1020 AA 1090	PDX 321 18:10			PHX 1276 AA 1276 21:16 1345	321 22:25	
A9							hico		AA 490 8:10 565*	9:25	10:11 68	11 CON 321 35* 11:25	AA 725 C 12:05 785 13	AA 801 319 AA 801 :05 13:21 860	321 14:20	LAS 908 AA 15:08 970 1	321 5:10	AA 1020 17:00 1090	321 18:10	LAS 1135 AA 2075 1	321 20:10	AA 1263 B 21:03 1329 22	321 1:09	
A11							6:44	404 LGA 321 479 7:59	AA 8:31	511 DEN 321 575 9:35	BDL AA 10:31	631 SJU 705 11:45		BOS 81 AA 13:30 80	0 DFW 321 5 14:25	BOS 909 L AA 970 1	EW DEW 321 AA 5:10 16:31	991 DFW 321 1060 17:40		AA 1154 19:14 1229	4 BOS 321 20:29	AA 1273 21:13 1339	MCO 321 22:19	
A13							6:15 420 6:15 7:00		AA 490 8:10 565*	321 9:25	AA 6 10:13 6	13 PHX 321 85 11:25	BNA 718 AUS AA 718 319 11:58 774 12:54	13:31 8	11 LGA 321 56 14:26	AA 905 MC0 321 15:05 960 16:00	ond	AA 103 17:16 110:	6 DEN 321 15 18:25	PHX 1154 AA 19:14 1975	321 20:20	LAX 1269 AA 1269 21:09 1330 2:	321 2:10	
A12									AA 490 8:10 564	321 9:24	AA 6 10:13 20	13 1PA 321 53 11:20	AA 731 12:11 100	73H 13:19	CODE STU	MIA 916 AA 15:16 1453	73H 16:25	DUV 1022	DFW 1091 AA 1091 18:11 1150	DFW 321 AA 19:10 19:35	1175 LGA 321 1240 20:40	1270 TERM	DC 4	
A10									491 AA 559 8:11	321 9:19	AA 10:18	518 0KD 321 585 11:25	EWK 74. AA 12:23 800	3 EWK DIW 73H AA 6 13:26 13:45	825 311 880 14:40	AA 905 15:05 985	73H 16:25	AA 1033 17:13 678	321 18:16	19:20 1220	321 20:20	AA 21:20 1334	319 22:14	
A8							397 TERI	M	AA 8:43	523 B03 321 585 9:45	AA 10:26	626 BOS 690 11:30	AA 3 12:09 784 13:	04 13:27 E	07 M31 319 75 14:35	15:25 1	6:10 DCA	999 FIL 321 1050 17:30		AA 1147 3 19:07 1205 20	321 :05	AA 21:12 1330 2:	321 2:10	
A6							ATI	ATI	8:5	0 575 9:35	AA 10:	637 104 7 700 11:40	AA 1950	319 13:15	AA 840 14:00 2249	73H AA 15:15 15:30 1	000 16:40	1021 TERM		AA 1139 321 18:59 1195 19:55		DEN 1278 AA 1335	321 22:15	
A4							AA 6:52	412 An 480 320 8:00	0 AA 509 8:29 555	319 9:15	601 TERM	SCA LAS	AA 12:28 800	8 319 AA 0 13:20 13:39	819 319 880 14:40	PDI 000	DTW	TERM		Т	TI85 TERM	AA 12/3 21:13 1384	73H 22:15	
A2							AA 3' 6:17 4'	77 319 70 7:50	AA 8:46	526 br w 569 9:29	10:3 CLT	ORIG LAS 5 680 11:20	AA 712 810 11:52 765 12:45	AA 8 13:31 8	11 319 70 14:30	AA 902 15:02 990	319 16:30	IND 1021	. CTI	TERM	EWP	AA 128 21:27 127	7 73H 17 22:30	
B1							ТРА	to c PDU	ILV -	MIA	10:3	⁶⁸⁰ 11:20	AA 795	319 AA 13:15 13:37	817 800 819 870 14:30	AA 903 15:03 990	319 16:30	AA 1031 17:11 1105	319 5 18:25	TERM	AA 20:36	1236 1608 2:	/3H 2:10	
B3							AA 6:46	406 319470 $7:50$	AA 5 8:30 1	10 MIA 73H 48 9:30	603 TERM	11:25 73	IG EWR 10 12:10 IOPE = 12	A/ 13	51 831 111 51 895 14:55	low	ppi	ALIC	- BDI	AA 19:45	1185 311 1233 20:33	AA 1264 21:04 1336	319 22:16	
B5							pic -	AA 422 319 7:02 479 7:59	AA 496 8:16 2529 9	73H 9:06	608 TERM	V DEW	OKF 743 AA 792	319 13:12	AA 836 144 AA 319 3:56 895 14:55	AA 915 15:15 980	319 16:20	AOS 103: AA 103: 17:15 110:	5 319 5 18:25	19:44	ORIG 1229 20:29	AA 1257 20:57 1345	319 22:25	
B7							AA 39 6:34 45	94 319 50 7:30	AA 488 8:08 550	319 9:10	A	$\begin{array}{cccc} & 642 & \text{DFW} \\ A & 642 & 73H \\ 0:42 & 330 & 11:35 \end{array}$	LUA 737 0. AA 12:17 785 13	319 :05	AA 842 319 14:02 895 14:55	AA 913 15:13 975	319 16:15	AA 1033 17:13 1100	319 18:20	AA 1149 19:09 1390	73H AA 20:10 20:38	1238 1360	319 22:40	
B9							EWP	EWP	AA 8:47	527 EWK 595 9:55	AA 10:33	633 319 710 11:50		AA 13:26 855	319 14:15	AA 15:44	944 319 1005 16:45	ALD 1021 D AA 1021 D 17:01 1085 1	319 8:05	AA 19:16 2483	73H AA 20:10 20:39	1239 1355	319 22:35	
B11							AA 6:47	407 ^{73H} 465 7:45	AA 5 8:21 5	01 319 80 9:40	AA 602 10:02 1458	73H 11:05				AA 920 15:20 979	319 16:19	AA 1027 17:07 1090	319 AA 18:10 18:35	1115 310 321 1170 19:30	4	AA 21:15 1340	319 22:20	
B13							840 0.5 t	DEN	AA 8:12 565*	320 9:25	DUE	A 644 BINA A 319 0:44 700 11:40		808 TERM	1	AA 914 15:14 969 10	319 :09	PDU toot P	AA 18:04	1084 319 1200 20:00	9 D	TEF	M	
B15							AA 374 6:14 455	321 7:35	AA 8:15 570	* 319 * 9:30	AA 10:14	614 319 690 11:30				AA 15:37	37 319 90 16:30	AA 1024 1 17:04 1085 1	319 8:05	TERM	2	AA 20:58 1335	319 22:15	
B16							PIT	AA 432 319 7:12 480 8:00	9 AA 49, 0 8:17 570 MEM) 319) 9:30	AA 10:19	695 319 695 11:35				AA 908 319 15:08 959 15:59	AA 16::	1010 319 50 1070 17:50		ORIG 19:15 20:00	D	AA 12 21:22 13 CLTSC4	82 319 60 22:40	
B14						CLTSC4 LC	AA 6:42	402 ₃₁₉ 455 _{7:35}	AA 8:43 BUF 499	525 319 595 9:55		ISH	LB			DTW	DO MSY D	CA 1014 IAH		TERM	1 8	21:40 I	LL 193 22:25	14
B12						5:20 GRIG	05 SC4 PHL		AA 559	319 9:19 524 BDL	A/ 10 PWM	39 715 11: 622 ATL	55 PHL 710 PHI	0		AA 15:39	319 A 990 16:30 10	A 1014 319 6:54 1074 17:54 CLE 1010 RIC	PIT	AA 1150 319 19:10 1200 20:00	9 A 0 2	AA 1255 20:55 1330 2: DTW 1255 LG	319 2:10 A 1250	TE
B10						5:50	395 6:35 CLTSC	4 PHL	AA 8:44 DCA	590 319 590 9:50 08 CHS	AA 10:33 PBI 6.1	699 319 699 11:39	AA 2054 E90 11:59 2054 13:00	0		RIC	41 ALB	AA 1019 319 16:59 1074 17:54 PHL 1026	AA 18:44 5 MCO	4 1194 319 4 1194 19:54	65 RIC	AA 1255 31 20:55 1324 22:0	4 TERM	
В8							6:45 CLTSC	450 7:30	AA 5 8:28 5	70 319 9:30 518 NAS	AA 67: 10:10 67: STL	5 11:15 627 DCA				AA 9 15:41 9 025	319 84 16:24	AA 1030 17:16 1733 NAS 1024	752 18:20 PIT	AA 11 19:25 12	30 319 JAX	TERM	AND JAX	
86							6:45 CLTS	450 7:30 ORIG FLL	AA 8:38 PIT	580 319 9:40 515 IAH	AA 10:27 SA	690 ³¹⁹ 11:30 ^T 639 ^{MCI}				TER MSY 010 BN	M	AA 1024 17:04 1095	319 18:15	AA 1154 19:14 1215 RIC 1151 1	319 20:15 IPA	AA 12 21:29 13	55 319 22:35	
B4							6:50	455 7:35	AA 8:35	575 319 9:35	ROC 61	39 700 319 4 CHS	CLTSCA	IG BWI		AA 950 3 15:30 966 16: NAS 910	BUF			AA 1101 19:11 1206 20 JAX 1155	319 0.06 RDU	TERM ^{MSY} 1280	BUF	
B2									AA 8:04 1839 9:00 CLE 51	0 10 MEM	AA 67 10:14 67	4 11:14 520 DTW	12:34 79	9 13:19 CL	ISC4 ROC	AA 15:10 989	319 16:29			BDL 1147 MC	20:10 1	IAH 1270	22:25 PBI	
62								CLTSC4 BOS	8:30 56 ST	54 9:24 L 531 PIT	AA 10:20 ALB	580 11:20 523 RDU		13:	50 875 14:35					AA 319 19:07 1200 20:00 BNA 1164	BUF	AA 21:10 1331 2 MCI	2:11 1300 ORF	
								7:05 470 7:50	A/ 8:5	51 585 9:45	AA 10:23	580 11:20								19:24 1215	20:15	AA 21:40	1360 319 22:40	
<u> </u>																								
014																								
AAIN							CĽ	TSC4 MBJ									МВ	^{IJ} *1010 TPA	GCM *	1094 bna	CUN *127	LTSC4		
11							6:5	5 465* 7:45 CLTSC4 PUJ ORIG PUJ							м	BJ *893 F	AA 16:: DU CUN	50 1073 321 17:53 *1000 BOS	AA 18:14 1 SXM	1189 320 19:49 *1120 DCA	20:29 TERM 20:29 CLTSC *1216	⁴ 21:14 ²⁴		
12								7:05 475* 7:55							A. 14	A 970 1	320 AA 5:10 16:40	1075 ³²¹ 17:55	AA 18:40	1185 ³²⁰ 19:45	20:16 TERM 21:0	11		

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	00:00 01:00	02:00	03:00	04:00 05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00 23	3:00
		minintu	ntulutu	ntulutu utulutu	ntulutu	htuluti		ntulutu	ntulutu	hininin	ntulutu	ntulutu	htulutu	utulutuli	uulutu	ուսիսի			ntulutu	ntulutu	ուսիսիսի	dutu
13									CLTSC4 10:35	RIG SXM 13* 11:25					PUJ AA 16:21	*981 ¹ 1711 ₁	WR 320 8:05	PLS *1135 AA 18:55 1215	MCO AU 321 AA 20:15 20::	*1250 0 1350	BWI 320 22:30	
14																		MBJ *1136 AA 1215	MIA 321 20:15			
15																PUJ 17:42	1062 ^{SAN} 1062 ^{AA} 18:15 18:40	*1120 PBI 321 1195 19:55	SXM CLT *1224 20:24 TERM 2	SC4 1:09		
16																	MEX AA 18:35	*1115 MDT 319 1189 19:49				
17																						
18																						
l10															LHR AA 16:15		*975 732*		LHR 333 20:15			
I11												C A 1	2DG IA 3:55	*8 110	35 10*		CDG 332 18:20					
l12												DUB AA 13:05	785 704*		FRA CL 332 AA 16:35 16:	.TSC4 ORIG A 1105*	FCO 333 18:25					
l13														MAD AA 15:50	*95 724	50 ¹ 4 1	DUB LHR * 332 AA 8:05 18:30 T	1110 CLTSC4 333 ERM 19:30				
114												FRA AA 13:00	*780 748*		MAD 332 16:40	CLTSC4 OF AA 11: 17:10 11:	LHR 333 20* 18:40					
l15														FCO AA 15:55	*955 CLTSC4 333 TERM 16:55		BCN AA 18:20	*1100 1245*	BCN 332 20:45			
OADO																						
O1	ATL DL 0:22	22 823	3	ATL M90 5:30	CLTSC4 ORD ORIG 6:03 6:48	CLTSC4 ORI 7:30	IG ATL 5 8:15	DTW DTW DL 544 717 9:04 9:39		ATL 676 ATI DL 71' 11:162251 12:00	ATL 753 DL 753 12:33 1095	ATL ATL 717 DL 13:15 13:42	822 ATL 320 2597 14:30	DEN 897 UA 1199	DEN MSP 320 DL 100 16:22 16:40	00 DTW A 00 320 D 17:20 1'	TL 1070 ATL L M88 7:50 826 18:45	ATL 1149 A DL M 19:09 1407 20	TL ORD 88 F9 05 20:42	1243 ORD 320 1290 21:30	1346 TERM	14 TE
O2	40 PUSH			5:45	C4 ORIG 390 6:30 6:30	LTSC4 BWI PULL 3773 55 3773 7:40	ATL DL 8:48	528 ATL M88 2422 9:30	JFK 601 JFK B6 E90 10:01 218 10:40			PHI F9 13:4	49 890 MCO 321 49 890 14:49	DTW 940 DL 15:40 179	0 MSP MDV 319 3 16:30 16:50	W MDW 1010 1 ⁰⁴⁵ 17:25	HOU ₁₀₇₅ HOU 17:55 ¹⁴⁹³ 18:30	DAL ₁₁₃₅ BWI 18:55 ¹⁷²¹ 19:30	TTN 1225 F9 20:25 932	TTN 319 1:10	1332 1 TERM TI	I 387 ERM
O3				CLTSC4 IAH 5:05 5:50	CLTSC4 ATL ORIG 420 6:15 7:00	CLTSC4 ORIG 485	MSP 8:05	ORD 566 UA 521	ORD 73G 10:15	BOS BOS B6 659 E90 10:59 11:36	DTW 727 DTW DL 319 12:07 1629 12:50		MSP 864 MSP 14:24 14:59		ATL 978 ATL DL 978 M88 16:18 2651 17:00	BOS 1038 E B6 17:18 1446 E 17:18 1446 18:	DS DTW 90 1 18:40	DTW 120 155 19:15		1268 TERM		1399 TERM
O4				DEN F9 5:10	310 200	DEN 319 7:20		BWI 575 9:35 3055	DAL 0:10			ORD 780 ORD UA 319 13:00 1140 13:45		ATL 904 ATL DL 904 M88 15:04213315:45			л В 1	^{FK} 1130 JFK 6 1168 E90 8:50 1168 19:28				1400 TERM
O5				CLTSC4 ORIG 5:15 360 6:00		CLTSC4 SLC ORIG 7:00 465 7:45			ATL 603 ATL DL 1454 M90 10:03 1454 10:45		MCO F9 12:22 805	PHL 321 13:24										
O6																						
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O31																						
O32																						
OAIN																						
l21															MUC LH 16:20	*980 1115*	MUC 346 18:35					
122																						
AEDO					1																	
D13							ORIG 510 I	530 PUSH		ORIG 5593	PULL 785	DAY AA 13:43	823 ORF CR2 880 14:40	ORF 907 AA 985	GSP CR2 16:25		1066 PUSH				PULL 1350	
D12					390 PUSH			PULL 590	LEX AA 10:40	640 780	BHM CR2 13:00	BTR AA 13:4	827 DAY 7 881 14:41	SDF 917 AA 995	MKE TL CR2 AA 16:35 16:	H 1015 A 1110	AVL CR2 18:30	HSV 11 AA 19:21 12	161 HPN A CR2 A 240 20:40 2	VL 1255 A 1361	MGM CR2 22:41	
D10				0 A 5	GSP 357 DCA AA 357 CR2 5:57 392 6:32	PHL 418 CAE AA CR2 6:58 465 7:45	BHM AA 8:30	510 680))	FAY CR2 11:20	TYS AA 12:20	740 870	BHM CR2 14:30	FAY 926 AA 990	IND AVL CR2 AA 16:30 16:5	L 1012 C/ 52 1080 18:	AE VPS R2 AA 00 18:38	1118 PHF CR2 1190 19:50	AGS AA 20:38	1238 1340	CAE CR2 22:20	
D8					CHO AA 6:23	383 549	1	BTR DCA CR2 AA 9:09 9:24	564 674	AGS CR2 11:14	CRW 735 F AA 735 790 13	WA FAY CR2 AA 3:10 13:45	825 TYS CR2 875 14:35	MLB 9. AA 9. 15:44 9.	44 JAN CR2 95 16:35	AA 1030 1030 1030 1030 1030 1030 1030 10	CAK CR2 8:04	CAK 1158 AA 1225	GNV CR2 20:25	VPS 1266 AA 1350	AGS CR2 22:30	
D6							T1 A/ 8:5	LH A 53	533 695	EVV CR2 11:35	PGV 725 LEX AA 779 CR2 12:05 779 12:59	MOB AA 13:42	822 LEX CR2 865 14:25	LEX AA 15:55	955 VPS 1005 CR2 16:45	CAE 1023 AGS AA 1023 CR2 17:03 1075 17:55	ORF AA 18:4	1123 AGS CR2 3 5398 19:45	LGA BTV AA 1200 E75 20:00 20:40	IAN 1258 AA 1335	BTR CR2 22:15	
D4					CAI AA 6:50	E 410 BHM CR2 0 455 7:35	AA 8:22	502 AGS CR2 585 9:45	YUL 606 AA 695	GSP CR2 11:35	GSP 737 1 AA 790 1	TLH CR2 3:10	ORIG 890	OAJ 933 ^M AA 15:33 979 1	IGM CR2 6:19	PHF 1042 AA 1094 17:22 1094	LEX CR2 18:14	BHM 116 AA 122 19:23 122	3 YUL CR2 5 20:25	GNV 128 AA 135	0 LEX CR2 5 22:35	
E1						ORIG 455	MOB AA 8:42	522 GSP 599 9:59	CAE 621 AA 679	MYR CR2 11:19	CLE 725 GNV AA CR2 12:05 770 12:50		CHA 841 VPS AA 880 CR2 14:01 880 14:40	HSV 920 BHM AA 920 CR2 15:20 965 16:05		FAY 1025 GNV AA CR2 17:05 1075 17:55	G A 18	SP 1129 MKE A CR2 3:49 1184 19:44	FAY 1199 HSV AA 1240 CR7 19:59 1240 20:40	1275 TERM		
E2					GN AA 6:5	412 LEX CR2 2 450 7:30	PGV 491 AA 559	PGV CR2 9:19	VPS 606 AA 678	TYS CR2 11:18	OAJ 725 CHO AA CR2 12:05 769 12:49		MYR 841 AVL AA CR2 14:01 880 14:40	CHO 930 CAE AA CR2 15:3097016:10		LEX 104 AA 17:25 109	5 CHO CR2 5 18:15	YYZ 1157 AA 1210	CAE CR2 0:10	DAY 1 AA 21:31 1	291 EVV CR2 360 22:40	
E3						DAY 434 CLE AA 470 CR2 7:14 470 7:50	AGS AA 8:21 566	OAJ CR2 9:26	EVV AA 10:23 680	JAN CR2 11:20	AGS 736 OAJ AA CR2 12:16 780 13:00		PGV AA 847 CR2 14:07 885 14:45	CAE 922 HSV AA 922 CR2 15:22 960 16:00		BHI AA 17:4	M 1065 CHA 1105 CR2 15 18:25	EWN 1145 FAY AA CR2 19:05 1190 19:50	MEM AA 1205 CR9 20:05 20:45	CHO AA 21:08 1335	TLH CR2 22:15	
E5						CAK AA 7:08 463 7:43	LEX 5 AA 5 8:30 5	510 MOB CR2 575 9:35	MK AA 10:4	E 648 SDF CR2 18 700 11:40	CAE 742 FA AA 782 CR 12:22 785 13:0	Y AG: 2 AA 15 13:4	S 829 CR2 49 865 14:25	EVV 923 CAK AA 960 CR2 15:23 16:00		MOB AA 1030 CR2 17:10 17:49	ATL 1085 DSM AA 1085 CR9 18:05 18:45	CRW 1145 FWA AA CR2 19:05 1189 19:49		CAE 1259 MK AA 1259 CH 20:59 1325 22:1	2	
E7					TYS AA 6:24	384 GSP 465 7:45	CAE 501 AA 549	HSV CR2 9:09	OR 67	IG 14	BHM 750 M AA 12:30 790 1	IOB VPS CR2 AA 3:10 13:4	829 PHF 865 CR2 14:25	TYS 8937 EW AA 937 Cl 15:37 974 16:	/N R2 14	1031 TERM		MGM AA 1: 19:40	80 CR2 200 20:20	BTR AA 21:35	295 MOB CR2 360 22:40	
E9					CHS 378 AA 450	3 AUS CR9) 7:30	FW/ AA 8:49	A 529 MGM CR2 585 9:45	BTV 621 H AA 665 11	RIC 375 :05	GNV ₇₄₅ TYS 12:25 ⁷⁸⁰ 13:00	G A	SP 834 YYZ A 870 CR2 3:54 14:30		GNV 969 BTR 16:09 ¹⁰⁰⁵ 16:45	CHA 1041 AA 1091	TYS MSN CR7 AA 18:15 18:4	1123 OAJ CR7 3 1185 19:45		MKE AA 21:37	297 GSP CR2 360 22:40	
E11					ILM AA 6:41	401 SAV 465 7:45	MGM AA 8:38	518 TYS 575 9:35	CHA AA 10:44	646 PGV 5 690 11:30	745 TERM	CVG 81 AA 13:31 80	11 HSV 65 CR7 14:25	JAN 940 CF 15:40 ⁹⁷⁵ 16	W 1/ 15 TE	008 ERM	2	MLB 1132 MSN AA CR7 18:52 1194 19:54		CAK 1 AA 1 21:35 1	295 CRW CR2 355 22:35	
E13							ORI0 550	3	634 TERI	м	TLH 74 AA 81 12:28 81	48 MSN LIT CR7 AA 14 13:34 13:	A AUS A CR9 51 885 14:45	PHF AA 15:13	913 1080	D/ Cl 18:	AY R7 00	OAJ 1133 SDF AA CR7 18:53 1189 19:49	HP1 AA 20::	4 1250 ORF 3904 CR2 21:30	1321 TERM	
E15								ORIG 585	63 TEI	9 RM	CHO 732 AV AA 785 CR 12:12 785 13:0	L GPT 8 AA 8 13:37 8	817 CHA CR7 867 14:27	CHA 9- AA 15:40 10	40 GPT 000 CR7 16:40	HSV 1 AA 17:38	058 PHF CR7 100 18:20	IND 1138 CAK AA CR7 18:58 5306 19:45		LEX ₁₂₉ 6 ^A 21:36 22:1	5	
E17					ORF 38 AA 444	7 CVG CR9 4 7:24	CRW 496 GNV AA CR2 8:16 540 9:00	ROA 555 GSO AA DH3 9:15 595 9:55		659 TERM			PULL 890			SAV 1029 AA 1105 17:09	ILM CR9 18:25			TYS 1259 AA 1345	AVL CR7 22:25	

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							SGF 600 SGF	SDF MLB	JAX 720 DTW								ulululu	GPT 1270		
E19				AA 6:44 GS0	460 - CR9 - CR9 - 460 - 7:40	AA 520 CR2 8:40 560 9:20 PHF 400 GPT	AA 10:09 650 ER4 10:09 650 10:50	500 11:05 ⁷⁰⁰ 11:40 SN 645 PHF	AA 750 CR9 12:10 780 13:00 RDU 720	TERM	921	AA 929 15:29 974 1 PIT 924	CR7 6:14 LIT	AA 1020 17:06 1100	CR9 18:20	AA 5221 CR7 19:16 19:56		AA 1270 21:10 1334 PHF 129	CR7 22:14 26 PHF	
E18				AA 6:52	412 CR9 2 460 7:40	AA 490 CR7 8:10 560 9:20	A.4 10	A = 043 = CR7 A = 705 = 11:45 A = 646 = FL0	AA 739 12:19 795 1	CR9 3:15 T	ERM	AA 924 15:24 990	CR9 16:30	AA 1104 17:22 111	CR9 0 18:30	1120 CVG		AA 120 21:26 135	CR7 22:30	
E16				4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	40	PUSH	A. 10	A 640 DH3 1:46 693 11:33		IAN	827 HPN	AA 921 E 15:21 969 16:	75 09	1065	AA 18:40	1120 CR9 1185 19:45	(SP)	1100	:M GSO	
E14				AA 38 6:22 40	82 043 50 7:40	AA 560 9:20	A/ 10	A 646 E75 0:46 705 11:45		AA 13:47	827 CR7 873 14:33	970	DNIC	AA 1036 17:16 1100	CR9 AA 18:20 18:	50 1184 19:44	AA 19:59	1365	CR9 22:45	
E12				AA 6:35	395 DH3 460 7:40	AA 501 CR7 8:21 559 9:19	10:21 ⁶⁵⁵ 10:5	5	AA 749 12:29 800	CR9 13:20	842 TERM	AA 15:43	943 CR9 1004 16:44	AA 1034 C 17:14 1085 18:	R9 05	AA 110 19:26 12	0 CR9 AA 0 20:30 20:45	1245 1350	CR9 22:30	
E10					AA 424 GSO AA 470 7:50	SDF 512 HPN AA 5384 9:30	GSO AA 10:30	630 EWN 715 DH3 11:55	AA 730 CR9 12:10 779 12:59	JAX 8 AA 8 13:32 8	12 ILM CR9 75 14:35	DAY 914 AA 974 1 15:14 974 1	SAV CA CR9 AA 6:14 16:	AK 1013 GSP A CR9 53 1070 17:50		AA 1140 CR9 19:00 1200 20:00		LM 1263 AA 1355	CHS CR9 22:35	
E21						HSV 513 JAN AA 570 9:30	SAV AA 10:38	638 779	ILM CR9 12:59	DAB AA 13:40	820 MEM CR9 880 14:40	MHT 902 TLH AA 959 CR9 15:02 959 15:59	1 / 1	DSM 1018 CLE AA CR9 16:58 1070 17:50	PN: AA 18:	S 1130 GRR 50 1185 19:45		1270 TERM		
E23					ORIG 449	SRQ 484 TLH AA CR7 AA 555 8:04 540 9:00 9:15 590	AVL BHM 6 DH3 AA 6 9:50 10:13 6	13 BHM CR9 11:35	FAY 730 CHS AA CR9 12:10 774 12:54	CAK AA 13:28 865	IAD CR9 14:25	MDT 907 CMH AA CR9 15:07 959 15:59		RIC 1039 AA 1090 1 17:19 1090 1	BNA CR9 18:10	TYS 1141 SAV AA CR9 19:01 1195 19:55		1265 TERM		
E25				TRI AA 6:39	399 HHH 455 7:35	TYS 502 LIT AA 502 CR9 8:22 555 9:15	TUL AA 10:20	620 DAY 695 11:35	MYR 735 MYR AA CR9 12:15 779 12:59	GSO AA 13:33 864	3 CMH CR9 4 14:24	OKC 914 SDI AA CR5 15:14 965 16:05	F PVI 9 AA 5 16:5	^D 1011 ^{SRQ} 51 1060 17:40	DAB 1080 OKC AA CR9 18:00 1125 18:45	DAB 1 AA 1 19:36 1	176 CLE CR9 230 20:30	SDF 12 AA 12 21:25 12	285 MYR CR9 22:40	
E27				389 PUSH		MDT 488 CMH AA 550 E75 8:08 550 9:10	610 PUSH	PULL 700	MEM 727 SYR AA CR9 12:07 770 12:50	SRQ 81 AA 13:37 80	17 SAV CR9 57 14:27	BHM 910 IAD AA CR9 15:10 960 16:00		TUL 1028 IAD AA CR9 17:08 1075 17:55	GS0 AA 18:4	^D 1129 DAY CR9 49 1180 19:40		ORF 1269 AA 1340	CHA CR9 22:20	
E29				SAV AA 6:36	35	396 GRR CR9 565 9:25	CLE 6 AA 10:21 6	21 MDT CR9 85 11:25	HTS 738 AGS AA DH3 12:18 781 13:01	AUS AA 13:45	825 CHS CR9 875 14:35	ILM 93: AA 93: 15:35 98:	5 GSO CR9 5 16:25	XNA 1024 CVG AA CR9 17:04 1070 17:50		TLH 1159 AA 19:19 1210 2	GSO P? CR9 A. 0:10 20	NS 1255 DA A 1325 CH 0:55 1325 22:0	Y 19 15	
E31					ORIG 455	CHS 489 MYR AA CR9 8:09 570 9:30	OM/ AA 10:4	A 641 PIT CR9 1 705 11:45	EWN 749 G AA D 12:29 792 13	GSP 9H3 :12	GRR 845 ATL AA CR9 14:05 895 14:55	IAD 915 DAB AA 915 CR9 15:15 964 16:04		MYR 1039 BH AA C 17:19 1085 18:	IM R9 05	MYR 1140 PNS AA CR9 19:00 1190 19:50		AUS 1265 AA 1335	IAD CR9 22:15	
E33					ORIG 460	GSO 516 AA 590	JAX OKO CR9 AA 9:50 10:4	C 642 IAD CR9 12 705 11:45	GSO 738 TRI AA DH3 12:18 779 12:59	PN A/ 13	AS 836 DTW A CR9 156 885 14:45	CLE 925 AA 925 15:25 974 1	CVG CR9 6:14	PWM1030 SDF AA CR9 17:10107417:54		CMH 1156 MH AA 1205 20	T 19	CHS 1260 AA 1350	XNA CR9 22:30	
E35					ORIG 465	IAD 523 AA 595	IND AVP 61 CR9 AA 68 9:55 10:18 68	8 AVP CR9 0 11:20	AVL 732 LYH AA 732 DH3 12:12770 12:50	OI A/ 13	RF 836 MYR A CR9	CHS 930 AA 979	TYS BNA CR9 AA 16:19 16:45	LGA IAD 1005 CR9 AA 1045 17:25 17:46	1066 TUL CR9 1110 18:30	CVG 1166 AA 19:26 1215	ABE CR9 20:15	XNA AA 21:33	293 BNA CR9 360 22:40	
E38						MSY 526 AA 590	SDF DSM 61 CR9 AA 68	9 GSO CR9 0 11:20	TRI 743 ROA AA 743 DH3 12:23 781 13:01	M A/ 13	KE 836 ABE A CR9	AVP 93 AA 93 15:36 98	6 XNA CR9 5 16:25	CHS 1032 MDT AA 1075 CR9	10.50	CHS 1143 SRQ AA CR9 19:03 1190 19:50		ROA 1260 AA 1350	LYH DH3 22:30	
E36				H	HH ROA A 416 DH8	BNA 529 AA 590	DAB ABE CR9 AA	639 CVG CR9 700 U 40	LYH 752 FLO		IND 841 PNS AA CR9	MYR 933 AA 980	CHS CR9	CMH AA 10	061 MYR 100 CR9	DTW 1144 GSP AA CR9		BHM 1	292 MEM CR9 355 22.35	
E34				CMH AA 6-28	398 IND 475 7:55	SAV 496 MKE AA CR9 8-16 554 9-14	9.50 [10.59	CVG 649 XNA AA CR9 0:49 710 11:50	CMH 747 AA 804	MCI ILM E75 AA	832 MKE CR9 2 880 14:40	CVG 914 MEM AA CR9 15:14 960 16:00	10.20	17.11	18.20	MKE 1161 LA AA 120520	D 19	BNA 1 AA 1	294 ILM CR9 355 22:35	
E32				IND AA 6-51	411 DTW E75 465 7:45	MLB 527 F AA 527 S85	2NS CR9	CMH 650 PWM AA CR9 10-50 710 11-50	SAV 727 CHA AA CR7 12:07 770 12:50	15.24 [15.3	YYZ 859 AA 915	LGA MEM 935 E75 AA 935 15:15 15:25 980	MYR CR9 16-20			ABE 1146 OMA AA 1146 CR9 19:06 1189 19:49		CLE AA 21-39	1299 LIT CR9 1355 22:35	
E30						ORIG 559		DAY 654 PVD AA CR9 10:54 710 11:50	IND 732 GSO AA 732 E75 12:12 785 13:05	SDF 82 AA 13:40 8	20 DAB CR9 65 14-25		ORIG 995	ROA 1030 AA 1110	6 LYH DH3) 18:30	SDF 1168 AA 1210	DAB CR9 0:10	CHA 1 AA 1 21-28 1	288 PGV 288 CR2 360 22:40	
E28				AGS 39 AA 45	01 SDF CR2 50 7:30	GSP 498 IAD AA CR9 8-18 549 9-09	SRQ 610 AA 662	ORF CR9 1:02		SAV AA 13:50	830 RIC CR9 870 14:30	942 TER	2 M	CRW 10: AA 11: 17:30 110	50 OAJ DH3 05 18:25	PGV 1155 AA 1230	EWN DH3 20:30	IAD 1281 T AA 1221 1329 2	YS CR9	
E26						GRR 529 RD AA 529 CR 8:49 580 9:4	U XNA 6 9 AA 6 10:28 6	28 OMA CR9 80 11:20	DTW 743 ME AA 790 13	75 ROA 10 13:50	830 ROA DH3 875 14:35	EWN 906 L AA D 15:06 970 16	YH H3 :10	EWN 1044 AA 17:24 1095	ROA DH3 18:15	LYH 1139 AA 18:59 1210 2	NH DH3 0:10	SRQ 12 AA 21:3913	99 SDF CR9 40 _{22:20}	
E24				SDF AA 6:46	406 MEM CR9 470 7:50	DAB 515 SRQ AA 515 CR9 8:35 564 9:24	MHT 6 AA 10:30 6	530 STL CR9 580 11:20		SBY 81 AA 13:3985	9 CRW DH3 9 14:19	TRI 9: AA 9: 15:38 9:	38 TRI DH3 90 16:30	HTS 1038 HI AA 1085 18	H AVL H8 AA 05 18:42	1122 CHO DH3 1189 19:49		CVG 128 AA 21:22 135	2 BHM CR9 0 22:30	
E22				CHA 38 AA 45 6:29 45	9 IAD CR9 0 7:30	HTS AA 8:00	480 685	AVL DH8 11:25		FLO AA 13:48	828 EWN 865 DH3 14:25	LYH 93: AA 15:35 984	5 AVL DH3 4 16:24			CHO 1150 AA 1215	TRI DH3 20:15	JAX 1293 21:33 ¹³²⁹ 2	MH 2:09	
E20						TRI 496 HTS AA DH3 AA 8:16 540 9:00 9:19 5	59 BNA E75 99 9:59 10:27 67	27 ILM CR9 76 11:16		CRW 805 HT AA 13:25 845 14:0	S 8 5	FLO 920 ROA AA 965 16:05	A 3 5	CHO ₁₀₂₁ FLO 17:01 ¹⁰⁵⁵ 17:35	ROA AA 18:43	1123 ROA DH3 1184 19:44		MDT 128 AA 21:29 134	AVP CR9 22:20	
E8						LIT 525 MHT AA 5089 9:30	MYR 622 AA 10:22 670	SAV CR9 11:10		AVL AA 82 13:42 85	2 CHO 2 DH8 9 14:19	GSP 933 AA 15:33 976	PGV DH3 16:16			AGS 1149 AA 1209 2	LO 0H3 09	LIT 127 AA 135	8 JAN CR9 5 22:35	
E6						PNS 518 OKC AA 518 CR9 8:38 560 9:20	FAY 607 AA 674	ROA DH3 11:14		HI 13	HH ₈₃₆ HHH ::56 ⁸⁷⁰ 14:30	ROA 94 AA 15:41979	1 AGS M DH3 A 9 16:19 10	4DT 1016 IND AA E75 6:56 1070 17:50		TRI 1140 SBY AA DH3 19:00 1190 19:50		MYR 1259 CV AA CH 20:59 1325 22:1	G 19 05	
E4						DAY 531 FA AA 531 CR 8:51 580 9:4	Y 0 9 A 0 10	RF 647 ^{MEM} A CR9 0:47685 11:25		BNA AA 13:42	822 GSO E75 885 14:45	940 959		GSO 1019 CMH AA E75 16:59 1070 17:50		FLO 1 AA 19:40	180 HTS DH8 230 20:30	IND 12 AA 21:3913	99 MDT E75 40 _{22:20}	
F1						517 TERM	ME AA 10:4	M 643 DSM 680 CR9 11:20			RIC 842 OMA AA E75 14:02 895 14:55	GSO AA 15:30 987) YYZ E75 16:27	MSY 1028 JAX AA E75 17:08 1079 17:59	ILN AA 18::	M 1130 IND 50 1185 19:45		OAJ 128 AA 135 21:24	4 EWN DH3 0 22:30	
F2						LYH 492 TF AA 580 DH 8:12 580 9:4	63 0 TER	1 XM						HHH 105 AA 17:31 109:	1 TRI DH8 5 18:15			LYH AA 1286 DF 21:26 1325 22:0	A 13 05	
F3				C' A. 6:	VG 416 MYR A CR9 56 460 7:40	CHO 495 LYH AA DH3 8:15 575 9:35	н	HH ₆₄₇ CRW 0:47 ⁶⁷⁹ 11:19								ORIG 1184	TR AA 20:	1253 4925	TRI DH8 22:25	
F4						EWN 512 SBY AA 512 DH3 8:32 560 9:20	RI A.4 10	C 645 CLE CR9 :45 695 11:35					SGF AA 16:5	F 1011 SGF 51 1070 17:50		1135 TERM		HHH 1275 AA 1340	HHH DH8 22:20	
F5						ORIG 530 0000000000000000000000000000000000	2R9 0:45	ORIG 710										YYZ AA 21:22 13:	32 MSY 55 22:35	
F6						FLO 523 EWN AA 523 DH3 8:43 564 9:24		645 TERM										CMH 1274 AA 1330 2	YZ E75 2:10	
F7						CMH 516 YYZ AA 516 E75 8:36 567 9:27		IAD 670 SAT AA 715 CRS 11:10 715 11:55										ORIG 1325		
F8																				
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07			ORIG 360			515	UA 582 CR7 9:42 10:22	11:06 11:36	BKW	DL 794 LGA 13:14 3642 14:00	UA 3315 E7 14:24 15:0	70 12	16:4 ⁴	1006 4843 17:21 17:4	1069 12 7349 9 18:20	DL 1158 LGA DL 1158 CR7 19:18 6227 20:00		1271 TERM		1410 TERM
O8			ORIC 369	J ORIG 420		B:35 3840 9:15		LGA	VC 12:00		720 1025		BK EN 17:	1050 1075		1135 IAD 8:55 ⁶¹⁶⁰ 19:30				1379 TERM
O9				ORIG 425	0.0.0	8:34 3648 9:09	9:57 ³³⁹⁹ 10:30	DL 674 C 11:14 5069 12:	R7 00		$14:09^{6120}$	DL 906 LGA DL 5099 16:00		DL 1032 LGA DL 1032 CR7 17:12 5135 18:00				1281 TERM		1379 TERM
O10					ORIG 460	BKW BKW 515 8:35 ⁵⁴⁵ 9:05	MSP 63:	2 MSP 7 11:07	712 EWR					UA 1034 1/ UA 6285 19-	TW 05					

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Date:04/11/2019 Time:13:00

	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
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O11							OR 44	RIG 45			YYZ 10:37 ³⁴	YYZ				1		EWR ₁₀₄₀ EWR 17:20 ¹⁰⁷⁶ 17:56				1281 TERM		
O12																								
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HS							La construction de la constructi				<u></u>				1	1	11							
R01	CLT AA 0:00								O379 O380*								L 17	HR 333 1:10		DCA AA 19:32		T447 T448		CLT 319 23:55
R02	CLT AA 0:00								O377 O378*								FCO 333 16:55			ROC AA 19:47	,	T457 T458		CLT 319 23:55
R03	CLT AA 0:00						O375 O376							ROC 319 13:50			FC A/ 16	0 55			*T461 T462			CLT 333 23:55
R04	CLT AA 0:00						O373 O374						BWI 319 12:34		DCA AA 14:08				T- T-	453 454				CLT 319 23:55
R05	CLT AA 0:00					O359 O360					IAH 320 10:34						IAH AA 16:15			-	Г459 Г460			CLT 319 23:55
R06	CLT DL 0:00			O391 O392			SLC 320 7:00					MCI AA 11:08					PSH 1793					CLT 319 21:40	ORD UA 22:52	T465 CLT 73G T466 23:55
R07	CLT AA 0:00				O361 O362					LGA 321 9:10	BNA AA 10:41							T439 T440					i	CLT 320 23:55
R08	CLT UA 0:00		O38 O38	81 82		ORD 73G 6:03		DEN AA 7:17								T435 T436								CLT 321 23:55
R09	CLT AA 0:00						i			O36 O37	9 0									PVD 321 19:44	MIA AA 20:00	T44 T44	5 6	CLT 321 23:55
R10	CLT DL 0:00			O389 O390				MSP 717 7:20			FLL AA 10:43							T449 T450						CLT 321 23:55
R11	CLT DL 0:00			O383 O384				ATL 738 7:30			OR AA 10:-	8						T451 T452						CLT 321 23:55
R12	CLT AA 0:00							O363 O364								LGA 321 15:25		EWR AA 17:41			T437 T438			CLT 321 23:55
R13	CLT AA 0:00					O367 O368						EWR 321 11:25							DEN AA 18:01		T4 T4	141 142		CLT 321 23:55
R14	CLT AA 0:00					O365 O366					LAS 321 10:35										LAX AA 20:25		T443 T444	CLT 321 23:55
R15	CLT DL 0:00		0 0	387 388			ATL 73H 6:15		LC A/ 8:5	iA A 53				PSH 565				CLT 321 17:45		DFW AA 19:45		T455 T456		CLT 73H 23:55
R16	CLT AA 0:00									O371 O372										JFK 73H 19:15		ATL DL 21:48	T467 T468	CLT 73H 23:55
R17	CLT WN 0:00		O385 O386			MDW 73W 5:45				MKE AA 9:25	PS 7	H 5	CLT CR2 12:30						SDF AA 18:21		PSH 1350	CLT CR2 21:55	A D 2	TL T463 CLT DL 73H 23:06 T464 23:55
R18		MDW WN 1:20		1	PSH 3773		CLT 73W 6:55					BTR AA 11:09						T479 T480						CLT CR2 23:55
R19	CLT AA 0:00					O401 O402					CHA CR2 10:39	PHF AA 11:14						T481 T482						CLT CR2 23:59
R20	CLT AA 0:00					O409 O410						HSV BHM CR2 AA 11:15 11:34						T483 T484						CLT CR2 23:55
R21	CLT DL 0:00			O395 O396			LGA F CR9 A 6:25 7	PHF AA 7:05	PSH 590	CLT CR2 9:15				HSV AA 13:00					T475 T476					CLT CR2 23:55
R22	CLT AA 0:00						O3 O4	399 400							IND CR2 14:15			FWA AA 17:46			T47. T474	3 4		CLT CR2 23:59
R23	CLT AA 0:00					O397 O398						FPO CR7 11:10		M A 1:	IGM A 3:53				T48 T48	5 6				CLT CR2 23:59
R24							N A 7	MYR AA 7:04	I	PSH 700	((11	LT R9 05			TYS AA 14:26					T487 T488				CLT CR2 23:59
R25	CLT AA 0:00							O403 O404								LEX CR7 15:35		FPO AA 17:23			T477 T478			CLT CR7 23:59
R26	CLT UA 0:00			O3 O3	93 94			DEN E7W 8:00			GSP AA 10:4:		PSH 890		CLT HPN CR7 AA 14:15 14:37					T489 T490				CLT CR7 23:59
R27										CAK AA 9:12				PSH 1065			((17	2LT 2R7 1:10				LGA DL 21:46	T469 T470	CLT CR9 23:59
R28										JAN AA 9:12							T495 T496							CLT CR9 23:59
R29												ILM AA 11:06						T497 T498						CLT CR9 23:59
R30	CLT AA 0:00							04 04	105 106							STL CR9 16:00	SAV AA 16:17				T493 T494			CLT CR9 23:59
R31	CLT AA 0:00										O411 O412											IND CV E75 DI 21:30 21	G T471 56 T472	CL1 CR1 23:55
R32												FLO AA 11:20						T501 T502						CLT DH8 23:55
R33	CLT AA 0:00									O407 O408									CI 1 19	MH MCI E75 AA 9:09 19:30		T499 T500		CL1 E75 23:55
R34																								
R35																								

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CLT 2016 Gating Scenario 3

	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
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AADO																								
A21							BWI 3 AA 4 06:36 4	396 JFK E 320 A 450 07:30 0	WR 475 A 560	PBI 320 09:20	MSY AA 10:24	624 ST 32 710 11:50	T TPA 726 AA 726 12:06 790	BOS TPA 321 AA 13:10 13:28	808 MSP 890 320 14:50	FLL 905 ATL AA 905 320 15:05 959 15:59			BWI AA 18:39	1119 1220	FLL 320 20:20	MCI AA 21:40	1300 ORF 319 1360 22:40	
A22									BOS AA 08:28	508 FLL 590 09:50	DCA AA 10:32	632 R 715 11	SW 320 1:55	PHL 798 AA 798 13:18 865	PBI 320 14:25		R A 10	SW 1015 BWI A 320 6:55 1065 17:45				MSP 1264 PV AA 1325 22:0		
A23							06:45	C4 ORIG 450 07:30	BWI 50 AA 57 08:20 57	00 TPA 320 75 09:35	ATL 61 AA 685	2 GCM 320 5* 11:25	ATL 722 AA 792 12:02 792	LGA BWI 8 320 AA 8 13:12 13:30 8	10 FLL 320 70 14:30			PHL 1036 AA 17:16 1733	MCO 752 18:20	ATL 1142 AA 1225	SAT 320 20:25	ATL 1276 1 21:16 1330 22	AH 1349 20 10 TERM	[
A24									CLTSC4 ORIG 08:29 554	MSY 09:14	AA 6 10:20 6	520 AUA 320 90* 11:30	JFK 7 AA 12:30 81	50 CUN PH 320 A. 10* 13:30 13	$\begin{array}{cccccccccccccc} & & & & & & & & & & & & $	MSP 925 AA 985	RSW 320 16:25	1AH 1035 ATL 17:15 ¹⁰⁷⁰ 17:50		PBI 1134 PH AA 1205 20:0 18:54 1205 20:0	AA 122 AA 122 20:29 127	9 ATL PHX 320 AA 9 21:19 21:50	1310 RDU 321 1365 22:45	
A25									RSW 4 AA 08:28 4	508 ATL 320 413 09:35	SYR 611 AA 663	MSY 319 11:03	BOS 724 AA 800	MIA 321 13:20		SFO 903 AA 984	TPA LGA 321 AA 16:24 16:44	1004 PHX 321 1065 17:45	LGA 1082 MSY AA 1135 320 18:02 1135 18:55	FLL 1152 AA 1220	BWI 320 20:20	LAS 1280 AA 1280 21:26 1790	PHL 321 22:25	
A26							LAS AA 06:10	370 LAS 658 08:00	ATL 501 AA 560 08:21 560	MSP 320 09:20	10:34	4 ORIG 679 11:19	ORD 717 PHD AA 321 11:57 780 13:00	MIA 1 AA 0 13:35	815 ORD 2080 321 14:50	TPA 9 AA 15:27 7	27 LAX 1 321 / 25 16:40 1	PTT 1017 AA 1100 16:57 1100	SMF 321 18:20	MSY 1154 AA 1215	JAX 319 20:15	SEA 1280 AA 1280 21:26 1340	RSW 321 22:26	
A27							SEA 3 AA 06:15 4	75 SAN 321 70 07:50	PVD 492 AA 565*	SXM 320 09:25	LGA 60 AA 70 10:00 70	0 PLS 321 0* 11:40	DEN 723 TP AA 723 32 12:03 782 13:0	A ORD 8 21 AA 8 32 13:23 8	03 PHX 321 75 14:35	MCO 9 AA 15:25 6	025 LAS 321 537 16:45	TPA 1 AA 1 17:20 1	040 LGA 321 120 18:40	RDU 1135 RSW AA 1200 20:00 18:55 1200 20:00		FLL 1281 AA 1340	LAX 321 22:20	
A28							PHX 369 AA 460 06:09	MCO 321 07:40	493 PUSH	CLTSC4 LGA 09:10 595 09:55	RDU AA 10:38	638 IND 690 11:30						CLT: 17:4:	SC4 DFW ORE PULL AA 5 565 18:30 18:4	0 1125 LA 5 643 20:0	AS SJU 21 AA 05 20:23	1223 D 1330 22	21 10	
A29						ALTON DEL	PDX 37 AA 46 06:14 46	74 1PA 321 55 07:45	AA 481 08:01 585	LAX 321 5 09:45	BOS AA 10:19	619 MIA 705 11:45	PHX 726 AA 726 12:06 789 1	PIT LGA 321 AA 13:09 13:37	817 MCO 321 885 14:45	LGA 900 AA 975	21 16:15	0.0	-	AA 1151 11 19:11 1206 20:0	PA PHL 19 AA 06 20:40	1240 472	321 12:15	
A1						05:15 ³⁶⁰ 06:00	AA 06:26	386 0kb 321 475 07:55	08D 5 AA 08:20 6	00 PHX 321 80 09:40	AA 60: 10:05 690	5 MBJ 321 * 11:30		AA 13:45	825 PHL 321 885 14:45	AA 900 PH AA 559 16:0	21 AA 05 16:46	1006 0K 1908 18:0	21	PHL 1145 AA 19:05 844	20:27 20:	A 1252 1335	321 12:15	
A3							AA 362 06:02 408	321 07:30	AA 482 08:02 565*	MBJ 321 09:25	AA 10:35	635 F 715 11	AA 734 1:55 12:14 1878	321 A. 13:15 13	A 832 321 A 895 14:55	DEN 92 AA 92 15:24 99	4 911 95 16:35	AL 1017 AA 1090	18:10	AA 1155 R 19:15 1210 20	319 0:10	AA 1262 21:02 1340	321 22:20	
A5							AA 364 06:04 450	321 07:30	AA 5 08:22 5	502 321 580 09:40	AA 10:32	632 FO 710* 32 11:50	DFW 74 AA 74 12:27 80	7 321 4 13:24	V	AA 920 15:20 984	321 A. 16:24 10	A 1014 3 5:54 1085 18	321 A/ 8:05 18	$\begin{array}{c} 1129 \\ 32 \\ 349 \\ 1205 \\ 20:0 $	21 05	AA 1264 21:04 557	321 22:20	
A7							AA 370 06:10 1993	321 07:35	DFW AA 08:34	514 321 590 09:50	MIA AA 10:29	629 DEN 321 521 11:45	AA 724 ACC AA 32 12:04 781 13:0	1 AA 1 13: 14 DEN 2011	X 830 1PA 321 50 890 14:50	AA 15:35	935 SFO 321 705 16:40	AA 1020 17:00 1090	321 18:10	AA 1147 MCI AA 319 19:07 1200 20:00	Acti	PHX 1276 AA 1276 21:16 1345	321 22:25	
A9							hee		AA 490 08:10 565*	321 09:25	10:11 685	1 CON 321 * 11:25	AA 725 3 12:05 785 13:	AA 801 319 AA 801 :05 13:21 860	MIA 321 14:20	LAS 908 E AA 15:08 970 16	305 321 6:10	AA 1020 17:00 1090	321 18:10	LAS 1135 M AA 18:55 2075 20	321 0:10	AA 1263 B 21:03 1329 22	21	
A11							AA 06:44	404 LGA 321 479 07:59	08:31	511 DEN 321 575 09:35	AA 10:31	631 SJU 321 705 11:45		AA 81 13:30 80	10 DFW 321 55 14:25	AA 970 16	321 AA 6:10 16:31	991 DFW 321 1060 17:40	c DEN	AA 1154 19:14 1229	321 20:29	AA 1273 21:13 1339	321 22:19	
A13							06:15 420 07:00	MCI	AA 490 08:10 565*	321 09:25	AA 61 10:13 68	3 321 5 11:25	AA 718 A05 AA 319 11:58 774 12:54	13:31 8	11 1074 321 66 14:26	AA 905 321 15:05 960 16:00	OPD	AA 1030 17:16 110	6 321 5 18:25	DEW DEW	321 20:20	AA 1269 1 21:09 1330 22	21 10	
A12							AA 3 06:17 4	470 07:50	AA 08:10 564	321 09:24	AA 10:13 205	321 3 11:20	AA 731 12:11 100	73H 13:19		AA 916 15:16 1453	73H 16:25	PHY 1022	AA 1091 18:11 1150	321 AA 19:10 19:35	1175 10A 321 1240 20:40	TERM	acal	
A10							20	7	AA 08:11 559	321 09:19	AA 10:18 6	321 35 11:25	AA 12:23 800	3 LWK DTW 73H AA 6 13:26 13:45	825 312 319 880 14:40	AA 15:05 985	73H 16:25	AA 17:13 678	321 18:16	AA 19:20 1220	321 20:20	AA 21:20 1334	319 2:14 SP	
A8							TER	2M	AA 08:43	525 321 585 09:45	AA 10:26	626 321 690 11:30	AA 3 12:09 784 13:	AA 13:27 E	319 375 14:35	15:25 970 16	6:10 DCA	050 ³²¹ 17:30		AA 32 19:07 1205 20:0	21 05	AA 21:12 1330 22	21 10 TPA	
A6							AT	L 412 ATI	08: 08:	50 575 09:35	AA 10:37	637 321 700 11:40	AA 12:19 1950	319 13:15 D IAH MEM	AA 840 14:00 2249	73H AA 15:15 15:30 1	000 16:40	TERM	SIL	AA 321 18:59 1195 19:55	195	AA 1278 21:18 1335	321 22:15	
A4							AA 06::	412 32052 480 $08:00$	AA 509 08:29 555	319 09:15	TERM	4 LAS	AA 12:28 800	8 319 AA 0 13:20 13:39	819 319 880 14:40	BDL 002	DTW	TERM	AA 18:35	1115 321 1170 19:30 TE	ERM	AA 12/3 21:13 1384	73H 12:15	
A2									AA 08:40	526 321 6 569 09:29	10:35 CLTSC	680 11:20	AA 712 319 11:52 765 12:45	AA 8 13:31 8	319 370 14:30	AA 15:02 990 8SW 002	319 16:30 PVD	IND 1021	STI	1160 TERM	EWR	AA 128 21:27 127	7 73H 7 22:30	
B1							ТРА	ADC RDU	IFK c	10 MIA	10:35	680 11:20	EWB 745	319 AA 13:15 13:37	817 319 870 14:30	AA 903 15:03 990	319 16:30	AA 17:11 1105	319 18:25	TERM BOS	AA 20:36	1236 1608 22	3H 10 ROC	
B3							AA 06:46	406 319470 $07:50$	AA 5 08:30 1	48 09:30	TERM	11:25 73	RIG 2010 30 12:10	A/ 13	831 319 51 895 14:55	BWI 015	BDI	AUS	e BDI	AA 19:45	1185 319 1233 20:33	AA 1264 21:04 1336	319 22:16	
B5							RIC	AA 422 319 07:02 479 07:59	AA 496 08:16 2529 09	73H 9:06 BUF	TERM	CIO DEW	AA 12:23 792	319 13:12	AA 836 319 13:56 895 14:55	AA 15:15 980	319 16:20	AA 103: 17:15 1105	5 319 5 18:25	19:44	ORIG 112 1229 20:29	AA 20:57 1345	319 22:25 BIC	
B7							AA 3 06:34 4	50 07:30	AA 08:08 550	319 09:10	AA 10:4 MDT	642 73H 12 330 11:35	AA 3 12:17 785 13:	319 :05	AA 842 319 14:02 895 14:55 BOS	AA 913 15:13 975	319 16:15	AA 17:13 1100	319 18:20	AA 19:09 1390 20	73H AA 0:10 20:38	1238 1360	319 22:40 ORD	
B9							EWR	407 EWR	AA 08:4 BDL	527 73H 7 595 09:55	AA 10:33 EWR 602	633 31 710 11:5	9 0 CLTSC4	AA 800 13:26 855	319 14:15 TSC4 ROC	AA 15:44	944 319 1005 16:45 SYR	AA 1021 1 17:01 1085 18 BWL 1027	319 8:05 RDU	AA 1150 19:16 2483 20 BNA 1164	73H AA 0:10 20:39 BUF	1239 1355 PBI 1275	319 22:35 SYR	
B11							AA 06:47	407 73H 465 07:45	AA 5 08:21 5	501 319 580 09:40	AA 10:02 1458	73H 11:05	12:34 ORI	IG 13:19 13:	ORIG 50 875 14:35	AA 920 15:20 979 BNA 014 F	319 16:19 RIC	AA 17:07 1090	319 18:10 ORD	AA 1164 19:24 1215	319 20:15	AA 1275 21:15 1340	319 22:20	
B13							SFO 274	DEN	AA 08:41 RIC 405	521 320 580 09:40	AA 10 BUF 6	44 700 11:40	PHL 710 PHI	TERN	1	AA 914 : 15:14 969 16 PHL 0	319 309 27 PBI	RDU 1024 P	AA 18:04 WM	1084 319 1200 20:00		BUF 1258	9 M ALB	
B15						(cu	AA 455	321 07:35 BOS 422 BNA	AA 493 08:15 570 JAX 400	* 319 * 09:30 7 DCA	AA 6 10:14 6	90 11:30	AA 719 E90 11:59 2054 13:00	0		AA 9 15:37 9 ATL 008 JAX	90 16:30	AA = 1024 17:04 = 1085 18 1010 = DCA	319 8:05	TERM CLTSC4nco JFK		AA 1258 20:58 1335 ALB 12	319 12:15 22 ATL	
B16						05:5	50 395 06:35	AA 452 319 07:12 480 08:00	AA 570 08:17 570 MEM) 319) 09:30 523 RSW	AA 10:19 MCI	695 11:35				AA 908 319 15:08 959 15:59	AA 16::	50 1070 319 50 1070 17:50		19:15 1200 20:00		AA 12 21:22 13	52 319 50 22:40 PIT	
B14						CLTSC4	AA 06:42	455 _{07:35}	AA 08:43 BUF 488	595 319 09:55	AA 10:28 AUS	639 A	ALB			DTW q	1793	CA 1014 IAH		STL 1150 MEM	R	RIC 1255 A	319 22:25 US	14
B12						05:20 365 06:	05	CLTSC4 BOS	AA 100 08:08 559 IND	319 09:19 524 BDL	AA 10:39 PWM	633 ATL	319			AA 15:39 9 MSY 020 BN	319 A. 090 16:30 16	A 319 5:54 1074 17:54 CLE 1019 RIC	PIT	AA 1190 319 19:10 1200 20:00 1124 PIT	A 20 D	AA 1255 10:55 1330 22 DTW 1255 LG/	19 10 1350	TE
BIU							CLTSC	07:05 470 07:50 C4 07:50	AA 08:44 DCA 5	590 319 09:50 08 CHS	PBI 610	699 319 11:39 PHL				AA 966 31 15:30 966 16:0 RIC 9,	06 41 ALB	AA 319 16:59 1074 17:54	AA 18:44	4 1194 319 19:54 1AH 116	55 RIC	1324 22:0 1285	TERM	1
Bõ							06:45 CLTSC	450 07:30 C4 DCA	AA 5 08:28 5	70 09:30 518 NAS	10:10 675 STL	627 DCA				NAS 910	84 16:24 BUF	NAS 1024	PIT	19:25 123	319 20:30	TERM DCA 12	39 JAX	
							06:45 CLT	450 07:30 TSC4 FLL ORIG FLL	08:38 PIT	580 09:40 515 IAH	10:27 SAT	690 11:30 639 MCl				15:10 989	16:29	17:04 1095	18:15			21:29 13 1272	55 _{22:35}	
D4							06:5	⁴⁵⁵ 07:35	ILM 484 PHI	575 09:35	ROC 614	700 11:40 CHS										TERM MSY 1280	BUF 319	
									08:04 1839 09:00 CLE 51	0 MEM	10:14 674 PIT 62	11:14 0 DTW 319				935						IAH 1270	22:25 PBI	
									08:30 56	54 09:24 L 531 PIT 319	ALB 62	30 11:20 23 RDU 319				TER	M			1147		21:10 1331 2	11	
04									08	:51 585 09:45	10:23 6	30 11:20								TERM				
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010																								
C14																								
C16																								
AAIN														 	 									
11							CI	LTSC4 MBJ									MB	J *1010 TPA	GCM *	1094 BNA 320	CUN *1229	LTSC4		
12							06	6:55 07:45 CLTSC4 PUJ ORIG 475*							M	BJ *893 R	16: DU CUN 320 AA	*1000 BOS	18:14 SXM AA	*1120 DCA 1185 320	20:29 1ERM AU. AA	A *1250	BWI 320	
		I	1		1			07:05 07:55	1	1	1			1	14	1:53 970 16	5:10 16:40	10/5 17:55	18:40	1100 19:45	20:5	50 1350	22:30	

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Date:04/11/2019 Time:12:51

CLT 2016-Scenario 3

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	ntulutu	hilulutu	hitulutu	hilululu	hilitu	utulutu	hutulutu	hitulutu	hutulutu		hitulutu	անսիսն		hinhitu	hutulutu	htulutu	սեսիսես	ntulutu	hutulutu	utulutu	utulutu	ntulutu	ntulutuli	ստեսն
13									+		CLTSC4	RIG SXM			+		PUJ AA 16:21	*981 ^E 1711 18	WR F 320 A 8:05 1	^{LS} *1135 A 8:55 1215	MCO 321 20:15			
14											10.00						10.21			ABJ *1136 AA 1215	MIA 321 20:15			
15																		PUJ _{*1}	062 095 18:15 095 18:40	*1120 PBI 321 1195 19:55	SXM *1224 20-24 TERM 21	SC4		
16																		17.42	MEX AA	*1115 MDT *1189 10:40	PUJ CLTSC4 *1216 20.16 TERM 21.01			
17																			18.55	19,49	20.10 21.01			
18																								
l10																	LHR AA		*975 732*	1	LHR 333			
l11															CDG AA	*:	335		CDG 332		20:15			
112														DUB AA	13:55 785 704#		FRA CI 332 AJ	TSC4 ORIG	18:20 FCO 333					
I13														13:05	/04	MAD AA	16:35 16 *95	0 D	18:25 DUB LHR *1 332 AA TE	110 CLTSC4 333				
114														FRA AA	*780)	MAD 332	CLTSC4 OR	IG LHR 333	19:30				
I15														13:00	/48	FCC	16:40 *955 CLTSC4 333	17:10 112	BCN AA	*1100	BCN 332			
OADO																15:5	5 I EKIVI 16:55		18:20	1243	20:45			
01	ATL DL		22	2		ATL M90	CLTSC4 ATI ORIG 420	CLTSC4 N ORIG 485	ASP	DTW ₅₄₄ DTW 579		ATL 676 AT	TL ATL 753 17 DL 109	ATL ATL 717 DL	822 ATL 320	ATL 904 ATL DL 2123 M88	MSP DL 15	00 DTW AT 24 320 DL	L 1070 ATL M88	ATL 1149 AT DL 1407 M8	L. 88	1268	1346 TEDM	14
02	00:22		82:	3		05:30 CLTSC4 ORIG 360	06:15 07:00 W	07:20 08 07:20 08 08 08 08 08 08 08 08 08 08	ATI DL	L 528 ATL 2422 M88		11:16/2/01/12:0	DTW 727 DTW DL 1620 319	13:15 13:42	2597 14:30 MSP 864 1503	DTW 94 DL 17	16:40 MSP 319	17:20 17	:50 820 18:45	19:09 1407 20:0	15	IEKM	IEKM	1387
03						05:15 06:0	00	07:00 07:45 CLTSC4 ORIC 495	G ATL	48 2422 09:30	ATL 603 ATL DL 1454 M90		12:07 1029 12:50		14:24 14:59	15:40 1 /	ATL 978 ATL DL 2651 M88		DTW	DTW				1400
04						CLTSC4 IAH ORIG 350		07:30	08:15	ORD 566	10:03 14:34 10:45 ORD 73G			ORD 780 ORD 319		DEN 897 UA 1100	16:18 2031 17:00 DEN 320		18:40	19:15				1399
05						05:05 05:50	CLTSC4 ORIG 408			09:26 521	10:15			13:00 1140 13:45		14:57 1199	16:22						1332	IEKM
06	4	10				CLTS	06:03 06:48 ORIG MDW C	LTSC4 BWI		BWI 575	DAL						MD	MDW 1010	HOU_HOU	AL 1135 BWI			IEKM	
013	PU	SH				05:45	5 06:30 0	6:55 07:40		09:35	10:10 JFK 601 JFK B6 218 E90	BOS BOS B6 659 E90					16:5	BOS 1038 BO B6 1446 E9	17:55 ¹⁴⁷³ 18:30 [1 IS JFF 00 B6	8:55 ¹⁷²¹ 9:30 JFK 1130 E90				
014											10:01 2 18 10:40	10:59 11:36						17:18 1440 18:0	18:	50 1100 19:28				
018						DEN F9	310	DEN 319					MCO 743	PHL PHI 321 F9	L 830 MCO 1020 321						ORD F9	243 ORD 320		
019						05:10	200	07:20					12:22 168	8 13:24 13:	49 1029 14:49						TTN 1225	1207 21:30 TTN 319		
020																					20:25 932 2	1:10		
027																								
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OAIN																								
121																	MUC LH	*980	MUC 346					
122																	16:20	1113.	18:35					
AEDO																								
D13									ORIG	530 PUSH		659 TERM	PULL 785	DAY	823 ORF 880 CR2	ORF 907 AA 985	GSP CR2	SDF AA	6		1066		CHO CR2	
D12							PHF AA		390 590	VPS CR2	LEX AA	640 780) BHM CR2	13:43 BTF 2 AA	R 827 DAY CR2	SDF 917 AA 005	INCES	H 1015	AVL CR2	HSV 110	61 HPN A ¹ CR2 A.	VL 1255 A 1361	MGM CR2	
D10							GSP 357 DCA	PHL 418 CAE AA 465 CR2	ВНМ	09:50 51	0	FAY CR2	TYS AA	740 870	BHM CR2	FAY 926	16:35 16 IND AVI CR2 AA	1012 CA CR	18:30 E VPS 12 AA	1118 PHF 1190 CR2		1238	22:41 CAE CR2	
D8							CHO AA	383 549	08:30	BTR DCA CR2 AA	564 674	AGS CR2	CRW 735 AA 790	FWA FAY CR2 AA	825 TYS cr2 875 1425	MLB AA	044 JAN CR2 095 16:20	TYS 1030 C AA 1084 C	AK (R2 -04	CAK 1158 AA 1225	GNV CR2 20:25	VPS 1266 AA 1350	AGS CR2 22:30	
D6							00.23	547	T	09.09 109.24 FLH AA	533 695	EVV CR2	PGV 725 LEX AA 725 CR2	MOB AA	822 LEX 865 LASS	LEX AA	955 VPS 5 1005 CR2	CAE 1023 AGS AA CR2 17-03 1075 CR2	ORF	1123 AGS 5398 ID 12	LGA BTV AA 1200 E75 20.00 1240 20.46	AN 1258 AA 1335	BTR CR2 22:15	
D4							CA	E 410 BHM CR2 50 455 07-35	HPN AA 09-22	502 AGS 585 CR2	YUL 606 AA 695	GSP CR2	GSP 737 AA 790	TLH CR2 13:10	ORIG 890	OAJ 933 AA 979	MGM CR2 16-19	PHF 1042 AA 1094	LEX CR2 18:14	BHM 1163 AA 1225	YUL CR2 20.25	GNV 128 AA 134	0 LEX 0 CR2 5 22-35	
E1							06:	ORIG 455	MOB AA	522 GSI 599 CR2	P CAE 621 AA 679	MYR CR2	CLE 725 GNV AA 770 CR2	13:10	CHA 841 VPS AA 880 CR2	HSV 920 BHM AA 965 CR2	16:19	FAY 1025 GNV AA 1075 CR2	GSI AA	1129 MKE F	AY 1199 HSV AA 1199 CR7 AA 1240 20 40	1275 TERM	22:35	
E2							GP A/	V 412 LEX 52 450 07-20	PGV 491 AA 550	PGV CR2 09:19	VPS 606 AA 678	TYS CR2	OAJ 725 CHO AA CR2 12:05 769 12:00		MYR 841 AVL AA CR2 14:01 880 14:00	CHO 930 C/ AA CI	1E 22	LEX 1045 AA 1045	5 CHO CR2 5 18:15	YYZ 1157 C AA 1210	CAE CR2	DAY 1 AA 1	291 EVV CR2 360 22:40	
E3							06	DAY CLE AA 434 CR2	AGS 50	01 OAJ CR2	EVV 623	JAN CR2	AGS 736 OA AA 780	J 2	PGV 847 FAY AA 847 CR2	CAE 922 HSV AA 922 CR2		BHN	1065 CR2	EWN 1145 FAY AA CR2	MEM MLB AA 1205 CR9 1245 CR9	CHO 1268 AA 1335	TLH CR2	
E5								CAK 428 CHA	LEX AA	510 MOB 575 0025	MK AA	E 648 SDF CR2	CAE 742 E AA 742 C	AY AG R2 AA	iS 829 CR2	EVV CAK AA 923 CR2		MOB MOB AA 1030 CR2	ATL DSM AA 1085 CR9 18:05 1125 10.44	CRW 1145 FWA AA CR2	20:05 20:45	CAE 1259 MR AA 1259 CH 20.59 1325 CH	E 2	
E7							TYS	384 GSP 465 CR7	U8:30 MGM AA	518 TYS 575 CR2	OR	IG 74	BHM 750 AA AA 700	13: MOB VP: CR2 AA	49 14:25 S PHF 829 CR2 40 865 14:20	15:23 16:00 TYS AA 937 6 974	WN CR2	1031 TERM	18:05 18:45	MGM AA 118 AA 122	VPS 0 CR2 20 20:20	BTR AA	295 MOB CR2	
E9							CHS 378 AA 450	AUS CR9	08:38 FW AA	VA 529 MGM A 585 CR2	BTV 621	RIC E75	GNV 745 780	s (13:	49 14:25 3SP 834 YYZ AA 870 CR2	[15:37 1]	GNV 969 BTR	CHA 1041	TYS MSN CR7 AA	1123 OAJ 1185 CR7	20:20	21:35 MKE AA	1297 GSP CR2	
E11							06:18 450 ILM AA	401 SAV 465 CR9	CAE 501 AA 540	HSV CR2	10:21 003 11 CHA AA	646 PGV CR2	12:25 T 13:00 745 TEDM	CVG 8 AA	11 HSV CR7 65 UCR7	JAN 940 975	16:09 16:45	008 FRM	18:15 [18:43 M A/	^B 1132 ^{MSN} CR7		21:37 CAK 1 AA 1	295 CRW 255 CRZ	
E13							06:41	07:45	08:21 349 (ORI	IG	10:4 634 TED	M	TLH 7 AA	48 MSN LI CR7 A/	T 831 AUS A 885 CR9	PHF AA	913	DA	18 Y O 7 A	AJ 1133 SDF AJ 1189 CR7		1265 TERM	22:35	
E15									330	ORIG	63 TEI	9 RM	CHO 732 A AA 785 C	13:34 13 VL GPT R7 AA	817 CHA CR7 867 14.22	CHA AA	940 GPT 000 CR7	HSV 10 AA	058 PHF CR7 100 18-24	IND 1138 CAK AA CR7 1855 5306 CR7		LEX.IVI LEX_CA 1296	ĸ	
E17							ORF 38 AA 44	7 CVG CR9 4 07-24	CRW 496 GN AA 540 CR	ROA 555 GSO AA 505 DH3	610 PUSH	ORIG 5593	12:12 703 13:	13:37	PULL 800	15:40	16:40	SAV 1029 AA 1105	ILM CR9	16.38 5 5 5 6 19:45		121:36 22:1 TYS 1259 AA 1345	AVI. CR7	
		I	1	I	1	1	06:27 44	• 07:24	08:16 540 09:0	09:15 2 7 2 09:55	10511	5575	1	1	0/0			17:09 1105	18:25			20.39 1343	22:20	

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	htulutu	huhuhut		ntulutu	ulululu	ntulutu	ntulutu		hililili	ntuluti			hininin			ntulutu	ուսիսիս		ntulutu	htulutu	ulululu	ntulutu	ուսիսիս	hilitii
E19							IAD AA 06:44	404 CHS CR9 460 07:40	FAY 52 AA 08:4056	20 CRW CR2 50 09:20	SGF 609 SGF AA ER4 10:09 650 10:50	SDF 665 MLB 11:05 700 11:40	JAX 730 DTW AA 780 CR9 12:10 780 13:00	798 TERM		AVL 929 AA 15:29 974 1	OAJ CR7 6:14	ома 1026 ад 1100	SAV CR9 18:20	LEX TYS AA 1156 CR7 19:16 5221 19:56		GPT 1270 AA 1334	SRQ CR7 22:14	
E18							G: A/ 06	SO 412 RIC A CR9 52 460 07:40	PHF 490 AA 560	GPT CR7 09:20	M: A/ 10	SN 645 PHF A CR7 (45 705 11:45	RDU 739 AA 795	CAK CR9 13:15	831 FERM	PIT 924 AA 990	LIT CR9 16:30	DTW 1042 AA 17:22 1110	2 GSO CR9 0 18:30			PHF 128 AA 135	6 PHF CR7 0 22:30	
E16							0	RIG 440	517 PUSI	н	0. A. 10	AJ 646 FLO A DH3 0:46 693 11:33				CMH 921 IL AA 969 16:0	M 75 09	PULL 1065	SAT AA 18:40	1120 CVG CR9 1185 19:45		130 TER	0 M	
E14							LYH 3 AA 06:22 4	882 OAJ DH3 160 07:40	OAJ 493 AA 560	CVG CR7 09:20	IN A. 10	AD 646 CMH A E75 0:46 705 11:45		JAN AA 13:47	827 HPN CR7 873 14:33	ORIG 970		SYR 1036 AA 1100	CHS ME CR9 AA 18:20 18::	^M 1130 CHS CR9 50 1184 19:44	GSP AA 19:59	1199 1365	GSO CR9 22:45	
E12							EWN AA 06:35	395 FAY DH3 460 07:40	AVL 501 AA 559 08:21	CHO CR7 09:19	ROA ₆₂₁ HH 10:21 ⁶⁵⁵ 10:5	H 55	IAD AA 12:29 800	BNA CR9 13:20	842 TERM	STL AA 15:43	943 PNS CR9 1004 16:44	ILM 1034 OR AA 1034 CR 17:14 1085 18:0	2F 29 05	IAD 110 AA 122 19:26 122	66 MSY GSO CR9 AA 20:30 20:45	1245 1350	SAV CR9 22:30	
E10								ROA 424 GSO AA DH3 07:04 470 07:50	SDF 51 AA 53 08:32 53	12 HPN CR7 84 09:30	GSO AA 10:30	630 EWN DH3 715 11:55	STL 730 SAV AA CR9 12:10 779 12:59	JAX 8 AA 8 13:32 8	312 ILM CR9 375 14:35	DAY 914 AA 15:14 974 1	SAV CA CR9 AA 6:14 16:	AK 1013 GSP A CR9 53 1070 17:50		SAV 1140 ORF AA CR9 19:00 1200 20:00		ILM 1263 AA 1355	CHS CR9 22:35	
E21									HSV 51 AA 51 08:33 51	13 JAN CR7 70 09:30	SAV AA 10:38	638 779	ILM CR9 12:59	DAB AA 13:40	820 MEM CR9 880 14:40	MHT 902 TLH AA CR9 15:02 959 15:59	E A 1	DSM 1018 CLE AA CR9 16:58 1070 17:50	PN: AA 18::	S 1130 GRR CR9 50 1185 19:45		1270 TERM		
E23								ORIG 449	SRQ 484 TLH AA CR7 08:04 540 09:00	SBY 555 AVL 09:15 ⁵⁹⁰ 09:50	BHM 6 AA 6 10:13 6	613 BHM CR9 11:35	FAY 730 CHS AA CR9 12:10 774 12:54	CAK 808 AA 865	8 IAD CR9 5 14:25	MDT 907 CMH AA CR9 15:07 959 15:59		RIC 1039 B AA 0 17:19 1090 18	3NA CR9 8:10	TYS 1141 SAV AA CR9 19:01 1195 19:55	HP AA 20:5	0 ORF 1250 CR2 0 3904 21:30	1321 TERM	
E25							TRI AA 06:39	399 HHH 455 07:35	^{TYS} 502 AA 555	LIT CR9 09:15	TUL AA 10:20	620 DAY 695 11:35	MYR 735 MYR AA CR9 12:15 779 12:59	GSO 81 AA 13:33 86	3 CMH CR9 4 14:24	OKC 914 SDF AA CR9 15:14 965 16:05	PVI AA 16:5	D 1011 SRQ CR9 51 1060 17:40	DAB 1080 OKC AA CR9 18:00 1125 18:45	DAB 1 AA 1 19:36 1	176 CLE CR9 230 20:30	SDF 12 AA 12 21:25 13	85 MYR CR9 60 22:40	
E27							389 PUSH		MDT 488 C AA 550 09	MH E75 9:10		PULL 700	MEM 727 SYR AA CR9 12:07 770 12:50	SRQ 8 AA 13:37 8	17 SAV CR9 67 14:27	BHM 910 IAD AA CR9 15:10 960 16:00		TUL 1028 IAD AA CR9 17:08 1075 17:55	GSC AA 18:4	^D 1129 ^{DAY} CR9 49 1180 19:40		ORF 1269 AA 1340	CHA CR9 22:20	
E29							SAV AA 06:36	3 5	996 565	GRR CR9 09:25	CLE 6 AA 6 10:21 6	21 MDT CR9 85 11:25	HTS 738 AGS AA DH3 12:18 781 13:01	S AUS 3 AA 1 13:45	825 CHS CR9 875 14:35	ILM 935 AA 935 15:35 985	GSO CR9 16:25	XNA 1024 CVG AA 1070 CR9 17:04 1070 17:50		TLH 1159 AA 19:19 1210 2	3SO P! CR9 A 0:10 20	NS 1255 DA' A 1325 CR 0:55 1325 22:0	9 5	
E31								ORIG 455	CHS 489 AA 570	MYR CR9 09:30	OM. AA 10:4	A 641 PIT CR9 11 705 11:45	EWN 749 AA 12:29 792	GSP DH3 13:12	GRR 845 ATL AA CR9 14:05 895 14:55	IAD 915 DAB AA 915 CR9 15:15 964 16:04		MYR 1039 BHN AA 17:19 1085 18:0	M 89 05	MYR 1140 PNS AA CR9 19:00 1190 19:50		AUS 1265 AA 1335	IAD CR9 22:15	
E33								ORIG 460	GSO AA 08:36	516 JAX CR9 590 09:50	OK) AA 10:4	C 642 IAD CR9 42 705 11:45	GSO 738 TRI AA DH3 12:18 779 12:59	P A 1:	NS 836 DTW A CR9 3:56 885 14:45	CLE 925 AA 15:25 974 1	CVG CR9 6:14	PWM 1030 SDF AA CR9 17:10 1074 17:54		CMH 1156 MH AA 1205 20: 19:16 1205 20:	1T 89 05	CHS 1260 AA 1350	XNA CR9 22:30	
E35								ORIG 465	IAD AA 08:43	523 INI 595 09:5	D AVP 61 9 AA 61 5 10:18 68	8 AVP CR9 0 11:20	AVL 732 LYH AA 732 DH3 12:12 770 12:50	0 A 1:	0RF 836 MYR A CR9 3:56 885 14:45	CHS 930 AA 979 15:30 979	TYS BNA CR9 AA 1 16:19 16:45	LGA IAD 1 1005 CR9 AA 1045 17:25 17:46	1066 TUL CR9 1110 18:30	CVG 1166 AA 19:26 1215	ABE CR9 20:15	XNA 1 AA 1 21:33 1	293 BNA CR9 360 22:40	
E38									MSY AA 08:46	526 SDF CR9 590 09:50	DSM 61 AA 68 10:19 68	9 GSO CR9 0 11:20	TRI 743 ROA AA 743 DH3 12:23 781 13:01	A M 3 A 1	IKE 836 ABE A CR9 3:56 885 14:45	AVP 930 AA 15:36 98	5 XNA CR9 5 16:25	CHS 1032 MDT AA 1075 CR9 17:12 1075 17:55		CHS 1143 SRQ AA CR9 19:03 1190 19:50		ROA 1260 AA 1350	LYH DH3 22:30	
E36							1	HHH ₄₁₆ ROA 06:56 ⁴⁵⁰ 07:30	BNA AA 08:45	529 DAB CR9 590 09:50	ABE AA 10:35	639 CVG CR9 700 11:40	LYH 752 FI 12:32 ⁷⁸⁶ 13:	:06	IND 841 PNS AA CR9 14:01 890 14:50	MYR 933 AA 15:33 980	CHS CR9 16:20	CMH AA 100 17:41	61 MYR 00 CR9 18:20	DTW 1144 GSP AA CR9 19:04 1190 19:50		BHM 12 AA 12 21:32 13	92 MEM CR9 55 22:35	
E34							CMH AA 06:38	398 IND E75 475 07:55	SAV 496 AA 554	MKE CR9 09:14	, 1	CVG 649 XNA AA CR9 10:49 710 11:50	CMH 747 AA 12:27 804	7 MCI ILN E75 AA 4 13:24 13:	M 832 MKE 52 880 14:40	CVG 914 MEM AA CR9 15:14 960 16:00				MKE 1161 IA AA 11205 20:1	D 89 05	BNA 12 AA 12 21:34 12	294 ILM CR9 355 22:35	
E32							IN AA 06	D 411 DTW E75 51 465 07:45	MLB AA 08:47	527 PNS CR9 585 09:45		CMH 650 PWM AA CR9 10:50 710 11:50	SAV 727 CHA AA CR7 12:07 770 12:50		YYZ 859 AA 915	LGA MEM 935 E75 AA 15:15 15:35 980	MYR CR9 16:20			ABE 1146 OMA AA 1189 CR9 19:06 1189 19:49		CLE 1 AA 1 21:39 1	299 LIT CR9 355 22:35	
E30									OR 5	RIG 59		DAY 654 PVD AA CR9 10:54 710 11:50	IND 732 GS AA 732 E 12:12 785 13:0	SO SDF 8 75 AA 05 13:40 8	20 DAB CR9 65 14:25		ORIG 995	ROA 1036 AA 1110	LYH DH3 18:30	SDF 1168 AA 19:28 1210 ₂	OAB CR9 0:10	CHA 12 AA 12 21:28 13	288 PGV CR2 60 22:40	
E28							AGS 3 AA 4 06:31 4	91 SDF CR2 50 07:30	GSP 498 1 AA 549 09	AD CR9 9:09	AA 610 10:10 662 1	CR9 11:02	le ser e se e se e se e se e se e se e s	AA 13:5	830 RIC CR9 5087014:30	942 TER	M	CRW 105 AA 105 17:30 110	50 OAJ DH3 05 18:25	PGV 1155 AA 19:15 1230	DH3 20:30	AA 1281 C 21:21 1329 22	Y S R9 09	
E26							0.00		AA 08:45	529 RDU 529 CR9 580 09:40	AA 6 10:28 6	528 CR9 580 11:20	DTW 743 M AA 743 12:23 790 1	E75 AA 3:10 13:5	4 830 ROA DH3 50 875 14:35	AA 906 DI 15:06 970 16:	H H3 10	AA 1044 17:24 1095	DH3 18:15	AA 1139 18:59 1210 2	DH3 0:10	21:39 134	9 SDF CR9 0 _{22:20}	
E24							AA 06:40	406 MEM 5 470 07:50	DAB 51 AA 51 08:35 56	5 SRQ 64 09:24	AA 10:30	530 S1L CR9 580 11:20		AA 81 13:3985	9 CRW DH3 59 14:19	AA 92 15:38 99	88 TRI DH3 00 16:30	AA 1038 DH 17:18 1085 18:0	H AVL 18 AA 05 18:42	1122 CHO DH3 1189 19:49	TDI	21:22 1350	CR9 22:30	
E22							CHA 3 AA 4 06:29 4	89 IAD CR9 50 07:30	H1S AA 08:00	480 685	cue	AVL DH8 11:25		AA 13:48	828 DH3 865 14:25	LYH 935 AA 15:35 984	AVL DH3 16:24	CHO ELO	PO A	AA 1150 19:10 1215	DH3 20:15	21:33 ¹³²⁹ 22	09	
E20									ORIG 530	09:10 ⁵⁸⁵ 09:45	CHS 62 AA 62 10:27 62	27 CR9 76 11:16		AA 05 DF 13:25 845 14:0	15 18 05	AA 920 KOA 15:20 965 16:05	DCM	17:01 ¹⁰⁵⁵ 17:01 ¹⁰⁵⁵ 17:35	AA 18:43	1123 KOA DH3 1184 19:44	10	AA 1289 21:29 1340	CR9 22:20	
E8									AA 08:45	525 CR9 5089 09:30	AA 622 10:22 670	CR9 11:10		AVL 8: AA 8: 13:42	22 DH8 59 14:19	4A 15:33 976	DH3 16:16	IDT I THE IND		AGS 1149 I AA 1209 I 19:09 1209 20	DH3 0:09	AA 127 21:18 135	CR9 5 22:35	
E6									AA 08:38 56	8 CR9 0 09:20	AA 607 10:07 674	DH3 11:14		III IIII IIII	836 3:56 ⁸⁷⁰ 14:30	AA 941 15:41979	DH3 A. 16:19 16	A 1016 E75 6:56 1070 17:50		AA 1140 DH3 19:00 1190 19:50	too UTS	AA 1259 CR 20:59 1325 22:0	MDT	
E4									AA 08:5	531 CR9 51 580 09:40	A	A 647/101 0:47685 11:25		AA 13:42	822 E75 885 14:45	940 959	I VYZ	AA E75 16:59 1070 17:50	II N	AA 19:40 1	230 DH8 20:30	AA 129 21:39 134	022:20	
F1									TERN TERN	M	AA 10:	643 CR9 43 11:20			AA 842 E75 14:02 895 14:55	AA 930 15:30 987	E75 16:27	AA 1028 E75 17:08 1079 17:59	AA 18::	50 1185 19:45		AA 128- 21:24 135	DH3 0 22:30	
F2								CVG A16 MYR	AA 492 08:12 580 CHO 405	DH3 09:40	TER	RM HH. CRW						AA 1051 17:311095	DH8 18:15	OPIC	TR	AA 1286 DH 21:26 22:0	3 5 TRI	
F3							, L	AA CR9 06:56 460 07:40	AA 495 08:15 575	DH3 09:35 SBY	RI	647 0:47 11:19 C 645 CLE					SGF	F 1011 SGF		1184	A# 20	4925 HHH 1275	DH8 22:25 HHH	
F4									AA 512 08:32 560	DH3 09:20 YYZ 550 B	A/ 10	A 645 CR9 (45 695 11:35					AA 16:5	51 1070 17:50		TERM		AA 1275 21:15 1340 YYZ 128	DH8 22:20 2 MSY	
F5									AA 000 DH3 08:16 540 09:00	AA 0500 E 09:1959909	:59	710										AA 120 21:22 135 CMH 1274 Y	2 E75 5 22:35 YZ	
F6									AA 08:43 5 CMH 5	64 09:24		TERM										AA 12/4 1 21:14 1330 22	275 :10	
F7									AA 08:36 50	67 09:27		AA CR9 11:10 715 11:55										1325		
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07						ORIG		ORIG		IAD	582 CR7	E	WR ₇₁₂ EWR		EWR 864 IAH		ORD	1006 ^{ORD}	1/	AD 1135 IAD				1410
0/						360 ORIG	i	0RIG	EWR ₅₁₄ EV	09:4	12 0150 10:22	11	:52 ³³¹¹ 12:27		14:24 ³³¹⁵ 15:02		16:46 ⁴	EWR ₁₀₄₀ EWR	1	8:55 19:30	<u> </u>			1379 TERM
0						369		460	08:34 ³⁶⁴⁸ 09 ORIG	0:09					14:09 ⁰¹²⁰ 14:44			17:20 ¹⁰⁷⁶ 17:56 IAH 1034 IAI UA F7V	H			1281		1379
O10							ORIG	l	515 LGA 515 DL 505	LGA CR9	MSP 63	2 MSP		LGA 794 LGA DL CR9		LGA 906 LGA DL CR7		17:14 6285 18:0 1050	05	LGA 1158 LGA DL CR7		1281		TERM
0.0		1	1	1	1	1 1	425	-1	be-25 3840	00.15	10.2200	11.07	1	12.14 3647 14 00		15.06 5099 1000	1	1075		10,10 022/ 20.00		I FRM		1 1

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Date:04/11/2019 Time:12:51

	00:00 01:00	02:00	03:00 04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00			
		dutulutu		ulutulutu	ntulutu	ուսիսիս	utulutu	hutulutu	utulutu i	dulutu	ուսիսիս	hilulutu	hitulutu	utulutu	ntulutu	սեսիսես	hitulutu	hilidutu	hitiliti	huhuhuh	Jutulutu	hituliitu			
O11					ORIG 420				GA 597 LGA	LGA 674 LGA DL CR7 11-14 5069 12:00						LGA 1032 LG DL CR				1271 TERM	+++++++++++++++++++++++++++++++++++++++				
O12								1		CVG 666 1:06 ⁹⁹						17.12									
O15							BKW BK 515	w		1.00 11.00	BKW VC 12:00	I	720 1025	1	BK EM	W 12									
O23							08.33 09.		YYZ ₆₃₉ YYZ		12.00				173	YY 17:	71069 YYZ								
O24									10.39 11.10	9						173	18.20								
O25																									
O26																									
HS																									
R01	CLT AA							O31 031	,									RIC 319		PIT AA 21/10	T379 T380	CL1 315			
R02	CLT AA							0323 0324									MI 3	19:45 DT PIT 619 AA	T371 T372						
R03	CLT UA		O333 O334			DEN 319		0.524	JAX AA							T393 T394	19:	19:24							
R04	00:00 CLT AA		000			O319 O320	<u> </u>		10:2	9				BDL 319		1374			ELP T373 C AA T374 C						
R05	00:00 CLT AA				03	321 322							IAH 319	15:35						21:35	13/4	T411 T412			
R06	00:00 CLT DL		O341 O242		SEA 319	522	LC A/	jA A				PSH 565	14:10			CLT 321					FLL NK	T403 CL1 T404 320			
R07	00:00 CLT UA	0335	0342	IAH 319	06:50		08	MKE AA	PSH 785		CLT CR2	303	TPA AA			17:45	1	F369							
R08	00:00 CLT NK	0	0331	05:05	IAH 320			CAK AA	/85		12:30	PSH 1065	14:08		(CLT CR7		PHL	HIL T381						
R09	00:00 O332 06:45							09:12 0315 0216				1005				/:10	PBI 321	TPA AA	19:45 T382 TPA T385 AA T385			23:55 CL1 321			
R10	00:00 CLT 0325 AA							0310				PBI 321			18:28					PHX T387 AA T388					
R11	00:00 0326 CLT 0339 MSF PL 0310 717						GSP PSI												PVD T375 AA T376			23:55 CL1 321			
R12	00:00 0340 07:20 CLT AA							0313 0211							MSP 738					20:10 13/0 AA T389 AA T300					
R13	00:00 CLT AA						0317	0314								RDU 738	18:29		20:40	STT AA	T370 T377	23:55 CL1 321			
R14	00:00 CLT DL	<u></u>	0343	<u></u>	<u></u>	ATL 738	0318					JFK AA	<u></u>	<u></u>	<u></u>	17:25	T391			21:09	13/8	23:55 CL1 738			
	00:00 ATL DL		0344			07:30					T395	13:10					1392					23:59 CL1 739			
R16	01:02 CLT WN	0327	HOU 73H			MYR AA	I	PSH	CLT CR9		1396										ORD	23:59 7 T397 CL1 7300 730			
R17	00:00 CLT WN	0328	9	MDW 73W		07:04		/00	11:05												22:47	ATL T407 CL1 DL T407 73F			
R18	00:00 MDW WN	0330	PSH	05:45	CLT 73W																iA T40	23:06 1408 23:59 01 CL1 CS			
R19	01:20		3//3		06:55															21	<u>51 140</u> JFK DI	23:59 CLI CLI CLI CLI CSI CSI CSI CSI CSI CSI CSI CS			
B20	CLT DL	0	0337		JFK CS1																22:5 BO(B6	^S T409 CL1 ^S T409 E90			
R21	00:00 CLT B6	0	0345 0345	(6:08	FLL E90								H	SV E			1 22.50 T410 22 T431							
R22	00:00 CLT AE		0346		0	0347							<u> </u>	HSV CR2	11555 1452 23:59 0KC T417 CIT AE T410 CR										
R23	00:00 CLT AE					0348	O349								17:39 TRI CR7		BTV AE	1418 23 T415 T416							
R24	00:00 CLT AE						O350 O351								17:40 TYS CR7		19:12 CLE AE	T416 T429			23:55 CLI CRS				
	00:00 CLT AE		O355				20322 XNA CR9									1740 19:18 1430 CHS T423 AE T423									
R26	00:00 CLT AE		0356	0353			09:20 YUL E75									17:4	7	M	T424 2 AE T419						
R27	00:00			0354				10:0										1	GRR AE	14	7425	23:55 CLI CRS			
R28																			20:25 GRB AE		T426	23:55 CLI CRS			
R29																		BDA AE	20:27	T413	1422	23:55 CLI E75			
R30																		19:20 YUL AE		T414 T427		23:55 CLI E75			
R31	MDW WN										T399							19:36		1428		23:5 CL 73V			
R32	01:20										1400						ORD			T383		23:55 CL1 738			
R33																	18:44			T384		23:59			
R34																					+				
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CLT 2028 Gating Scenario 2
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	mululu		hitulutu		hutulutu				utulutu	ահորհուն	Intulutul	սիսիսիս		ուսիսիս	ահորհոր	անսիսիս	անսիսիսի	ահոհունո	ուսիսիս	ատեղությո	ulululul	
AADO																						
A21				CLTSC4 DFW ORIG 5:15 2451 6:00			AA 865*	320 9:25	BNA 821 AA 876*	AUA 320 11:30	BOS AA 2044 12:04	MIA 321 13:20	SAN AA 14:5	$\begin{array}{cccc} 4 & 823 & LAS \\ 823 & 321 \\ 1 & 65 & 15:49 \end{array}$				MSY 732 AA 1885	BUF 319 20:15	MSP 1897 AA 1998 21:04 1998	BWI 320 22:30	18 TEI
A22				CLTSC4 ORIG 5:20 ²⁰⁶⁰ 6:	05		ORF AA 1770 8:29	ORF 319 9:15	MSY AA 10:24	833 320 11:50		PHL 1 AA 1 13:18 1	789 MSP 321 855 14:50			^{BWI} 1915 AA 2038	PVD 320 18:15	1976 TERM		LAX FLI AA 1717 321 21:09 22:10	2005 TERM	[
A23				5:50	ORIG 0 ²⁰¹⁰ 6:35		BOS AA 8:28	1709 FLL 321 9:50	BWI 876 AA 821*	GCM 320 11:25	RSW AA 12:00	445 580	DEN 321 14:20	MCO AA 6 15:25	37 LAS 321 16:45	CLTSC4 ORIG 17:25 1915 1	RDU 8:10	EWR 1598 AA 19:16 2483 20	AH 738 1:10	DCA AA 192 21:29	2 319 22:40	
A24					CLTSC4 MIA ORIG 6:15 ¹⁸⁷⁷ 7:00	A 10	JFK AA 14 8:30	MIA 48 738 9:30	SYR MSY AA 1909 319 10:11 11:0			ORD AA 13:23	695 TPA 321 1810 14:50		LGA AA 16:44	436 PHX 321 17:45	LGA MSY AA 1809 320 18:02 18:55	STL 1768 PIT AA 319 19:101747 19:54	SJU AA 20:23	753 MSI 2039 22:10	550 TERM	
A25					CLTS 6:45	ORIG PHL 1956 7:30	ILM PHL AA 1839 319 8-04 9-00		CI	TSC4 MCI ORIG 1964 11-40	TPA BC AA 629 3	DS SMF 1 21 AA 1 10 13-28 1	1154 SAN 321 1583 1445	LGA AA 494	PHX DFW 72 321 AA 72 16:15 16:31 83	20 PHL 321 30 17-30	PDX 1853 SJ AA 660 19-0	JC BNA 1945 20 AA 733	SAT 319 20:25	2035 TERM		
A26					CLTS	SC4 ROC ORIG 868 7.20	MSY AA	5330 ^{MHT} 5089 030	ORD 172 AA 196	29 PUJ 7* 1150	LGA ORD AA 893 738	1051 PUSH	1400	15.00	10.51	17.50	CLTSC4 PV PULL PV 18-25 275 10	VD DFW 56	DEN 321	ALB AA 2070	CLE 319	
A27					6:45 CLTS	7:50 SC4 RSW 928 RSW	ORD AA 68	PHX 80 321	LGA AA 879*	PLS 0 321 /	ORD PHX AA 628 321	MIA	ORD 321	BWI AA		1889	18:25 19:	10 19:35 014 PH 32	L 1	277 TERM	783 TERM	
A28					6:45 CLTS	7:30 SC4 SAT 0RIG 1727	FLL AA 19	9:40 SEA 012 321	RDU AA	1977 ^I	EWR 321	LGA AA	MCO 581 321	15:15 F	BI	294	EV 3	20:0 WR BOS 321 AA	5 5 793 319	1971 TERM	TERM	
A29					6:45 CL1	TSC4 LAX ORIG 1993	8:22 SFO 1944 AA 1046	9:40 ORD 321	FLL 1735	MBJ 321	PHX PI AA 1842 32	13:37 T BWI AA 17	FLL 60 321	IAH 174 AA 194	6:00 5 ALB 2 319	MSP AA	1836 F	FLL 11:45 FLL CLTSC 321	20:33 4 RIC 2006	LGA AA 557	SFO 321	
A1					6:50 CL1	50 7:35 TSC4 FLL EV ORIG A.	8:01 1946 WR A 1866	9:35 PBI 321	10:03 826* DCA AA	11:30 RSW 1837 321	12:06 13:0 MIA I AA 1878	09 13:30 DFW BOS 321 AA 89	14:30 DFW 1 321	SFO 704 L	3 16:24 GA 21	17:40 CLE RIC AA 2028 319	1841 19 BWI AA	416	20:30 FLL 321	21:04 2 PHX 499 AA 10.55	22:20 DEN 321	
Δ3					6:50 C	50 525 7:35 7: CLTSC4 MCO ORIG MCO	LGA AA 1772	9:20 DFW 321	10:32 IAH AA	11:55 FLL 1961 321	12:14 1 FLL AA 1970	3:15 13:30 BWI LAX 321 AA	14:25 1810 PHL 321	LAX 724 PHI AA 724 32	10 SFO AA	16:59 17:54 1908 SI 3	18:39 PBI 21 AA	1798	20:20 DFW 321	21:16 1865 SFO MAA 1857	22:25 ACO 321	
A5					6:	6:55 7:40 CLTSC4 MCI ORIG	8:13 DFW	9:29 835 321	10:35 BUF AA 858	11:55 NAS 321	12:19 DEN TPA AA 1808 321	13:19 13:5 DEN AA 2059	0 2055 14:45	15:00 559 16:0: RSW AA 1992	PVD DC 319 A4	1799 18: CA IAH A 673 319	05 18:5	54 844 ROC AA 1921	20:27 JAX 319	21:13 2 724 BOS AA 17	2:19 ORD 88 321	
A3						7:05 1906 7:50 CLTSC4 RDU ORIG RDU	8:34 PHL	9:50 CUN 321	10:14 05/0	11:30 521 321	12:03 13:02 MCO 1725 MCO	13:21 DFV	14:20 W 2091 JFK	15:03 PHX 1	16:30 16 899 SFO A 321 A	17:54 17:54 17:54 17:54 17:54	LAX ORD	19:07	20:15 TEI MCO 321	RM 21:39	22:35 0S	
A7						7:05 2011 7:50 CLTSC4 ORD ORIG ORD	8:10 BWI	9:25 TPA	10:29 PHL 826	11:45	12:04 691 13:01 DFW	ATL PBI	52 1972 14:55 BWI 2062 221	SEA 2107	705 16:40 1 SEA	6:57 678	18:16 18:45 30 LGA	ATL RSW	20:15	21:12 22: SEA	15 RSW	
A9						7:10 7:55	8:20 CLTSC4 CLTSC4 CLTSC4	9:35 MSY	10:05 1735 DTW	521 11:20 CUN	AA 8/3 12:27	321 AA 13:24 13:2 GA PHX	2003 321 52 14:50 LGA	15:16 443 DFW	321 16:20 FLL	17:20 17	40 18:40 1	AA 1820 321 19:02 20:00 487 SL	c	AA 1803 21:26 ATL 1998	22:26 ATL	
A11							8:29	9:14 DTW 925 FNT	AA 885* 10:11 CLT:	321 11:25 SC4 BWI	AA 2066 12:02 13 IAH 382	738 AA 206 :12 13:31 JFK I	58 321 14:26 .AS 1458 SMF	AA 1719 15:20 LAS 748 B	321 16:24 OS ORD	622 TPA	AA 18:49 LAS	451 20:0	1 5 1SP	AA 21:16 1897 MCO BDL	738 22:40	
A13							MSP	AA 319 9:06 1109 9:52 LGA	10:50 AUS	0 ¹⁹²⁴ 11:35	AA 502 12:11 100	738 4 13:19 1 JAX MCO	AA 1900 321 3:58 1917 14:50 2055 PHX	AA 1999 16 15:08 1999 16 BOS DI	21 AA 10 16:39	731 321 EWR	AA 18:5 SAN	2075 55 20 MIA 760	321 1:10 PVD	AA 1704 321 21:03 22:09 DEN T	PA	
A12					LAX	696 TPA	AA 8:46 MCO	1910 321 9:55 SFO	AA 10:39 RSW	184 PHX	49 <u>1</u> PHL 1882 PHL	319 AA 3:15 13:45 1855	695 _{14:35}	AA 1775 3 15:09 16 DEN 428	21 10 TPA	AA 470 17:01 FLL 609	321 18:15 PDX	AA 19:20 1990 RIC MCI	321 20:29 PHL	AA 1873 3 21:18 22 892 PI	21 15 4X	
A10					AA 6:26	1813 321 1813 7:45	AA 461 8:10	321 9:24 LAX	AA 679 10:13 MCQ 700	321 11:25 TPA	AA 1002 319 11:59 2054 13:00 EWR 1615	TERM		AA 15:24 1791 MSP	321 16:24 RSW	AA 17:00 1787 1 BOS 1787	321 8:10 SEA	AA 1769 319 19:11 20:00	AA 20:40 BOS	472 3 LAS	21 15 PHL	
A8					AA 6:14	20. DEN	98 157 	321 9:45 DEN	AA 2053	321 11:20 ORD	AA 1013 12:23 1447	738 13:26		AA 2046	321 16:25	AA 1787 17:00 609 1 MCO	321 8:10 DEN	AA 19:20 1783	321 20:29	AA 1796 21:26	321 22:25	
A6					431 6:10 428	321 3 7:35 SEO	AA 4 8:31	45 321 9:35	AA 1862 10:18	321 11:25	AA 12:19 25	4 319 4 13:45	ROC	AA 1715 31 15:02 16:0	9	AA 651 17:16	321 18:25	AA 19:12 541	321 AA 20:20 20: BWI	A 2039 321 :52 890 22:10		
A4					AA 579 6:04 662	321 7:30	AA 8:43	1982 321 9:45	AA 10:31	752 321 11:45	AA 1973 12:23 13	AA 18 12 13:27	60 319 14:35	AA 1999 16:00 15:05 1899 16:00		AA 17:21 565	1 321 5 18:30	AA 1920 19:12	321 20:20	AA 1774 21:02	321 22:20	
A2					AA 19 6:14 4	1930 321 487 7:50	AA 8:41	1960 321 9:40	AA 193 10:26	7 321 11:30	AA 2078 319 12:05 13:05	AA 20 13:28	045 319 14:35	AA 504 321 15:05 15:59		AA 767 17:13 466	321 18:20	AA 662 19:14 1975	321 20:20	AA 1737 21:21	321 22:20	
B1					AA 661 PL AA 1872 7:	320 7:05	RSW 413 AA 713 8:28 713	MSP 321 9:20	DFW AA 10:37	2064 321 11:40	AA 653 319 11:58 12:54	MEM AA 13:39	1827 319 14:40	AA 1130 D 15:20 184 16	21 AA 10 16	A 1799 ORD 321 54 1908 18:00		AA 1871 3 19:07 20:	334 106 TERM	AA 1277 21:27	MIA 738 22:30	
B3					DEN AA 6:37	BOS 1980 321 7:50	LAS 1955 AA 1905 8:10 1905	MCO 321 9:19	BOS 1967 AA 1729	MCO 321 11:20	BDL RDU AA 1914 319 12:09 13:04		JFK 2530 AA 2249	EWR 1 738 15:15	AX 819 SJU A 321 6:00 972 16:50	PHL 799 AA 1733	MCO 321 18:20	JAX AA 19:15	1861 2043	PB 31 22:1	9	
B5					EWR AA 6:47	R EWR 1364 738 7 7:45	MIA AA 8:47	EWR 1496 738 9:55	SJU AA 10:5	$\begin{array}{c} 1376 {}^{\mathrm{SRQ}}_{321} \\ {}_{0} 1404 {}^{\mathrm{11:40}} \end{array}$	PVD AA 657 12:28	IAH 319 13:20		EWR AA 379 15:05	MIA R5 738 AJ 16:25 16	SW BWI A 703 321 5:55 17:45		CLTSC4 MDT ORIG 19:04 ¹⁷²⁰ 19:49	I I	RDU PVD AA 2038 738 20:57 22:05		
B7					TPA AA 6:46		20 17	011 797		RDU 321 11:20				MIA 2448 AA 1453	ORD P 738 A 16:25 1	PT 1829 DFW AA 321 6:57 721 17:40	M/ A/ 18	A 746 PHX A 321 8:59 463 19:55	EWR AA 20:36	1245 JFk 1608 22:10	8	
B9					BWI AA 2 6:36	JFK 2042 738 7:30	BUF 829 AA 1941	DTW 319 9:19	ATL AA 2065 10:12	IAH 738 11:19		SAT AA 13:48	1633 296 1	FNT 319 5:11			SJU 83 AA 83 18:35 61	36 SFO 321 9 19:30		MIA EV AA 1384 7 21:13 22:	VR 38 15	
B11					SMF AA 6:02	476 840*		MBJ 321 9:25	EWR 1451 EW AA 73 10:02 1458 11:0	R 18	CHS 1849 1 AA 12:25 1950 1	DCA PIT 319 AA 17 3:15 13:31	BDL 00 319 14:30	TPA 51 AA 51 15:27 72	39 LAX 321 25 16:40	IAH EW AA 1711 7 17:15 18:	7R CLTSC4 0RIG 05 18:28 1530 19	PBI 766 9:13 TERM		RSW 1805 IAF AA 321 21:10 745 22:10		
B13							DTW F AA 1942	BUF 319 9:10	JFK AA 10:42	DFW DC 330 738 AA	CA RIC A 2077 319 -52 12:45	DTW AA 13:45	STL 756 319 14:40	ATL 2032 AA 1821	DTW 319 16:30	MCI AA 1701	MIA 738 18:20	844 TERM		BUF A AA 1940 3 20:58 22:	LB 19	
B15					RDU AA 1732	DCA 319 7:30	FNT 1751 AA 97	SLC 319 9:30	1924 TERM	DEN AA 11-15	1446 LAX 652 13:00	RI	DU 2069 PIT A 2084 319 3:56 2084 14:55	IND 18 AA 15 15:30 18	343 DCA 319 364 16:40	RDU DT AA 2067 3	W 200 19 05 TEI	984 RM	R	AUS AA 1893 319 0:55 22:10	5	
B16					PHX 2020 AA 2091) DFW 321 7:30	BDL AA 17	CLE 780 319 9:40	PVD AA 10:32	MIA 1831 321	887 TERM		FNT AA 14:30	10.00	1974 1242	BUF 319		DFW JFK AA 2648 738 19:05 20:00	BWI AA 20-38	864 2035	JAX 319 22:35	
B14					SLC 2014 AA 408	4 PHX 321 7-20	PIT	1978 NAS 319 852 9:40	STL AA 1923	DTW 319		CLE AA 19	RDU 934 319	DCA AA 1653	MCI 319	ALB PW AA 2052 3	M SLC 19 AA	19:05 20:00	78 881	STL 319	22.33	
B12					0.10	BOS BNA AA 1817 319 7.12 8:00	RIC 1941	MEX 319	MDT AA	1753 JAX 1753 319		BUF AA 2002	BOS 319	15.15		NAS AA 859	PIT 319	JFK 101 E	WR 738	BDL AA 1952	BUF 319 22-25	
B10						1.12 8.00	PHX 423 AA 1965*	9.50 PUJ 321	LGA AA	ALB 1988 319		13.20	CHS DCA AA 1938 319	RDU AA	1962 ^{BWI} 319	IND AA 765	STL RDU 319 AA	U	861	ATL 5563 738 TERM	22.23	
B8					MCO AA	LGA 2062 321	JAX AA 1722	9:25 DCA 2 319	ріт АА 1730	DCA MCI) 319 AA	1267 BUF ALB AA	1756 ALB 1753 319	14:02 14:55	JAX AA 2036	16:45 SYR 319	17:11	18:25 [18:5 BUF AA	584		MCI PHX 319 AA	RDU 1854 321	
B6					RIC AA 10	BDL 654 319	8:17 MEM AA	9:30 RSW 1853 319	10:20	ELP 281 ELP AA 1870 319	131 12:30 12:50	1755 13:50	CLTSC4 IAH ORIG 2069	RIC 1	864 PIT JAX 319 AA	DCA 1750 319	CLTSC4 ORIG 1317	MSP CI	TSC4 LGA ORIG 1954	SAT R AA 1870	22:45 OC 319	
B4					6:34 PIT AA	7:30 PVD 1903 319	8:43 STL AA	9:55 PIT 1677 319	PWM AA 1	ATL 814 319			14:10 14:55	PHL AA 20	PBI 47 319	0 17:50	DFW DF AA 1752 3	9:14 19 FW IAH 744 F 521 AA 10.01	55 20:40 DU 319	21:25 22 SYR DC AA 1987 3	:16 7A 19	
B2					6:42 SEA AA	7:35 624 LAS 321	8:51 IND AA	1 9:45 BDL 1756 319	PBI AA 1847	11:39 PHL 319				MSY R AA 1821 3	16:30 IC 19	aus aa 1840	18:11 19: BDL DCA 319 AA	19:25 1801 20 ILM 1979 319	10 D	21:04 22: DTW LGA AA 1981 319	14	
C2					6:15	058 8:00 DCA PIT AA 1904 319	DCA AA 179	9:50 CHS 95 319	10:10 ALB AA 1707	11:15 SXM 319			2017	15:30 1330 16: BNA 1886 JAX AA 319	BUF AA	17:15	18:25 18:52 422	2 20:00 FSD 319	808	0:55 22:04 CLTSC4 PULL	SYR	
C4						7:02 7:59	8:28 IAH AA	9:30 852 IAH 319	10:23 613* MCI 179	11:25 97 IND 319		CLTSC4	PUSH RIG PBI	15:14 2032 15:59 MCI AA	16:20	422	524	19:54 ELP 319	1954 TERM	MSY AA 1793	22:20 PIT 319	
04							8:38 1 EWR 2531 JF AA 2531 7	1978 9:35 FK FSD 784	10:28 197 MCI SAT 319 AA	850 319		13:40	14:25	15:35 DTW AA 15	MSY 319	1540	55 NAS	19:15 8 605 PLS 319	TERM CLTSC4 PULI	L FNT MCI AA 17	22:25 ORF 319	
68					AT	TL ATL 4 469 321	8:16 2529 9:0 CLE	MEM 24 319	10:15 10:39 ROC	11:40 CHS				15:39 CLTSC4 ORIC	16:30 BDL	PUS	SH 18:5	54 1029* 20:00 451	20:32 1002	² 21:17 21:40	22:40 973	
<u> </u>					6:5	52 8:00	ATL 71	9:24 3 ATL 3 221	10:14 BD/	11:14 1840 MEX 319	x			NAS	16:20 BUF EI 321 A	LP	TERM 1891	TERM DTW 319		2043	TERM	
C12							8:21 41	3 9:35	10:5	1 1434* 12:00	0			15:10	16:29 16	5:55	736	20:00		TERM		
012																						
014																						
AAIN											CLTSC4	CUN			МВЈ	*869	LAS	^{3J} *827	MIA	SJO	*1850	
11						CLTSC4		GCM *860 HAV		PAP	*368	.7* 13:30 NAS	M	₩ ₽/12 R	AA 16:5 DU CUN	ю 749 <u>1</u> *884 воя	321 AA 8:10 18:: PLS	56 1919 5 *880 OR	321 20:15 D AU	A appCLTSC4	TERM 22:40	
12						7:05 ORIG 7:55		$AA = 1615 * 319 \\ 9:00 = 1615 * 9:45$		AA 11:00	1826	319 3:15	AA 14	53 2056 16	21 AA 10 16:40	1806 321 17:55	AA 18:5	55 1851 20:0	1 20:5	50 TERM 21:35		

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				սեսիսես	lutulutu				Julululu		Intulutu		սիսիսիս	ulululu	ntulutu	1			ntulutu		սիսիսիս
13				6	CLTSC4 CUN ORIG CUN 5:55 804* 7:45			PLS AA 10:00 1	*842 KI 1040* 31 12:0	IN 19 00				PUJ * AA 16:21	1963 ATL 738 787 17:50	CUN AA 18:40	*886 PBI 2061 19:55	PUJ *1968 20:16 TERM 21:01			
14				6	0RIG MBJ 6:55 ^{843*} 7:45				MEY	20				HAV	PD 4	AA 18:40	*866 BNA 320 1867 19:49	20:29 TERM	21:14		
15								IN the S.A. PAR	MEX *1844 SD AA 1853* 31 11:00 1853* 12:0	19 00				HAV *1074 AA 1028	319 17:30	AA 18:00 1865*	319 19:30	20:24 TERM 2	:09		
16							A 9:	A 854 747 A 319 55 1647* 10:50	CUN #1202 SIO						AA 17:42	*19 64	$\frac{1}{3}$ $\frac{1}{20}$	45 21 05	spin spin		
17						SDO #102	UVE	, L	AA 1087* 11:55							AA 18:14 8	322 BCA 320 56 19:44	AA 20:15	1342 32 874* 22:0	2 0	
18					G	AA 8:00 982*	321 9:45				FRA *705 CLTSC	4		LHR	*721	AA 18:35	1768 319 20:00 CLTSC4 DLLL	GRU			
l10					A. 7:	A PUSH 8:50					AA 705 78 13:00 PUSH 14:0	9	FC	AA 16:15 0 *721 CLTSC4	730*	789 18:40	AA POLL 19:00 1568*	332 20:30			
l11													A/ 15 FC	55 TERM 16:55		BCN	*745	BCN			
l12													A/ 15 MAI	$\frac{721}{155}$ 748* $\frac{789}{16:40}$ *74	0 D	AA 18:20 UB LHR	744*	332 20:45 LHR			
113											 k	CDG	AA 15:50 *787	D 72- FRA CI	4 18 JISC4 PUILL	332 AA 3:05 18:30 FCO	732*	789 20:15			
114											DUB	AA 3:55	704*	332 AJ 16:35 16	55 720*	789 18:25 CDG					
115											AA 13:05		786*			332 18:20					
OADO 01	1078	[CLTSC4 HOU CLTSC	Ang MDW C	CLTSC4 BWI		BWI	DAL	BOS 1245 BOS	T				BOS 8021 BOS		HOU1747HOU	DAL BWI		2808		
01	TERM 9		4:40 643 5:25 5:45 DEN	¹⁰¹⁰ 6:30 6 201	5:55 3773 7:40 DEN CI	LTSC4 DEN	9:35 1	0:10	10:59 ¹²⁴⁶ 11:36	ISP		BNA 5136 BNA	PHL M	B6 E90 16:00 8016 17:00 CO MD ³	N ₈₅₃ MDW	17:55149318:30	8:55 19:30		TERM		5812
02	TERM 1441		5:10 CLTSC4 ORIG IAH	200	7:20 7: CLTSC4 SLC ORIG	:50 5290 8:35	ATL	ATL ATL DI 1454 M90	11:20 353 12	2:05 DTW DTW DL 1620 319		MSP MSI 14:00 684 14:45 MSP MSI	15:21 16	ATL 602 ATL 734	0 ¹⁷⁴⁸ 17:25	L ATL	ATL A	TL		1076	TERM 19
01	TERM		5:05 1191 5:50 CLTSC4 GRIG DTW	CLTSC4 ATI ORIG ATI	7:00 521 CLTSC4 ORIG	8:48 MSP	9:30 DTW DTW 2792	10:03 10:45 MCO PI F9 1028 3	HL ATL AT	12:07 12:50 IL 1029 519 12:07 12:50 IL 1005	ATL 5 717	14:24 14:59	ATL ATL DI 2122 73H	16:18 2651 17:00 MSP 13	22 DTW 22 320	:50 18:45	19:09 20: DTW 57	05		TERM 8017	522 TE
05			5:15 1366 6:00 CLTSC4 ORIG ATL	6:15 2488 7:00 CLTSC4 ORIG ORD	0 7:20 2266 SFO 170	8:05 4 SFO 739	9:04 9:39 BOS B6	1028 1028 1028 1028 1028 1028 1028 1028	11:16 12:0	12:33	13:15 ATL DL	ATL 2597 320	15:04 15:45 DTW (503 MSP 319	²⁴ 17:20 BOS 1445 BO B6 1445 E9	18:40 JFI 00 B6	19:15 C 1119 F90			TERM	TERM 876
06			4:45 823 5:30 CLTSC4 ORIG	6:03 1712 6:48 BOS	7:21 196 CLTSC4 ORI	9 8:20 IG ATL	9:24 ORD 425 UA 425	8020 10:51 ORD 73G			ORD 1484 ORD UA 319	14:30	DEN 1711	793 16:30 DEN 320	17:18 1446 18:0 SFO 1 UA	176 SFO 739	50 ¹¹¹⁸ 19:28	TTN 933	TN 320	1286	TERM 1974
013			5:33 8022	6:18	7:30	8:15	9:26 521	10:15			13:00 1140 13:45		15:10 1199	16:22	17:31 1	698 18:30		20:25 932 2	1:10	TERM	TERM
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AEDO				PUE	PHE PHE	PGV 500 t	RCM	EVV	MUD		MGM	SDE	FAX	ND	EAV			GNM	1 500 6 6	AK MGM AFY	
D13				AE 5 6:30 5	5557 7:35	AE 5234 8:11 5187	CR2 9:19	AE 10:23	5241 CR2 5132 11:40	AE 5176 CR2 12:05 5314 13:00	AE 544	CR2 4 14:25	AE 383 15:26 407	CR2 6 16:30	AE 17:05	5486 5172	FAV	CR2 A 20:25 20	5326 C 55 5124 22	2R2 2:05 2:2:27 ² 2:59 5156 PGV	
D12				G	NV cape LEX	AE 8:38 FAY	5295 CR2 5440 9:45 5273 TYS	6	AE 11:05 HA 5277 EVV	CRW 5227 BHM	23 DAY	CR7 14:50	AE 5032 15:23 5366	CR2 16:14 GNV	AE 17:10	5119 5256	CR2 19:50 CRW 5149 FWA	20:15 ⁰⁴⁹ 20:50	AE 21:31 LEX	5118 CR2 5118 22:40	
D10				AE 6.5	E 5228 CR2 5039 7:30 CAK 5255 CHA	AE 8:40 GSP 5235	5297 9:35	AF 10 LEX	E 5032 CR2 0:46 5032 11:35	AE 5257 CR2 12:15 5164 13:00 HSV 2000 CA	AE 13:43	5052 CR2 5052 14:25	AE 0095 CR7 15:05 5096 15:50 0AJ 521	AE 16:09 4 MGM AV	5259 18 - 4011 CA	EE	AE CR2 19:05 5405 19:49 CHS SRQ	AE 5265 20:05 CR9 20:45	AE 21:36	5298 CR2 22:41	
D8					7:08 5277 7:43	AE 5255 8:18 5509 9 8 MLB	CR9 9:09 5175 HPN	PULL	0 ⁵⁴⁶³ CR2 11:20	AE 3906 CI 12:25 13: BHM 5142	R2 05 TLH	AE 4011 CR2 14:01 14:40 PGV 5117 FAY	AE 0517 15:33 5222	CR2 AE 16:19 16::	52 3775 18:0 PHF 5052	LEX SHV 5514	AE 5227 CR9 19:03 19:50 LH MGM		21:15 ^{221:46} 5222	мов	
D6				5279	PUSE	AE 8:47	5384 9:30 5292	5343	PULL	AE 5218 12:30 5218 1 GNV 5371 TYS	CR2 13:10 GPT	AE CR2 14:07 5486 14:45 532	3973	OAJ	AE 17:22 5264 FWA 5135 DA	CR2 18:14 18:30 18:30 18:30 19 19	:05 AE 19:40 4769	TRI	5304 5186	CR7 22:40	
				PUSH		CRW 5347 B	PUSH	MS	5117 SN	12:25 ³⁰⁵ 13:00 5231	AE 13:37	522 HPN	26 MGM 5366	CR7 16:14 LFT	AE 17:11 5156 18:0 BHM	AE 18:42 18:42	4895 TRI 4786	CR7 20:15 EWN	5099		
E1		5006	5 · · · · · · · · · · · · · · · · · ·	CRW	,	AE 8:16 5142 5263	CR2 9:10 LFT	VPS 5157	:45 CHA RAP	5104 5514 DAB		CR7 14:33	AE 14:57 5096 ORF 3773 BHI	CR7 16:20 M	AE 17:4: 3SO IND	5 ⁵¹¹⁶ CR2 5 ¹⁸⁶ 18:25	AE 19:00 4755	CR7 20:30 PULL	TERM TYS 5037	AVL	
E2		PUSI		AE 6:45		5335	ORIG	AE 10:06 5179 PHF	E/S AE 11:14 11:40	5255 CR9 12:20 CMH 453	8 MCI TY	(s 5294 TYS	AE 15:07 3865 16:0 SDF 379	5 5 8 MKE	4522 E75 6:59 17:50 HHH		48	5468 92	20:59 5100	CR7 22:25 TRI CR7	
E3 E5				LYH 4'	738 OAJ	4935 DA	5452 Y	5122	5294 CK2 11:18 PHF	AE 12:27 467 AGS 5396	75 13:24 13 FWA CR7	CAE 5	327 EVV	9 16:35	AE 17:31 CHA	5508	0AJ	LFT 5411 SHV	AN 5257	22:25 BTR CR7	
E3 E7				6:22 4	889 7:40 4921 GSO	TERM 8:51	533	5364 7	JAN CP7	AVL 4751 LY	13:10 H LF	T 5110	204 16:00 GNV HPN CR7 AE	5526 HPN	17:21 ROA 482	5233 29 LYH CB7	19:45 BHM 38	20:00 5523 20:40 865 HPN CR7	0:58 5407 CAE 3775 M	22:15 IKE	
				AE 6:35 AGS 52	4826 7:50 296 SDF CR7	8:30	551	4 390	11:20 CAE CR7	12:12 4804 13:0 TYS 5297 M	13 13 MOB FAY CB7 AF	50 5459 5463 VPS	15:15 15:44 INA 5569 ICT VPS	5166 17:00 5138 HTS	17:16 479 CRW 47	08 18:30 749 OAJ ROA CR7 AF	4842 SBY CP7	2023 20:40	20:59 4056 22 OAJ 49	2:05 31 LYH CR7	
F11				6:31 50 TRI AE	093 7:30 4867 HHH CR7	TRI 485	2 LYH CR7	MC AF	0B 5	12:20 5512 1 5506	13:10 13:45 SHV CVG 54 CR7 AF	66 HSV CR7	4:55 ⁵¹⁹⁶ 15:32 15:55 EWN 4773 I AE	0 5200 17:00 YH TI CR7 A1	17:30 49	031 18:25 18:43 BTR 5500 F	4835 19:50 ISV HSV 3972	3 YUL CR7	21:24 49 ROA 4807 R AE 4807 R	22 22:30 OA CR7	
F13				6:39	4942 7:35 ROA 4776 FAY AE 4024 CR7	8:16 482 HPN AE 513	0 9:35 50 MOB CR7	10 SH AE	×45 5 V 554	46 BTR CR7	13:15 13:31 53	⁸ 5263 DAY ⁶ CR7	15:06 4779 10 CHA AE	5582 GPT 5002 CR7	55 5202 17:55 CID 5456 AE 5456	18:30 ⁵⁵⁰⁵ 19 CID MSN CR7 AE	5437 CAK CR7	20:25 LGA 4460 BTV AE 4582 E75	21:00 4799 22 HHH AE 4943	HHH CR7	
F15				F	7:04 4954 HHH 4915 4763	MDT 4669 C	DI 9:35 MH MLI E75 AE	5111	GRR CR9	SAV 5185 CHA AE 5502 CR7	AEX_AEX 5375	49 5123 14:41 HPN 5384 MLB AE 5202 CR7	PHF 5364	5083 16:40 .EX CR7	17:04 5429 18 5431	18:43 0RF AE	5306 19:45 5209 AGS 5208 CR7	20:00 4382 20:40	21:15 BTR AE	22:20 5074 EVV 5028 CR7	
E17				CHS 5: AE 5	6:56 7:30 246 SAV 205 CR9	8:08 4538 LYH 4886 AE 4921	9:10 9:40 SBY CR7	CID AE	11:30 5320 CID 5423 CR7	HTS 4866 AGS AE 4905 CR	13:14 ¹¹⁴ 13:46 S 7 AE	14:02 5302 14:50 4904 ROA CR7	15:13 5283 10 MLB AE	5132 JAN 5257 CR7	EWN 4939	18:43 ROA M CR7 A	5398 19:45 LB MSN E 5230 CR7		GPT 5083 AE 5202	SRQ CR7	

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E19						MYR 535 AE 530 6:29 530	57 CHS CR9 09 7:40	EWN 42 AE 42 8:32 42	884 TRI CR7 841 9:40	FAY 4934 AE 10:07 4904	FLO CR7 11:33	GSP 5067 LEX AE CR7 12:17 5153 12:59	MOB 52 AE 13:42 50	51 LEX CR7 78 14:25	PWM 5572 GRR AE 5567 CR9 15:10 15:50		HTS 4759 HHF AE CR 17:18 4813 18:02	7	CAK 5036 AE 5143	VPS CR7 20:20	LYH 47 AE 21:26 47	08 EWN CR7 14 22:30	
E18						SAV 54: AE 53	452 MYR CR9 389 7:40	OAJ 5113 AE 5466	CVG CR7 9:20	OAJ 48 AE 48 10:46 47	89 EWN CR7 73 11:55	GSO 4903 TRI AE 12:18 4765 12:59	BTR AE 13:47	5225 BHM 5311 CR7 14:30	TRI 4765 AE 15:38 4769	AVL FPO CR7 AE 16:24 16:48	5077 FAY 5105 CR7 5105 17:45		AGS 4907 F AE C 19:09 4870 20	FLO CR7 0:09	MDT 51 AE 21:29 55	80 PHF 56 CR7 22:30	
E16						GSO AE 6:52	5026 MEM 5026 CR9 7:50	MOB AE 8:42	5278 AGS CR7 5396 9:45	PIA 5349 PIA AE 5349 CR7 10:26 5431 11:19		LYH AE 4820 12:32	GSP SBY 4831 CR7 AE 4831 3:12 13:39	CRV CR7 14:19	ORIG 4809	LIT AE 16:20	5	5513 5147	GRB CR9 19:57	MLB 54 AE 52 20:30 52	31 MOB CR7 07 21:30	LGA 5066 GSO AE CR9 22:01 5112 22:45	
E14						ORF 5460 AE 5268	CVG CR9 7:24	AVL 5365 AE 5152	CHO CR7 9:19	GSO 4826 ROA AE 10:30487911:14		TRI 4841 ROA AE 4926 CR7 12:23 13:01	CRW 4824 HTS AE 4759 CR 13:25 14:05	MSN CAK AE 5204 CR7 14:25 5272 15:05	FLO 4862 ROA AE CR7 15:20 4842 16:05		ORI 503	G GSP AE 18:49	3833 MKE 3889 CR7 19:44		MOB AE 21:40	5060 LEX CR7 5520 22:35	
E12									ORIG 5129	BTR 5507 AGS AE 5263 CR7 10:34 5263 11:14		EWN ₄₉₃₆ FL0 12:29 ⁴⁸⁶² 13:0	0 JAN AE 5 13:47	5071 CHA 5508 CR7 14:27	LYH 480 AE 15:47 478	D4 TRI LI CR7 AI 36 16:30 16	FT 5064 MLB E LE 5064 CR7 A 6:58 5376 17:40 1	AB 5315 OKC AE CR9 8:00 5258 18:45	PGV 4869 L AE 4780 20	LYH FWA 54 CR7 AE 52 0:10 20:30 52	76 LEX CR7 35 21:30 TH	256 IRM	
E10						SDF 5 AE 5 6:46 5	5342 STL CR9 5073 7:40	SRQ 5390 TLH AE 5091 9:00	ROA 4790 GSO AE 4790 CR7 9:15 4903 9:55	LIT 51 AE 51 11:00 52	83 EYW CR9 20 11:45	TLH 509 AE 543	01 MSN CR9 37 13:34	CHA 5179 ORF AE 5179 CR7 4:01 14:40	CHO AE 5048 CR7 15:30 5239 16:10		HSV 531 AE 17:38 536	9 PHF L 9 CR7 A 1 18:20 1	YH 4779 CHO LE CR7 8:59 4885 19:49		GNV 520 AE 528	2 CHO E75 7 22:30	
E21						IAD 539 AE 537	99 IAD CR9 73 7:30	MKE AE 8:50	3850 CAE 3814 9:45	MKE 3896 AE 10:48 3798	SDF CR7 11:40	RDU 5415 AE 5288	BNA CR9 13:20 AVL 480 13:42	0 CHO 3 14:19	ROA AE 4926 (15:41 4907 (AGS 2R7 5:19	ORI 479	G 6	FLO 4 AE 19:40 4	777 HTS CR7 767 20:30	MKE 39 AE 21:37 40	59 CAE 0 CR7 10 22:20	
E23							DAY AE 5328 CR2 7:14 7:50	GPT AE 8:51	5232 MSN 5060 9:45	CAK 5468 AE 10:50 5462	8 GPT CR7 2 11:40	CHO 5152 AVI AE CR 12:12 5086 13:02	ROA_ 13:50	4879 ^{EWN} 4939 14:25	PIA 5186	AEX 6:20	AEX 5060 FWA AE 5060 CR7 17:05 5324 17:45		LEX TYS AE 5283 CR7 19:16 19:56	HPN AE 20:5	ORF 0 3904 CR7 21:30		
E25						PHL AE 6:58	L 3899 CAE E75 8 3908 7:45	CAK 52 AE 8:37 50	42 JAN CR7 71 9:30	CAE 3908 MYR AE 3777 E75 10:21 3777 11:19		ILM 5107 AVE AE CR9 12:13 5189 13:04	HH 13:	HHH 56 ⁴⁸⁹² 14:30	AGS 4805 PC 15:40 ⁴⁸⁶⁹ 16:	3V 16	MOB 5512 MOB AE 5060 CR7 17:10 17:49	0ÅJ AE 18:5	J 5226 SDF CR7 53 5477 19:49		HSV 5050 PIA AE 5041 CR7 21:06 21:45		
E27						CMH 44 AE 45 6:38 45	1544 DTW E75 1542 7:45	AGS 5439 BT AE 5225 9: 8:21 5225 9:	FR DCA GSP R7 5260 09 9:24 9:59	P ROA HHH IAD 4763 AE 9 10:21 10:55 11:10	5373 SAT CR9 0 5210 11:55	JAX AE 12:10	5458 5087	CMH CR9 14:24	JAN 5514 ^{CR} 15:40 ⁵¹⁴⁸ 16:	W 15 1	CHO ₄₉₁₈ FLO 17:01 ⁴⁷⁷⁷ 17:35		CHO ₄₈₀₉ ROA 19:10 19:44 1	GSP AE 19:59	5214 5336	BNA CR9 22:40	
E29						IND AE 6:51	4661 IND 4531 7:55	HSV 5329 AE 8:33 5185	SAV CR7 9:19	RIC AE 10:45 5436	CLE CR9 11:35	STL 5073 ILM AE CR9 12:10 5345 12:59	CAK 4 AE 13:28	5245 PNS 5212 CR9 14:50	3909 TERM	D: Al 16	05M 5055 LE 5276	DSM CR9 18:45	GNV 5252 19:18 19:50		MYR 5449 AE 5114	CHS CR9 22:35	
E31								ORIG 5573	YYZ 4464 BNA AE 4684 E75 9:19 4684 9:59	HHH CRW 4942 9 10:47 ⁸¹⁶ 11:19		AE 5509 12:29 5243	CAK GSO 5: CR9 AE 5: 13:15 13:33 5:	372 MEM CR9 494 14:40	4933 TERM	EY AE 16	YW E 6:56	5253 5421		MLI CID 5 CR9 AE 20:22 20:40 5	530 GPT 491 21:30 T	090 ERM	
E33						CAE 3 AE 6:50 3	3967 ^{BHM} E75 3819 7:35	CAE 3826 HS AE 3826 E 8:21 3906 9:	SV 75 09	ORF AE 10:47		5252 5285		ILM CR9 14:35	CVG 5166 AE 15:14 5229 1	CHS CR9 6:20	MSY 4662 CMH AE 4506 E75 17:08 4506 17:50	MC AE 18:	^{C1} 4675 ^{CMH} E75 55 4624 19:44		OMA 4556 IN AE 21:05 4495 22:	ID 75 05	
E35						ORI0 5261	G 51	FLO 49 AE 8:43 49	14 EWN 36 9:24	OMA AE 10:41	5253 5266	SAV CR9 12:59	JAX AE 13:32 531	7 DAB CR9 5 14:25	3 TE	190 DSM AE 16:45		5378 5036	SAT CR9 20:00		CHO 5552 AE 5177	CRW CR7 22:35	
E38							ORIG 5547		ICT 5316 AE 5164	CMH FLO AV CR9 AE 4850 CR 10:30 10:45 11:2	1. 17 15	DTW 4542 M AE 12:23 4510 13	DT SRQ 512 AE 512 10 13:37 512	39 SAV CR9 51 14:27	GRR AE 15:50		5043 5236		BHM CR9 19:30 T	5077 ERM			
E36						CVG AE 6:56	3	5341 5116	OKC CR9 9:20	TUL AE 5054 10:50	TUL 4 CR9 11:40	PGV 5187 CHO AE E75 12:05 5048 12:49	AUS AE 13:45	5433 CHS CR9 5181 14:35	HT TLH E 5072 CR9 5:02 15:59		CAE 3957 AGS AE E75 17:03 4001 17:55				CAK 5: AE 21:35 5	259 AGS CR2 438 22:30	
E34							ORIG 5082	BHM 5346 AE 5237	CRW CR2 9:20	IND 4484 AE 4457	4 CMH E75 7 11:45	AUS 5171 LIT AE CR9 12:05 5395 12:50	TVC ₅₁₆₇ BTV 13:10 ⁵³¹⁴ 13:44	GRR 5533 ATL AE CR9 14:05 5192 14:55	DAB AE 15:30		5460 5053	LIT CR9 19:00	YYZ 3834 C AE 19:17 3968 20	CAE AGS E75 AE 0:10 20:38	4001 3795	GSP CR7 22:40	
E32							ORIG 5290	AEX AE 8:49		5117 5502	VPS CR9 11:50	FAY 5487 CHS AE CR9 12:10508412:54	5092 PUS	2 H	CMH 4457 ILM AE E75 15:21 4674 16:09		LEX 5078 AE 5552	CHO E75 18:15	IAD AE 19:26 523	02 MSY CR9 32 20:30	IND AE 21:39	MSY 4476 E75 22:35	
E30						CHA AE 6:29	5165 5457	JAX CR9 8:50	CVG AE 9:10	5128 OMA CR9 5504 11:20		MYR 5289 MYR AE CR9 12:15 5053 12:59		SYR 5223 AE 5349	CLE MLI CR9 AE 15:20 15:39		5267 5514	RAP CR9 19:03	DAB AE 19:36	533 523	35 38	CHA CR9 22:20	
E28						(ORIG 5252	CHO 4876 HTS AE CR7 8:15 4866 9:00	SGF AE 9:15	5177 TVC 5037 CR 11:2	C 9 4	MEM SYR AE 5184 CR9 12:07 12:50	LIT AE 13:51	5033 MKE 5098 14:40	AUS AE 15:30		5200 5456	SGF CR9 18:50			AUS 5301 AE 5299	MEM CR9 22:35	
E26								ORIG 5531	BHM AE 9:15	5204 OKC CR9 5033 11:20		CLE 5282 GNV AE CR2 12:05 5063 12:50	ILM AE 13:53	538 2 524	6 CV 14 16:1	G MI 19 AE 4 16	DT 4510 JAX E E75 556 4662 17:59		AE 5420 0 19:19 20	GSO CR9 0:10	5069 TERM		
E24						O 5	ORIG 5432	SAV 5130 * 8:16 5267	MKE LNK CR9 AE 9:14 9:33	5415 PN 5575 CR 5575 11:2	15 15	IND 4470 GSC AE 4537 I3:0:	0 OR 5 AE 13:	F 5081 MYR CR9 56 5313 14:45	STL 5. AE 5. 15:43 5	370 PNS C CR9 A 094 16:44 1	CVG AE 17:00	5398 5040	IC CF 20:0	CT GSO R9 AE 06 20:45	5121 D/ 5374 22:	XY 29 35	
E22						O 5	ORIG 5079	CHS 5207 AE 5289	MYR CR9 9:30	BHM 5356 AE 5474	PVD CR9 11:50	CAE 3814 FAX AE 3831 E7 12:22 3831 13:00	5 Mł 5 13:	CR9 56 5140 14:45	PNS AE 15:22	5592 5004		AUS SAT CR9 AE 18:25 18:40	5210 5335	CLE PN CR9 A1 20:30 20	NS 5094 CV E 5109 22:	7G 29 35	
E20								ORIG 4850 AE 8:47 5	294 ILM 525 _{9:25}	ORIG 5632 DAY 50 AE 51 10:54 51	42 XNA CR9 93 11:50		PN AE 13:	5255 DTW 56 5434 14:45	AVL AE 15:29	5086 5180	MDT CR9 17:55		DTW 5435 AE 5169	ABE CR9 20:15	CHS AE 5138 21:00 2	CR9 2:09	
E8						AE 509 6:41 506	96 CMH CR9 61 7:29	JAN AE 8:37	5194 IND 5568 9:55	SRQ 5102 AVP AE CR9 10:10 5322 11:20	PU 5	ULL 172	DAB 53 AE 13:40 50	17 IAD CR9 31 14:25	MYR AE 15:33	5053 5066	LGA CR9 17:25	ATL 5276 AE 5553	GRR CR9 19:45		JAX 4636 21:33 ⁴⁵⁵⁴ 2	2:10	
E6								SDF 5 AE 5 8:32 5	5495 PNS 6255 9:45	MH1 5162 AE 5166	CVG CR9 11:40		1	ND 5568 AUS AE CR9 14:015301 14:45	CHS 5084 AE 5088	CR9 16:30	AE 5034 17:10 5070	1LM S CR9 A 18:25 1	AE 5056 CR9 19:00 20:00		AE 528 21:22 521	1 BHM CR9 1 22:30	
E4								MYR AE 8:47	5431 SYR 5260 10:00	AE 5350 10:28 5178	CR9 11:35		ABE 51 AE 51 13:4450	91 CVG CR9 035 _{14:25}	CLE 5436 M AE 5170 1	6:20	AE 5131 17:06	SAV PNS CR9 AE 18:20 18:50	5212 CVG 5303 19:45		XNA AE 21:33	5236 MYR CR9 5161 22:40	
F1	-							AE 8:36	5417 CR9 5245 9:45	AE 503- 10:43 503-	4 CR9 4 11:50		AE 13:50	5051 CR9 5372 14:30	4537 AE 15:30 4498	E75 AE 16:27 16:45	5288 CR9 5049 17:54	AE 18:50	5494 CR9 5318 19:44 1	AE 5105 CR7 19:595224 _{20:40}	AE 5088 21:18 5334	CR9 22:20	
F2						SP DCA		AE 8:45	5158 5D1 5330 9:50	AE 5080 CR 10:21 0FC	19		AE 5504 CR9 13:18 5527 CR9	14:22 ⁵²⁸⁶ 14:59	AE 520 15:42 500	66 CR9 69 16:35	AE 5377 17:16	CR9 //	AE 5144 CR9 19:01 19:55		AE 21:39	5161 CR9 5333 22:35	
F3					5:	3802 57 6:32		AE 8:38	5487 9:40	AE 5510 10:42	CR9 11:45		AE 13:48	5265 CR9 14:26	AE 5064 CR9 15:07 15:59	Cab	AE 5249 17:22	CR9 A 18:20 18	E 5189 CR9 8:58 5155 19:50		AE 21:39	5250 22:35	
F4						TYS	GSP	513	6 UT	AE 5160 CR9 10:18 5370 11:20				AE 5103 CR9 14:07 14:45	AE 5116 CR9 15:14 5300 16:05	AE 16:5	5243 CR9 53 5331 17:50	AE 18:49	5418 CR9 5101 19:40		AE 5455 21:09 5099	CR9 22:20	
F5						AE 535 6:24	54 CR7 7:45	AE 5344 8:22 5033	CR9 9:15	AE 5129 CR9 10:19 5270 11:16	M		VPS	5414 4:00 ⁵⁵⁴² 14:35	AE 5178 CR9 15:10 5502 16:00 CAK		AE 5285 CR 17:14 5455 18:0: SDF 5	I 54 AVL ILM	AE 5170 CR9 19:00 5103 19:50		AE 528 21:21 545	0 CR9 1 22:30 MH	
F6								AE 8:36 454	46 9:27 OAJ	AE 5134 CR 10:39 5058 11:2	9 5 DAY		AE 13:49	5185	E75 16:00	M	AE 5 17:465	154 CR7 AE 326 _{18:30} 18:50	4572 E75 19:45	п	AE 4554 21:14 4579 2	E75 2:09	
F7								AE 8:49 GRR	5176 CR2 9:26 5524 RDU	AE 5304 10:38 5115	CR9 11:35		BNA	4605 OMA	AE 5043 CR 15:24 16:1	9 4 GSO	AE 5521 C 17:19 5563 18	R9 10	AE 5047 CR 19:16 20:0	२9 05	AE 5005 21:06 5349	E75 22:15	
F8								AE 8:49 DAB 535	5415 9:40	CHS 5300 GS0	2 CR9 2 11:45		AE 13:42	4556 E75 14:55 RIC 4618 GSO	AE 55418 15:35 5418	CR9 16:25 PVD	AE 5286 CR9 17:05 17:55 SRQ		TERM	D	TERM		
F9								AE 535 8:35 513	2 CR9 9 9:24 SBY 4770 AVL	AE 5505 CR9 10:27 5350 11:20 GSP 5467	FPO			AE 4018 E75 14:02 4695 14:45	AE 5035 CR9 15:15 16:04 .GA AVP 5322	AE 16:51 XNA	5125 CR9 1 17:40 CMH 5(087 GSO	AE 5050 CR 19:21512720:0 CVG 5169 D	89 05 DAB	TERN 1LM 5451	LIN	
F10								5371	AE 4751 CR7 9:15 9:50	AE 10:10 5593 BHM 3	CR7 11:45 819 HSV		GSF	AE 1516 14:19 4566 1: 3989 YYZ	E75 5:15 DAY 5115 MEM	CR9 16:25	AE 17:41 5	CR9 121 18:30	ABE 5140 OMA	CR9 0:10	AE 5200	CR9 22:35	
F11								AE 8:43 55 BNA	5325 DAB	ILM 5082 DSM	909 11:50		13:5	54 ³⁸³⁴ 14:30	AE 15:14 5265 16:00 MEM 5058	TYS	XNA 5193 CVG	5546	AE CR9 19:06 5248 19:49	5382	TERM		
F12								AE 8:49 OR	5317 9:50	AE CR9 10:31 5055 11:20 SGF 3706 SGF					AE 15:35520810 LEX	5153 BTR	AE CR9 17:04 5281 17:50 MYR 5313 BHN	TERN	A T	TERM 530	550)3 XNA	
F13								50 OR	71 IG	AE E75 10:09 3213 10:50 CVG	5268	DTW			AE 15:55 OMA 5431 DSM	5074 16:45	AE 17:19 5182 18:0	031 TUL	AE 19:28 5163	5076	19	CR9 22:30	
F14								55) TLH	09 5213 ^{VPS}	MYR 5389 SAV	5458	CR9 13:00			AE 5165 CR9 15:20 16:00	G	AE 17:465 SAV 5070 GSP	271 _{18:30}	TERM	TERM 5337			
F15								AE 8:53	5183 9:50 ORIG	AE CR9 10:22 5051 11:10 BTV 4649 RIC					319 TYS 53	0 05 VPS	AE CR9 17:09 5214 17:50 5181	TER	XM T	ΓERM	YYZ 4498	MDT	
									5294 ORIG	TUL 5196 ORF					AE 55 15:37 50 CAE 3960	65 16:45	TERM YOW 5543 YO	AE 18:38	5385 E75 19:50 5814		AE 21:22 4636	E/S 22:20	
								PHF 5383	5247	YUL 3916	GSP				AE 15:22 3833 SAT	16:25	17:06 5265 18 5587	:10	TERM		4796		
								8:10 5320	9:20	AE 10:06 3989	11:35				AE 16:0	0	5553		CR9 19:45		TERM		
					ORIG		ORIG	EWR3697EW	VR IAD	IAD YYZ ₇₃₄₆ YYZ			LGA 3888 LGA	EWR 364	2 EWR	ORD48	823 ^{ORD} YYZ ₇	348 ^{YYZ} IAI	D IAD				6234
					6238		6113	8:34 ³⁶⁴⁸ 9: 2010	09 09 09:42	10:22 10:39 ³⁴⁷ 11:10 ORI	IG ^{EWR}	R3367 ^{EWR}	13:14 3642 CR9	UA 14:33 335 EWR 3314 IAH	6 15:30	16:46	LGA 5508 LGA	18:20 18:	LGA 6224 LGA		6302		TERM
						ORIG		TERM	LGA	484 LGA ₃₃₃₇ LGA IAH 61	15 11:52 165 IAH	2 ³³¹¹ 12:27		IAH 6115 IAD	LGA 5096 LGA		EWR ₃₄₀₁ EWR		$\frac{DL}{19:18}6227\frac{CR9}{20:00}$		TERM		
010					ORIG	3612 ORIG		8:35 3840 ORIG	9:15	9:57 ³³⁹⁹ 10:30 11:04 ⁶³ MSP MSP	³¹⁰ 11:41 B	BKW		14:09 ⁶¹²⁰ 14:44 2030	15:06 5099 16:00	BKW	17:20 ³³⁴³ 17:56 ORIG				4781		
010					3312	3844		2120	1	10:32 11:07	L.	2:00		2140		EM. 17:0	4554				TERM		

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Date:04/11/2019 Time:12:58

CLT 2028-Scenario 2

	00:00	01:00	02:00 03	3:00 04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
	ntulutu	ntulutu		վորորդի	ահորհեր		սեսիսես	hindutu		ntulutu	անսիսիս	utulutu	hutulutu	huhuhuhu	ntulutu	սիսիսիս	ntulutu	hitulutu	htulutu	hilululu	ntulutu	սահանու	hitulutu
O11						ORIG 4663				JFK 409 10:38 ⁴⁰⁵	93 JFK 5811:15						IAH 6245 IA UA 6285 I8:0	uH W 05			3812 TERM		1
O12						OF 33	RIG 357			LWB 8010 LWF VC ER4 10:16 1180 11:0	B 4					LW VC 16	VB 8011 LW	VB R4 06				4128 TERM	
O15										10.10 11.0	4845 TERM					<u></u>	4554 TERM						
O23											LGA 5060 LGA DL CR9						JFK 4189 JFK DL 3433 CR9	<mark></mark>					3395 TERM
O24											11:14 5005 12:00	1					17:19-10-18:00						
O25																							
O26																							
HS																							
R01	CLT UA			O129 O130			DEN 319 7:59	GR AA	U				*P: 15	SH 68				CI 33	T PIT 2 AA		T117 T118		CLT 319
R02	CLT UA 0-00		O131 O132		IAH 319 5-05		7.50	LEX PS	SH CLT CR7 43 9:55					FRA AA 14:00	*PSH 720	CLT 789 16:55		STL AA 18-17	PSH 1002	CLT 319 20:32	FNT AA 21:02	T109 T110	CLT 319 22-59
R03	CLT DL		(0133	5.05	SLC 320		8.03	BT	R PSH	I CLT CR9			MSY AA	120	10.33	P.	'SH 971	1002	20.32	CLT 319 21-25		T133
R04	CLT UA		O139 O140		01	RD CH 3G AE	10 3	PS 511	H 7	CLT E75	11.50			FLL AA 14:00		PSH 275		CLT 321			PIT AA 21:10	T105 T106	CLT 319
R05	0.00		EVV		6	03 0:5	28	511		10:55	PSH 5468		1	14:00		215		18:25	CLT CR7		ELP AA	T103 T104	23:59 CLT 319
R06	CLT AA		<u><u> </u></u>		O103 O104					MCI 319	5400			SDF AE			PSI 550	H	19:55	1	CLT CR9	ORD UA	D T141 CLT 73G 77 T142 2259
R07	CLT AA				0104				O105	10.55				14.15				,5	RIC 319	PVD AA	21.40 T	111	CLT 321
R08	CLT AA								O109 O110									М	19.45 DT PHL 319 AA	20.10	T113	112	23.39 CLT 321
R09	0:00 CLT AA						0121		0110						BDL 319				19:45 TPA AA	-	T127		23:59 CLT 321
R10	0:00 CLT AA					01	113							IAH 319	15:35				PI A	/ HX A	T10	1	23:59 CLT 321
R11	0:00 CLT DL			0137 0138		01	MSP 717				JAX AA			14:10			T115 T116		<u> </u>	9:54	110	2	23:59 CLT 319
R12	0:00 CLT AA			0156	O107		7:20	1	<u> </u>	BWI 319	10:59			TPA AA			1110		F107				23:59 CLT 321
R13	0:00 CLT AA				0100			O101 O102		10:50			1	14:08			RDU 320			LAX AA		T123	23:59 CLT 321
R14	0:00 CLT AA							0102	011	7							17:25		LGA 321	20:40	STT AA	T124 T121 T122	23:59 CLT 321
R15	CLT AA								0111 0112									PBI ORD 321 AA	19:55	1	T125 T126	1122	23:59 CLT 738
R16	CLT AA 0-00					O119 O120			0.112				PBI 321 13:40					10.20 10.44			1120		ATL T137 CLT DL T137 73H 23:06 T138 23:59
R17	CLT AA					0120			0115 0116				13.40					MSP 738				BO B6	$T_{130} = 100 \frac{2339}{2339}$ S T139 CLT E90 T140 2359
R18	CLT DL 0-00			O141 O142			ATL 738 7-30						JFK AA 13-10					T119 T120	1				CLT 738 22-59
R19	HOU WN 0:40						7.50		II			T129 T130	13.10										CLT 73H 23:59
R20	CLT DL 0:00		O135 O136			ATL 73H 6:15													EWN AE 19:40		T157 T158		CLT CR2 23:59
R21	CLT WN 0-00		O123 O124	HOU 73H 4:40		0.13		HTS AE 8-25	11		1	1	1			T147 T148		I	19.40				CLT CR7 23-59
R22	0.00	MDW WN		4.40				0.35				T131 T132											CLT 73W 22:59
R23	CLT WN 0-00	1.20	0	127 128		BWI 73W 6:55					CVG DL						T145 T146						CLT CR7 23:59
R24	CLT WN 0-00		O125 O126		MDW 73W 5:45	0.33									HS AI	SV 3			T1: T1	51 52			CLT CR7 23-59
R25		ATL DL 1:02			0.40				·			T135 T136											CLT M90 22-59
R26	CLT AE 0:00						O153 O154								HSV CR2 15:25	GSP AE 16:08			T T	F153 F154			CLT CR7 23-59
R27	CLT AE 0:00							O157 O158									TYS CR7 17:40		BTV AE 19:12		T159 T160		CLT CR9 22-59
R28	CLT AE 0:00							O159									TRI CR7 17:40		CLE AE 19:18		T165 T166		23.39 CLT CR9 22:50
R29	CLT DL 0:00							0151									CVG OKC CR7 AE 17-20 17-20	I	1 12.10	T149 T150			23:59 CLT CR9
R30	CLT AE 0:00						0155 0156	0.02							CHO CR7 15:24		CHS AE			T16	7		23:59 CLT CR9
R31	CLT DL 0:00				O145 O146		0.00			CVC CR	3 7				13.27		µ7:47		M	HT E 2-53	T16	3	23:59 CLT CR9
R32	CLT DL 0-00		0147		0110	LGA CR9				11:0									19	TUL	110	T161 T162	23:59 CLT CR9
R33	CLT AE		0148			0:20	016	53 54							SGF E75	SGF AE				T155 T156		1102	23:59 CLT E75
R34	CLT AE				0161		010	,	YUL E75						15:49	16:30				1150			23:59
R35	CLT UA			0143	0102	IAH E7W			10:01 BKW VC			l	1			T143			I				CLT EM2
R36	0:00 CLT VC			0149		7:05	1	BKW EM2	9:10							1144							23:59
R37	0:00			0150				8:30															
R38																							
								1			L									I			

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CLT 2028 Gating Scenario 3

	00:00	01:00 02:00 03:00	04:00	05:00	06:00 07:	00 00	00:80	09:00	10:00	11:00	0 12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00 23	3:00
							ոհոր		իսիսի	սիսիսիս					սեսիսես			1				dulu
AADO									-													
A21				CLTSC4 ORIG 5:15 2451 6:00		PVE AA 8:12	2 865*	SXM 320 9:25	BNA 821 AA 876	AUA 320 * 11:30	BOS AA 2044 12:04	MIA 321 13:20					D A II	CA ILI A 1979 31 8:52 20:0	M 19 00	MSP 1897 AA 1998 21:04	BWI 320 22:30	18 TE
A22	_			CLTSC4 ORIG 5:20 ²⁰⁶⁰ 6:1	5A 05		ORF AA 1770 8:29	ORF 319 9:15	MSY AA 10:24	833	STT 320 1:50	PHL AA 13:18	1789 MSP 321 1855 14:50			BWI 1915 AA 2038	PVD 320 18:15 PU	78 JSH		LAX AA 1717 21:09	FLL 2005 321 2:10 TERM	
A23				CLT 5:50	ORIG 2010 6:35		BOS AA] 8:28	1709 51 9:50	BWI 8 AA 82 10:20 82	76 GCM 320 21* 11:25	RSW AA 12:00	445 580	DEN 321 14:20	MCO AA 6 15:25	37 321 16:45	CLTSC4 ORIG 17:25	8:10	EWR 1598 AA 2483	1AH 738 20:10 TERM	DCA AA 21:29	922 319 22:40	
A24					CLTSC4 MIA ORIG 6:15 7:00		9	CLTSC4 LAX PULL 2057 9:00 9:45	SYR AA 1909 10:11	MSY 319 11:03		ORD AA 13:23	695 TPA 321 1810 14:50		LGA AA 16:44	436 PHX 321 17:45	LGA MSY AA 1809 320 18:02 18:55	STL 1768 PIT AA 319 19:10174719:54	SJU AA 20:23	753 2039	MSP 550 321 2:10 TERM	
A25					CLTSC4 ORIG 6:45 ¹⁹⁵⁶ 7:30			DTW 925 FNT AA 319 9:06 1109 9:52	CLTS0 10:35	24 RDU PULL 1797 11:20	TPA AA 629 12:06 1	BOS SMF 321 AA 13:10 13:28	1154 SAN 321 1583 14:45	LGA AA 494 15:00	PHX DFW 7. 321 AA 6:15 16:31 8	20 PHL 321 30 17:30	PDX 1853 AA 660	SJC BNA 194 320 AA 19:09 19:24 73	45 SAT 319 3 20:25	2035 TERM		
A26					CLTSC4 ORIG 6:45 868 7:30		MSY 5 AA 8:46 5	5330 ^{MHT} 319 5089 9:30	ORD AA 10:08	1729 1967* 11	PUJ LGA OF 321 AA 893 7 1:50 12:17 13:	RD 1051 738 :05 PUSH	SA AA 14:	N 823 LAS 321 51 65 15:49		1891 PUSH	CLTSC4 PULL 18:25 275	PVD DFW 5 AA 19:10 19:35 6	60 DEN 321 16 20:20 TE	724 ERM	973 TERM	
A27					CLTSC4 ORIG 6:45 928 7:30		ORD AA 68 8:20	PHX 30 321 9:40	LGA AA 87 10:00	PLS 9* 321 11:40	ORD PHX AA 628 321 11:57 13:00	MIA AA 13:35	2080 ORD 321 14:50			MSP AA 17:40	1836 1841	FLL 766 321 19:12 TERI	M	277 TERM	783 TERM	
A28					CLTSC4 SAT ORIG 6:45 1727 7:30		FLL AA 191 8:22	12 SEA 9:40	RDU AA 10:38	1977 1936	EWR 321 12:10	LGA AA 13:37	581 MCO 321 14:45	P A 1	BI A 6:00	294 1673		EWR BOS 321 AA 19:11 19:4	5 20:33	1971 TERM		
A29					CLTSC4 LAX ORIG 1993 6:50 7:35	SFO AA 5 8:01	1944 1946	ORD 321 9:35	FLL 173 AA 10:03 826	5 MBJ * 321 11:30	PHX AA 1842 12:06 1	PIT BWI 321 AA 1 3:09 13:30	FLL 760 321 14:30	BWI AA 15:15		1889 1798		20	PHL 321 0:05	LGA AA 557 21:04	SFO 321 22:20	
A1					CLTSC4 ORIG 6:50 525 7:35	EWR AA 5 7:55	1866	PBI 321 9:20	DCA AA 10:32	1837	RSW MIA 321 AA 1878 11:55 12:14	DFW BOS 321 AA 8 13:15 13:30	DFW 91 321 14:25	SFO 704 L0 AA 3 15:03 2050 16	5A 21 10	CLE RIC AA 2028 319 16:59 17:54	BWI AA 18:39	416	FLL 321 20:20	PHX 499 AA 1865	DEN 321 22:25	
A3					CLTSC4 ORIG 6:55	CO LG/ AA :40 8:13	GA A 1772	DFW 321 9:29	IAH AA 10:35	1961	FLL FLL 321 AA 1970 11:55 12:19	BWI LA 321 AA 13:19 13	X 1810 PHL 321 50 2055 14:45	LAX 724 PHI AA 321 15:00 559 16:05	. SFO AA 16:46	1908 S 1799 18	FO E 21 05 1	PBI 1798 AA 844	DFW 321 20:27	SFO AA 1857 21:13	MCO 321 22:19	
A5					CLTSC4 ORIC 7:05	MCI 7:50	DFW AA 8:34	835 SJU 9:50	BUF AA 8 10:14	58 NAS 321 11:30	DEN TP. AA 1808 32 12:03 13:0	A DEN AA 2059 13:21	9 321 14:20	RSW AA 1992 15:03	PVD D 319 A 16:30 16	CA IAH A 673 319 5:54 17:54	Т	2084 CLT: ERM 19:4	SC4 RIC ORIG 5 ²⁰⁰⁶ 20:30	BOS AA 21:39	ORD 1788 321 22:35	
A7					CLTSC4 ORIG 7:05 2011	, RDU PHL AA 7:50 8:10	883*	CUN 321 9:25	MIA AA 10:29	521 DE 521 32	MCO 1725 MCO AA 32 12:04 691 13:0	D 1 A	FW 2091 JFK A 321 3:52 1972 14:55	PHX 1 AA 15:35	899 SFO 321 705 16:40	ATL 786 AA 678	LAX ORE 321 AA 18:16 18:4:	747	MCO 321 20:15	DFW AA 1812 21:12	BOS 321 22:15	
A9					CLTSC4 OR 7:10	IG ORD 16 7:55	BWI AA 192: 8:20	25 321 9:35	PHL 826 AA 10:05 1735	LAS 321 11:20	DFW AA 87.	ATL P 3 321 A 13:24 II	BI BWI A 2063 321 3:52 14:50	SEA 2107 AA 2107 15:16 443	SEA 321 16:20	TPA 7 AA 17:20 17	30 LGA 321 40 18:40	ATL RSV AA 1820 32 19:02 20:0	W 21 00	SEA AA 180 21:26	3 321 22:26	
A11							CLTSC4 ORIG 8-29	MSY 9:14	DTW AA 885	CUN 5* 321	ATL AA 2066	LGA PHX 738 AA 20	LGA 321 14-26	DFW AA 1719	FLL 321 16-24		SA AA 18	N 487 5	SLC 321 0:05	ATL 19 AA 18	98 ATL 738 97 22:40	
A13							STL AA 8:51	PIT 1677 319 9:45	10.11	CLTSC4 ORIG 10:50 1924 11:35	IAH 382 AA 12:11 100	JFK 738 13-19	LAS 1458 SMF AA 1917 14:50	LAS 748 B AA 1999 16	OS ORD 21 AA 10 16-39	622 TPA 321 731 17:53		LAS AA 2075	MSP 321 20:10	MCO AA 1704	3DL 321 2.09	
A12							0.01	2.45		CLTSC4 MCI ORIG 10:55 1964 11:40	12.11	MCC AA 13:4	2055 PHX 321 5 695 14-35	BOS DF AA 1775 3	W 21	EWR AA 470	SAN 321	MIA 76 AA 19:20	0 PVD 321 96 20:29	DEN AA 1873	TPA 321 22:15	
A10					LAX 696 AA 1813	TPA MCO 321 AA 7:45 8:10	o 461	SFO 321 9:24	RSW AA 67	9 321	PHL 1882 PHL AA 319 11-59 2054 13-00	1855 TERN	1	DEN 428 AA 15:24 1791	TPA 321 16-24	FLL 609 AA 1787	PDX 321 8-10	RIC MC AA 1769 31	CI PHL 19 AA 20:40	892 472	PHX 321 22:15	
A8					898 PUSH	7.45	MSP AA 8:46	1910 LGA 1910 321	MCO 790 AA 205) TPA 3 321	EWR 161	5 EWR 738 7 13-26		MSP AA 2046	RSW 321 16:35	BOS 1787 AA 609	SEA 321 8-10	LGA 61 AA 19:20 17	6 BOS 321 83 20-29	LAS AA 179	PHL 6 321 22:25	
A6					LAS 431 DEN AA 428 732	1	PBI AA 44	45 321 9-35	TPA AA 18	ORD 62 321 11-25	ROC 11 AA 12:19 2	907 ELP 319 254 13:45		BDL BN/ AA 1715 31	10.2.5	MCO AA 651	DEN 321 18:25	SEA 633 AA 541	SEA T 321 A 20:20	PA 2039	DFW 321 321	
A4					SAN 579 SFO AA 662 321		LAX AA 8:42	BOS 1982 321 0.45	BDL AA	752 ^{SJ}	U ORF 21 AA 1973	IND MCI 319 AA 1	ROC 860 319	ORD 1999 MCO AA 321 15:05 1899 16:00		DEN 181 AA 56	1 DFW 321	FLL AA 1920	BWI 321	JFK AA 1774	DTW 321 22:00	
A2					PDX 1930 AA 487	SAN 321 7-50	TPA AA	9.43 BWI 1960 321	MSP AA	BOS 1937 321	PIT CI AA 2078 3	LE DCA 19 AA 2	14.3.3 MSY 2045 319	FLL ATL AA 504 321		PHX 767 AA 466	SMF 321	SFO 662 AA 1975	LAX 321	FLL AA 1737	LAX 321 22:00	
B1					SJC 661 PDX AA 320 Coo 1872 7.05	7.50	RSW 413 AA 713	MSP 321 0-20	DFW AA	LGA 2064 321	BNA AUS AA 653 319	MEM AA	1827 319	SRQ 1130 D AA 15:20 184 16	EN M 21 A.	IIA 1799 ORI A 1908 32	18.20	BDL AA 1871	TPA 334 321 TERM	ORD AA 12	MIA 77 738 22:10	
B3					DEN AA 1980	BOS LAS 321 AA	⁸ 1955	MCO 321	BOS 19 AA 17	67 MCO 321 29 11-20	BDL RE AA 1914 3	DU 19	JFK 2530 AA 2249	EWR 1. 738 A	AX 819 SJU A 819 321 600 972 1650	PHL 799 AA 1733	MCO 321	JAX AA	1861	21.27	PBI 319	
B5					EWR AA 1364	738 738	MIA AA 8:47	EWR 1496 738	10.19	SJU 1376 SRQ AA 321	PVD AA 657	IAH 7 319	14.00	EWR AA 379	MIA R 738 A	SW BWI A 703 321	10.20	CLTSC4 MDT ORIG 10:04 1720 10:40		RDU P AA 2038 7	/D 38	
B7					2011 PUSH		JFK AA 14	MIA 18 738 0.20	AUS AA	10.50 - 10 - 11.90	1964 1849	JAX 319		MIA 2448	ORD 1 738	PIT 1829 DFW AA 321		MCO 746 PHX AA 463 10.55	EWR AA 20-26	1245 1608	JFK 738	
B9					BWI JFK AA 2042 738	EV A/	WR 2531 JFI	5.50 FK 38	ATL AA 206	IAH 5 738		SAT AA	r 1633	FNT 319	10.23	IAH EV AA 1711	VR SJU 38 AA	836 SFO 619 19:30	20.30	MIA AA 1384	EWR 738	
B11					476 PUSH		ATL 713 AA 413	3 ATL 3 321 3 9-35	EWR 1451 AA 1458	EWR 738	CHS 1849 AA 1950	DCA PIT 319 AA 1	BDL 700 319	TPA 52 AA 52	39 LAX 321 25 16:40	STL AA	10.55	1065		FNT CLTSC4 319 21-17 21-35	L SYR	
B13						DTW AA 8:08	V 1942	BUF 319 9-10	JFK AA 10-	330 738	DCA RIC AA 2077 319	DTV AA 13:4	756 319	ATL 2032 AA 1821	DTW 319 16:30	MCI AA 1701	MIA 738 18-20	844 TERM		BUF AA 1940 20:58	ALB 319 22:15	
B15					RDU DCA AA 1732 319 617 730	FNT AA 8:03	1751 97	SLC 319 9:30	1924 TERM	DEN AA 11:15	1446 LAX 652 13:00	C 1	RDU 2069 PIT AA 319 13:56 2084 14:55	IND 18 AA 15:30 18	343 DCA 319 364 16:40	RDU DT AA 2067 3	W 19 05	451 TERM		RIC AA 1893	AUS 319 2:10	
B16					PHX 2020 DFW AA 2091 321 6.09 2091 7.30	0.00	BDL AA 178	CLE 80 319 9:40	PVD AA 10:32	1831 MI 114	IA 887 21 TERN	4	1974 PUSE	IAH 174 AA 15:35 184	5 ALB 319 3 16-24	CLTSC4 BUI PULL 1242 18:00		DFW JF AA 2648 73	K BWI 58 AA 20 20-38	864 2035	JAX 319 22:45	
B14					SLC 2014 PHX AA 408 7:30		PIT 1 AA 8:35	1978 NAS 319 852 9:40	STL AA 1 10:27	923 319 11:20		CLE AA 13:37	RDU 1934 319 14:30	DCA AA 1653	MCI 319 6:15	ALB PV AA 2052 3	M 19 05	ROC AA 1921	JAX 319 20:15	2043 TERM		
B12					BOS AA 1	BNA RIG 817 319 AA 8:00 8:1	IC 1941 A 829*	MEX 319 9:30	MDT AA 10:33	1753	JAX 319 1-50	BUF AA 2002	BOS 2 319 14:15	NAS AA 853	BUF 321 16-29	NAS AA 859	PIT 319 18:15	JFK 101 AA 1390	EWR 738 20:10	BDL AA 1952	BUF 319 22-25	
B10						PHX AA 8:11	x 423 1965*	PUJ 321 9:25	LC A/ 10	A 1988	ALB 319 11:55		CHS DCA AA 1938 319 14:02 14:55	RDU AA 15:44	1962 BWI 16:45	IND AA 765	STL 319 18:25	RDU AA 18-55	861	ATL 556 738 21:19 TER	3 M	
B8					MCO AA 2062 6:44	LGA JA 321 A. 7-59 8:	iax aa 1722 8:17	DCA 319 9:30	PIT AA 1 10:20	730 DCA 11:30	MCI 1267 BUF AA 319 AA 11:45 751 12:30 12:4	B 1756 ALB 50 1753 13:50		JAX AA 2036	SYR 319 16:19		1692 TERM	MSY 732 AA 1885	BUF 319 20:15	ALB AA 207	CLE) 319 22:25	
B6					RIC BDL AA 1654 319 6:34 7:30		MEM AA 8:43	1853 RSW 9:55		ELP 281 AA 281 11:07 1870	ELP 319 1-50		CLTSC4 IAH ORIG 14:10 2069 14:55	RIC 1 AA 15:41 1	864 PIT JAX 319 AA 745 16:35 16:4	C DCA 1750 319 50 17:50	CLTSC4 ORIC 18:29	MSP 19-14	CLTSC4 LGA ORIG 19:55 1954 20:40	SAT AA 1870	ROC 319 22:16	
B4					PIT PVE AA 1903 319 642 7:34	9 BUF 9 AA 5 8:08	829 1941	DTW 319 9:19	PWM AA 10:33	ATL 1814 319				PHL AA 20	PBI 47 319 16:30		DFW AA 1752	DFW 1AH 744 321 AA 19:10 19:25 1861	RDU 319 20:10	SYR AA 1987 21:04	DCA 319 22:14	
B2					SEA 624 AA 658	LAS 321 8:00	IND AA 8:44	1756 BDL 319 9:50	PBI AA 1847 10:10	PHL 319 11:15				MSY 1821 R AA 1886 3 15:30 1886 16:	IC 19 09		584 PUSH	CLTSC4 DTV PULL 19:15 736 20:0	w	DTW LC AA 1981 3 20:55 22:	A 19 14	
C2					DCA AA 190 7:02	PIT)4 319 7:59	DCA AA 179 8:28	CHS 95 319 9:30	ALB 1 AA 10:23 6	707 SXM 319 13* 11:25			2017 PUSH	BNA 1886 JAX AA 319 15:142032 15:59	-	AUS AA 1840 17:15	BDL 1 319 18:25	NAS 605 PL AA 31 8:54 1029* 20:0	.S 19 00	RSW 1805 AA 745	IAH 321 2:10	
C4							IAH 8 AA 8:38 1	852 IAH 319 1978 9:35	MCI AA 10:28	1797 IND 319 1977 11:30		CLTSC 13:40	ORIG 1789 14:25	MCI AA 15:35		422 1540		ELP 319 19:15	1954 TERM	MSY AA 179: 21:20	PIT 319 22:25	
C6						ILM AA 8:04	PHL 1839 319 9:00	FSD 784 AA 9:23 993	MCI SAT 319 AA 10:15 10:39	BNA 850 319 9 11:40				DTW AA 18 15:39	MSY 16:30			1976 TERM		MCI AA 21:40	1785 ORF 319 22:40	
C8					ATL AA 469	ATL 321 8:00	CLE AA 1784	MEM 4 319 9.24	ROC AA 1868	CHS 3 319	<u> </u>				BUF AA 16:20		422 524	FSD 319 19:54	CLT:	SC4 MC1 PH PULL AA 5 21:30 21:	1854 321 0 22:45	
C10					profé					BDA 1840 AA 1434*	MEX 319 12:00			CLTSC4 ORIG	BDL 16:20		CLTSC4 ORIC 18-28 1530	PBI 19:13	10.4	CLTSC4 STI PULL 881 21:15 881 22:00		
C12																	10.20			22.0		
C14																						
C16																						
AAIN		· · · ·	· 	· 	· · · · · · · · · · · · · · · · · · ·				· 	·	· · · · · · · · · · · · · · · · · · ·	·	·	·			·	· 	·	·	·/	
I1											CLTSC4	4 CUN 0RIG 887* 13:30			MB AA	³ *869 50 749	LAS 321 8:10	MBJ *827 AA 1919	MIA 321 20:15	s	10 CLTSC4 *1850 1:55 TERM 22:40	
12					CLTSC4 0RI 7:05	G PUJ 3* 7:55	A	GCM *860 HAV AA 319 9:00 1615* 9:45		PAP AA 11:00	*368 1826	NAS 319 13:15	M A. 14	BJ *843 RI A 3 :53 2056 16	DU CUN 21 AA 10 16:40	*884 BOS 321 1806 17:55		PLS *880 C AA 18:55 1851 20	0RD 321 0:05			

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CLT 2028-Scenario 3

	00:00 01:00	02:00	03:00	04:00 05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
				ntoloto otoloto	ntulutu										ntulutu					ntulutu	ntulutu	ntulutu
13					6	LTSC4 CUN ORIG CUN :55 ^{804*} 7:45			PLS *{ AA 10:00 10	842 KII 140* 12:0	N 9 0				PUJ * AA 16:21	1963 ATL 738 787 17:50	CUN AA 18:40	*886 PBI 321 2061 19:55	PUJ *1968 20:16 TERM 21:0			
14						TTSC4 MPI	SDQ *1839 AA 982*	9 UVF 321 9:45	AA 10:	*1283 SJO 321 50 1087* 11:55	0				HAV *1074 AA 16:05 1028	BDA 319 17:30	SXM AA 18:40	*866 BNA 320 1867 19:49	20:29 TERM	21:14 21:14		
15					6	:55 843* 7:45	CLTSC4	MBI	KIN NOSA PAP	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	9 0					PUI	AA 18:00 1865*	319 19:30	AA 20:15	1342 300 321 874* 22:00		
16							8:35 840	0* 9:25	AA 319 0:55 1647* 10:50							AA 17:42	*190 643 GCM **	20 DCA	321 0:05 20::	0 TERM 21:35		
17																	AA 18:14 8	522 320 56 19:44 *828 MEI	20:24 TERM 2	1:09		
18						GR	U \$1062 CLTSC4					FRA *705 CLTSC4	4		LHR	*731	AA 18:35 LHR	1768 31 20:0	9			
110						AA 7:50	0 PUSH 8:50					AA PUSH 14:00		FC	AA 16:15 0 *721 CLTSC4	730*	789 18:40 BCN	*745	BCN			
111														A/ 15 FC	⁷⁸⁹ 55 TERM 16:55 ^O *721 ^{MAD}		AA 18:20	744* CLTSC4 PULL	332 20:45 GRU			
112														A/ 15 MAE	255 748* 16:40 *74	49 ¹	DUB LHR	*733	20:30 LHR 780			
113													DG	*787) 72 FRA C 332 A	24 1 CLTSC4 PULL	8:05 18:30 FCO 789	732*	20:15			
114												DUB	3:55	704* 725	16:35 1)	6:55 720*	18:25 CDG 332					
OADO												13:05		786*			18:20					
01	1078 TERM			CLTSC4 ORIG 643	C4 MDW ORIG 1010	UTSC4 BWI ORIG 3773		BWI 3055	DAL 5				BNA 5136 BNA WN 684 738		MD	0WMDW 853 1748	HOUHOUI 1747 1493	DAL BWI 1721				
02	9 TERM			4:40 5:25 5:45	6:30 6	:55 7:40		9:35	10:10				14:00 084 14:45		16::	50 17:25	17:55 18:30 1	8:55 19:30				
O3	1441 TERM			CLTSC4 ATL		CLTSC4 SLC ORIG 521	ATL	2422 73H	ATL ATL DL 1454 M90		DTW DTW DL 1629 319		MSP MSF 1503		ATL 602 ATL DL 2651 73H	AT D	ТL АТL L 826 73н	ATL DL 1407	ATL 73H	2808 TERM	1076 TERM	19 TF
O4	TERM			4:45 5:50 CLTSC4 DTW ORIG 0:00 5:15 1366 6:00		CLTSC4 ORIG 7:20 2266 8	8:48 1SP	9:30 DTW DTW 2292 9:04 9:39	10:03 10:45	ATL AT DL 2251 71	L ATL 7 DL 1095	ATL 5 717 13:15	[14:24 14:59	ATL ATL DL 2133 73H	MSP DL 13 16:40	322 DTW 322 320 524 17:20	DTW 10	DTW 57 19:15		TLAM	1 EICH	522 TERM
O5				<u></u>	CLTSC4 ATI ORIG 6:15 2488 7:00	CLTSC4 ORIC 7:30	ATL 8:15	2.04 2.02		11.10 12.0	12.00	ATL DL 13:42	ATL 2597 320 14:30	DTW 6 DL 15:40 1	603 MSP 319 793 16:30		10.10					876 TERM
O6				CLTSC4 IAH ORIG 5:05 1191 5:50		SFO 1704 UA 7:21 1969	SFO 739 8:20	ORD 425 UA 9:26 521	ORD 73G 10:15			ORD 1484 ORD UA 319 13:00 1140 13:45		DEN 1711 UA 15:10 1199	DEN 320 16:22	SFO 1 UA 17:31 1	1176 SFO 739 1698 18:30				1286 TERM	1974 TERM
O13								BOS B6 9:24	8025 BOS 8020 10:51													
O14				CLTSC4 ORIC 5:33 ⁸⁰²²	G BOS 2 6:18				JFK 219 JFK B6 218 E90 10:01 218 10:40	BOS 1245 BOS 10:59 ¹²⁴⁶ 11:36					30S 8021 BOS 36 8016 E90 16:00 8016 17:00	BOS = 1445 BO = 1600 B6	DS JFI 90 B6 00 18:	JFK 1119 E90 50 1118 19:28			8017 TERM	
O18				DEN	CLTSC4 ORIG 6:03 1712 6:48	7:5	0 5290 8:35		MCO	lich	ICH			DITI M					TTN	enst		5812 TERM
O19				F9 5:10	201 200	319 7:20			F9 1028 320 10:11 10:59	$\begin{array}{c} 15P \\ F9 \\ 11:20 \\ 353 \\ 12 \\ 12 \\ 12 \\ 12 \\ 12 \\ 12 \\ 12 \\ 1$	319 2:05			F9 1689 3 15:21 16	320 :09				^{11N} 933 ^{F9} 20:25 932	320 1:10		
O20																						
027																						
O28																						
029																						
030																						
031																						
121															MUC LH	*428	MUC 359					
121															16:20	429*	18:35					
AEDO																						
D13					PHF 5 AE 5	190 PHF CR2 557 7.25	PGV 5234 AE 5187	PGV CR2	AE 5	241 MLB CR2	OAJ 5176 OAJ AE 5314 CR2	MGM 5441	SDF CR2	FAY 383	1 IND CR2	FAY AE	5486		GNV CR2	GNV 5202 AE 5282	CHO E75	
D12					10:30 5	/////	MGM AE 9-29	5293 MGM 5440 P45	SGF 3706 SGF AE 3706 E75 10:09321310:50	SDF AE 11:05	509	93 23	IND CR7 14-50	EVV 5032 AE 5366	EWN CR2 16:14	TYS AE 17:10	5119 5256	FAY CR2	HTS 5461 20:15 ⁵⁰⁴⁹ 20:50	DAY 5 AE 21:31 5	156 PGV 118 22:40	
D10					67 A1	VV 5228 LEX 5039 CR2 7:30	6.30 FAY AE 8:40	5273 TYS CR2 5297 9:35	CHA AE 10:44	5277 EVV 6 5032 11:35	CRW 5237 BHM AE CR2 12:15 5164 13:00	4 DAY 2 AE 13:43	5120 PHF 5052 CR2 5052 14:25	GPT 5095 CID AE CR7 15:05 5096 15:50	GNV AE 16:09	5063 C 5259 IS	CAK CR2 8:04	CRW 5148 FWA AE CR2 19:05 5405 19:49	MEM 5265 MLB AE 5141 20:45	LEX AE 21:36	5264 MGM CR2 5298 22:41	
D8						CAK ₅₃₅₅ CHA 7:08 ⁵²⁷⁷ 7:43	CRW 5347 B AE 5142 C	HM CR2 9:10	LEX AE 50 10:40	039 FAY 463 CR2 11:20	HSV 3906 C/ AE 3960 Cl 12:25 13:	AE R2 :05	MYR 3777 AVL AE 4011 CR2 14:01 14:40	OAJ 5314 AE 15:33 5222	4 MGM AV CR2 AE 2 16:19 16:	4011 CA 52 3775 18:0	AE R2 00	CHS SRQ AE 5227 CR9 19:03 19:50		4796 TERM		
D6							CAE 3826 H AE 3906 9	ISV E75 0:09	BTR AE 550 10:34	7 AGS 3 CR7 11:14	BHM AE 5142 12:30 5218	TLH CR2 13:10	PGV AE 5117 CR2 14:07 14:45	ORIG 3973		PHF 5052 AE 5264	LEX SHV 5514 CR2 18:14 18:30 ⁵²⁵⁴ 19	LH 52 :05 PU	222 JSH	TLH ₅₂₁₁ LFT 21:15 ²⁷⁶ 21:46	PULL 5304	
D4							FWA AE 8:49	5406 CR2 5176 9:26	GSP 54 AE 55 10:10 55	67 FPO 93 CR7 11:45	GNV TYS 5371 12:25 ³⁰⁵ 13:00	S GPT AE 13:37	532 522	20 26	OAJ CR7 16:14	FWA 5135 DA AE 5135 CF 17:11 5156 18:0	AY AVL R2 AE 00 18:42	4769 4895	TRI HPI CR7 AE 20:15 20:	ORF 3945 CR7 0 21:30		
E1					fam	5058 PUSH	I I I I I I I I I I I I I I I I I I I	327 GRR CR9 533 9:25	PULL MSN 5343 10:45	cual have	5231 5104	t	HPN CR7 14:33	MGM 5366 AE 5096	LFT CR7 16:20	BHN AE 17:4	5311 CR2 5186 CR2 15 18:25		DIUT	5186 TERM	4377	
E2		500 PUS	6 SH		CRW AE 6:45		5263 5335	2175 HPM	AE 5157 10:06 5179	E75 AE 5 11:14 11:40	514 CR9 255 12:20	AE 13:	5294 TYS 515119 14:35	AE 3773 BHN 15:07 3865 16:0	5 5 5	CMH AE 17:41	5087 GS0 5121 18:30	TRI	PULL 5468	AE 5037 20:59 5100	AVL CR7 22:25	
E3					5279 PUSH	729 041	4025 DAX	5384 9:30	AE 55 10:39	294 CR2 11:18	AGS 5206	E75 13:24	CAE	AE 379	CR7 0 16:35	4892 PUSI	H	AE 4786 19:00 4755	CR7 20:30	5049 TERM	BTR	
E5					AE 6:22 4	7.58 CR7 389 7:40 4921 GS0	TERM 8:51	522	5122 5364	CR7 11:45 JAN	AE 5396 12:16 5135 1	CR7 13:10	AE 5. 14:03 5:	204 16:00	5576 HPN	AE 17:21 ROA 492	5233 5233	CR7 19:45	AE 5411 CR7 20:00 5523 20:40	AE 5257 20:58 5407 CAE 2775 MK	CR7 22:15 E	
E7					AE 6:35 AGS 5/	4826 7:50	AE 8:30 LFT	551	14 390	CR7 11:20 CAE	AE 4731 CR 12:12 4804 13:0 TYS 5297 M	R7 AE 03 13: MOB FAY	5463 VPS	CR7 AE 15:15 15:44 NA 5560 ICT VPS	5166 17:00 5138 HTS	AE 482 17:16 479 CRW 47	CR7 98 18:30 749 OAJ ROA	AE 3 19:23 4 4842 SBY	4023 CR7 20:40	AE 5775 CR 20:59 4056 22:0 OAJ 403	7 5 1 LYH	
E9					AE 5. 6:31 50 TRI	093 7:30 4867 ^{HHH}	AE 8:42 TRI 485'	2 LYH	002	CR7 11:19	AE 5277 12:20 5512 1 506	CR7 AE 13:10 13:45 SHV CVG 54	5453 ^{CR7} 66 ^{HSV}	4:55 ⁵¹⁹⁶ 15:32 AE EWN 4773 L	5200 CR7 5200 17:00	AE 4 17:30 49	931 18:25 18:43 BTR 5500 H	4835 19:50 SV HSV 397	73 YUL	AE 493 21:24 492 ROA 4807 RO	2 22:30	
E11					AE 6:39	4942 CR7 7:35 ROA 4776 FAY	AE 4833 8:16 4820 HPN 515	0 CR7 9:35 50 MOB	AE 10:45 SHV	5 554	514 6 втв	CR7 AE 54 13:15 13:31 53 AG	19 14:25 ⁸ 5263 DAY	AE 1779 16 15:06 4779 16 CHA	5582 GPT	6:55 5202 CR7 6:55 5202 17:55	18:30 ⁵⁵⁰⁵ 19 CID MSN	05 19:21 391 5437 CAK	5 20:25 LGA 4460 BTV	AE CR 21:00 4799 22:0 HHH	7 5 HHH CD2	
E13					•	AE 4934 CR7 7:04 7:40 HH4915ROA	AE 512 8:22 525 GSP 5235	51 CR7 9:35	AE 10:44 ORIG	536 LIT 5183 EYW	4 CR7 13:00 SAV 5185 CHA	AE AEX_5375 ^{AEX}	HPN 5384 MLB	AE 15:40 PHF 5364 I	5083 CR7 16:40	AE 5429 18	CR7 AE 8:04 18:43 ORF	5306 CR7 19:45 5209 AGS	AE 4582 E75 20:00 4582 20:40	AE 4943 21:15 BTR 4	CR7 22:20 5074 EVV	
E 10 E 17					CHS 5	246 SAV	8:18 5509 9 LYH 4886	SBY CP7	5632	11:00 5220 11:45 320 CID	HTS 4866 AGS	13:144 13:141 13:46 FLO	14:02 5302 CR7 14:02 5302 14:50 4904 ROA	15:13 5283 10 MLB	5132 JAN	EWN 4939	9 ROA M	5398 19:45		GPT 5083	5038 22:40 SRQ	
					6:18 5	295 7:45	8:12 4831	9:20	10:18 5	423 11:45	12:18 4805 CR	1 13:4	8 4829 14:35	AE 15:44	5257 16:35	17:24 480	7 18:15	:52 19:54		21:10 5393	22:14	

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	00:00	01:00	02:00 03:	00 04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00 18	8:00 19	9:00 20	:00 21:	00 22:	00 23:00
		ատեղությ	անոհունունու	սհորդորդ							սնվուն			որվորը		Infutul		վորոր	վորոր		ուսիսներ	
E19						MYR 53: AE 53: 6:29 530	57 CHS CR9 09 7:40	EWN AE 8:32	4884 TRI CR7 4841 9:40	FAY 4934 AE 4904	FLO CR7 11:33	GSP 5067 LEX AE 5067 CR7 12:17 5153 12:59	MOB 52 AE 52 13:42 50	251 LEX CR7 078 14:25	PWM 5572 GRR AE 5577 CR9 15:10 5567 15:50	0.0	HTS 4759 HHH AE CR7 17:18 4813 18:05		CAK 5036 VPS ME 5143 CR7 9:18 5143 20:20	L A 2	H 4798 EWN 26 4744 22:30	
E18						AE 52 6:36 52	452 MYR CR9 389 7:40	0AJ 5113 AE 5466 8:13 5466	CVG CR7 9:20	0AJ AE 10:46	4889 EWN 4773 CR7 11:55	AE 4903 CR7 12:18 4765 12:59	AE 13:47	5225 BHM 5311 14:30	1RI 4765 AE 15:38 4769	AVL CR7 16:24	5431 TERM	AGS AE 19:09	4907 FLO CR7 4870 20:09		E 5180 PHP E 5556 CR7 1:29 5556 22:30	
E16						GSO AE 6:52	5026 CR9 7:50	MOB AE 8:42	5278 AGS 5396 9:45	PIA 5349 AE 5431 10:26 5431	PIA CR7 11:19	AE 4820 12:32 4933	GSP SBY 483 CR7 AE 483 13:12 13:39	1 CRW 9 CR7 14:19	ORIG 4809		SDF 5154 A AE 17:46532618	CR7 AE 522 3:30 18:53 54	26 SDF CR7 77 19:49	MLB 5431 MOB AE 5431 CR7 20:30 5207 21:30	LGA 5066 AE 22:01 5112	GSO CR9 22:45
E14						ORF 5460 AE 5268	CVG CR9 7:24	AVL 5365 AE 5152	CHO CR7 9:19	GSO 4826 R AE 10:30487911	CR7 1:14	AE 4841 CR7 12:23 13:01	AE 4824 CR 13:25 14:0	5 MSN 5204 CAK 7 AE 5204 CR7 5 14:25 15:05	AE 4862 ROA 15:20 4842 16:05		ORIG 5037	GSP 3833 AE 3889 18:49 3889	3 MKE CR7 9 19:44		MOB 5060 LE AE 5520 CF 21:40 5520 22:3	X 17 15
E12						ILM 50 AE 6:41 50	96 CMH CR9 61 7:29	MDT 4669 AE 4538	CMH MLI E75 AE 9:10 9:40	5111 5514	GRR CR9 11:30	EWN ₄₉₃₆ FL 12:29 ⁴⁸⁶² 13:0	LO JAN AE 13:47	5071 CHA 5508 CR7 14:27	LYH 480 AE 15:47 478	4 TRI LF 4 CR7 AF 6 16:30 16	FT 5064 MLB DAB 53 E 5064 CR7 AE 53 6:58 5376 17:40 18:00 52.	15 OKC PG CR9 AE 258 18:45 19:	GV 4869 LYH E 4780 CR7 20:10	FWA 5476 LEX AE 5235 CR7 20:30 5235 21:30	5256 TERM	
E10						SDF AE 6:46	5342 STL 5073 7:40	AE 5390 TLF AE 5091 9:00	H ROA 4790 GSO 7 AE 4790 CR7 9:15 4903 9:55	P	PULL 5117	TLH 50 AE 54 12:28 54	091 MSN CR9 137 13:34	CHA 5179 ORF AE 5179 CR7 14:01 14:40	CHO 5048 CAE AE 5239 CR7 15:30 16:10		HSV 5319 PHF AE 5319 CR7 17:38 5361 18:20	LYH 47 AE 18:59 48	779 CHO CR7 885 19:49	HSV 5050 AE 5041 21:06	PIA CR7 21:45	
E21						IAD 53 AE 53 6:44 53	399 IAD CR9 373 7:30	MK AE 8:5/	KE 3850 CAE CR7 0 3814 9:45	MKE AE 10:48	3896 SDF 3798 11:40	RDU 5415 AE 5288	BNA AVL 480 CR9 13:20 13:42 ⁴⁷⁴	90 CHO ¹³ 14:19	ROA 4926 A AE 4907 C 15:41 16	GS R7 :19	ORIG 4796		FLO 4777 HTS AE 4767 CR7 19:40 4767 20:30		MKE 3959 CAE AE CR7 21:37 4010 22:20	
E23							DAY 5328 CLE AE 5282 CR2 7:14 7:50	GP AE 8:5		CAK AE 10:50	5468 GPT 5462 11:40	CHO 5152 AV AE 5086 CR 12:12 5086 13:0	7L ROA R9 05 13:50	4879 ^{EWN} 4939 14:25	PIA 5186 A 15:43 5310	:20	AEX 5060 FWA AE 5060 CR7 17:05 17:45	LE AE 19	EX 5283 TYS E 5283 CR7 0:16 19:56	OMA 4 AE 21:05 4	556 IND E75 195 22:05	
E25						PH AE 6:5	IL 3899 CAE 58 3908 7:45	CAK 5 AE 8:37 5	5242 JAN CR7 5071 9:30	CAE 3908 AE 3777	MYR E75 11:19	ILM 5107 AV AE 5107 CR 12:13 5189 13:0	/P HF 89 04 13	HH ₄₈₄₄ HHH :56 ⁴⁸⁹² 14:30	AGS 4805 PC 15:40 ⁴⁸⁶⁹ 16:	6	MOB 5512 MOB AE 5500 CR7 17:10 17:49	lava	FAY 5105 AE 5124 19:595224	HSV AVL 53 CR7 AE 53 0:40 20:55 51	CAK N CR2 4 22:05 2	IGM 5491 AEX 5292 2:27 22:59
E27						CMH 2 AE 6:38 2	4544 DTW E75 4542 7:45	AGS 5439 AE 5225 8:21 5225	BTR DCA GS CR7 5260 9:09 9:24 9:5	9 10:21 10:55	AE 5373 CR9 11:10 5210 11:55	JAX AE 12:10	5458 5087	CR9 14:24	JAN 5514 15:40 ⁵¹⁴⁸ 16:1	5 1	17:01 ⁴⁷⁷⁷ 17:35	19:10	4809 4810 0 19:44 19:59	5214 5336	2:	NA CR9 2:40
E29						IND AE 6:51	4661 IND 4531 7:55	HSV 532 AE 8:33 518	29 SAV CR7 85 9:19	AE 5. 10:45 5	290 CLE CR9 436 11:35	AE 5073 CR9 12:10 5345 12:59	CAK AE 13:28	5245 PNS 5212 CR9 5212 14:50	3909 TERM	DS AI 16	5055 E 5276	DSM G CR9 18:45 19	9:18 ⁰²⁴ 9:50	MYR AE 20:59	5449 CH 5114 22:3	15 19 15
E31								ORIG 5573	AE 9:20	5292 5172		LF1 CR9 12:25	GSO 5 AE 5 13:33 5	372 MEM 494 CR9 14:40	4933 TERM	E Y AE 16:	rw E :56	5253 5421	MLI CR9 20:22		5090 TERM	
E33						CAE AE 6:50	3967 ^{BHM} E75 3819 7:35	AE 4876 CR 8:15 4866 9:00	8 YYZ 4464 BN 7 AE 4464 E7 9:19 4684 9:5	A ORF 5 AE 10:47		5252 5285		ILM CR9 14:35	AE 5166 0 15:14 5229 10	HS R9 :20	MSY 4662 CMH AE E75 17:08 4506 17:50	MCI 467 AE 18:55 462	75 CMH E75 24 19:44	50 TE	99 RM	
E35								FLO 4 AE 8:43	4914 EWN CR7 4936 9:24	OMA AE 10:41	5253 5266	SAV CR9 12:59	JAX 524 AE 531 13:32 531	7 DAB CR9 5 14:25	31 TE	90 DSM AE RM 16:45	53 50	978 936	SAT CR9 20:00	CHO AE 21:08	5552 CR 5177 22::	W 17 15
E38							~		ICT 5316 9:03 5164	CMH FLO CR9 AE 48: 10:30 10:45	50 AVL 50 CR7 11:25	DTW 4542 M AE 12:23 4510 13	ADT SRQ 51 E75 AE 51 3:10 13:37 51	39 SAV CR9 51 14:27	GRR AE 15:50	le non	5043 5236	BI C 19	HM 5077 CR9 TERM	low	CAK 5259 AGS AE CR2 21:35 5438 22:30	
E36						CV0 AE 6:56	G 6	5341 5116	OKC CR9 9:20	TUL AE 10:50	5054 CR9 11:40	PGV 5187 CHO AE E75 12:05 5048 12:49	AUS AE 13:45	5433 CHS CR9 5181 14:35 1	AHT TLH AE 5072 CR9 5:02 15:59	LIT AE 16:20	5513 5147	r and they	GRB CR9 19:57	CID 5530 GPT AE 5530 CR7 20:40 5491 21:30		
E34								BHM 534 AE 8:30 523	46 CRW CR2 37 9:20	IND AE 10:46	4484 CMH E75 4457 11:45	AUS 5171 LIT AE CR9 12:05 5395 12:50	13:10 ⁵³¹⁴ 13:10 ^{13:44}	GRR 5533 AIL AE CR9 14:05 5192 14:55	DAB AE 15:30		5460 5053	CR9 AI 19:00 19	YZ 3834 CAE E E75 9:17 3968 20:10	AGS AE 20:38	4001 3795 2	GSP CR7 2:40
E32						ku e		AE AE 8:45	9 9	5117 5502	VPS CR9 11:50	FAY 5487 CHS AE CR9 12:105084 12:54	509. PUS	2 H	CMH 4457 ILM AE E75 15:21 4674 16:09		AE 5078 CHO AE 5552 18:15	D 4 D	AE 5502 CR9 19:26 5232 20:30		PULL 5503	
E30						CHA AE 6:29	5165 5457	JAX CR9 8:50	AE 9:10	5128 5504	CR9 11:20	AE 5289 CR9 12:155053 12:59		AE 5223 14:30 5349	CEP ME1 CR9 AE 15:20 15:39		5267 5514	CR9 19:03	AE 19:36	5335 5238	CR9 22:20	
E28									AE 9:15	5177 5037	CR9 11:24	AE 5184 CR9 12:07 12:50	L11 AE 13:5	5033 MKE CR9 1 5098 14:40	AUS AE 15:30	2 2 2	5200 5456	CR9 A 18:50 1	AE 5420 CR9 19:19 20:10	AUS AE 21:05	5301 CF 5299 22:3	5
E26								ORIG 5531	AE 9:15	5204 5033	CR9 11:20	AE 5282 GNV 12:05 5063 12:50	AE 13:5	538 2 524	86 CR 44 16:1	AE 4 16:	4510 JAX E 4562 E75 E56 4662 17:59		Long Long	506 TER	9 M	
E24								AE 5130 8:16 5267	MKE LNK CR9 AE 9:14 9:33	5415 5575	PNS CR9 11:25	AE 5509 12:29 5243	CR9 AE 13:15 13	5081 MYR 56 5313 14:45	AE 5. 15:43 50	370 PNS C CR9 A 194 16:44 1	AE 17:00	5398 5040	CR9 20:06	AE 512 20:45 5374	CR9 22:05	
E22								CHS 5207 AE 5289 8:09 5289	CR9 9:30	AE 535 10:13 547	6 PVD CR9 4 11:50	CAE 3814 FA AE 38314 E7 12:22 3831 13:0	75 AE 05 13	КЕ 5267 АВЕ СК9 :56 5140 14:45	5592 PUSH		PULL 5004	AE 18:40	5210 CRS 5335 20:30	AE 50 20:55 51	04 CVG CR9 09 22:05	
E20								AVP AE 8:47	5294 CR9 5525 9:25	AE 10:54	5042 CR9 4 5193 11:50	ND	AE 13	5255 DTW 56 5434 14:45	AVL AE 15:29	5086 5180	MDT CR9 17:55	AE 19:04	5435 CR9 5169 20:15	AE 5 21:00	38 CR9 22:09	
E8								AE 8:37	5194 IND 5568 9:55	AE 5102 10:10 5322	CR9 11:20	AE 4470 E7 12:12 4537 13:0	75 AE 05 13:40 50	17 IAD CR9 31 14:25	AE 15:33	5053 5066	CR9 AE 17:25 18:05	5276 5553	CR9 19:45		21:33 ⁴⁵⁵⁴ 22:10	
E6								AE 8:32	5495 CR9 5255 9:45	AE 510 10:30 510	62 CR9 66 11:40		ADE	AE 5568 AUS AE CR9 14:015301 14:45	AE 5084 15:30 5088	CR9 16:30	AE 5034 CR8 17:10 5070 18:25	9 AE 5 19:00	5056 CR9 20:00	AE 21:	5281 CR9 2 5211 22:30	N/D
E4						OR 526	IG 51	AE 8:47	5431 ST 5260 10:0	AE 535 0 10:28 517	0 CR9 78 11:35		ABE 5 AE 13:445(191 CR9 035 _{14:25}	AE 5436 W 15:25 5170 10	2R9 20	AE 5131 CR9 17:06 18:20	AE 521 18:50 530	2 CR9 3 19:45	f IT	AE 5236 0 21:33 5161 2:	CR9 2:40
F1							5079	AE 8:36	5417 CR9 5245 9:45	AE 10:43	5474 CR9 5034 11:50		AE 13:50	5051 CR9 5372 14:30	AE 15:30 4498	E75 AE 16:27 16:45	5288 CR9 5049 17:54	AE 18:50 5318	4 CR9 8 19:44	AE 21:18	5088 CR9 5334 22:20	N
F2					k	isp DCA	5432	AE 8:45 PNS	5158 CR9 5330 9:50	AE 5080 10:21	CR9 11:25		AE 5504 CR9 13:18 5527 13:57	14:22 ⁵²⁸⁶ 14:59	AE 520 15:42 506	O CR9 9 16:35	AE 5377 CR9 17:16 18:20 DTW MYR	AE 5 19:01	5144 CR9 19:55		AE 5101 CF 21:39 5333 22:3	19 15 M
F3						3802 57 6:32		AE 8:38	5343 CR9 5487 9:40	AE 10:42	5510 CR9 11:45		AE 13:48	5046 CR9 5265 14:26	AE 5064 CR9 15:07 15:59	САК	AE 5249 CR9 17:22 18:20	AE 51 18:58 51	189 CR9 155 19:50	ORF	AE 5331 21:39 5250 22:3	9 55
F4						TYS	GSP	51	136	AE 5160 10:18 5370	CR9 11:20			AE 5103 CR9 14:07 5565 CR9 14:45	AE 5116 CR9 15:14 5300 16:05	AE 16:5	53 5331 17:50	AE 5418 18:49 5101	CR9 19:40	AE 21:09	5455 CR9 5099 22:20	
F5						AE 53: 6:24	54 CR7 7:45	AE 5033 8:22 5033	CR9 9:15 5.47 YYZ	AE 5129 10:19 5270 1 ABE 512	CR9 11:16		VPS	5414 14:00 14:35 5192	AE 5178 CR9 15:10 5502 16:00 CAK	G	AE 5285 CR9 17:14 5455 18:05 SO IND	AE 5 19:00 5	103 CR9 103 19:50	AE 21:2 CMH	5451 CR9 5451 22:30	
F6							5252	AE 4. 8:36 4.	546 9:27 GPT	AE 515 10:39 505	8 11:25		AE 13:49	5223	E75 16:00 PIT SA	AI 16	RIC 5221 BNA	AE 457: 18:50	2 E75 19:45 MH MHT	AE 21:14 [VPS	4579 _{22:09}	
F7							5290	AE 8:10 5320 GRI	CR7 9:20 R 5534 RDU	AE 55 10:38 51 CMH	CR9 115 11:35		BNA	4605 OMA	AE 5043 CR 15:24 16:1 ILM 5345	GSO	AE 5521 CR9 17:19 5563 18:10	AE 19	E 5047 CR9 0:16 20:05	AE 21:06	5349 _{22:15}	
F8							5082	AE 8:49 DAB 53	9 5415 9:40 352 SRQ	AE 10:50 CHS 5309	5522 CR9 5522 11:45 GSO		AE 13:42	4556 E75 4556 14:55 RIC 4618 GSO	AE 5545 15:35 5418 IAD DAB	CR9 16:25 PVD	AE 5286 CR9 17:05 17:55 SRQ	TE	RM		5182	
F9							5547	AE 8:35 51 ORIG	CR9 139 9:24 SBY 4770 AVL	AE 5505 10:27 5350 YUL 3916	CR9 11:20 GSP			AE 4018 E75 14:02 4695 14:45	AE 5035 CR9 15:15 16:04 LGA AVP 5322	AE 16:51 XNA	5125 CR9 1 17:40 CAE 3957 AGS		AE 0000 CR9 19:21512720:05 CVG 5169 DAB	ILM	TERM 5451	т
F10								5371	AE 4770 CR7 9:15 4751 9:50	AE 3989	CR7 11:35 CRW		GSI	AE 4540 14:19 4566 1 P 3080 YYZ	E75 5:15 DAY 5115 MEM	CR9 16:25	AE 575 17:03 4001 17:55 IAD 5031 T	UL ABE	AE 5105 CR9 19:26 5307 20:10	AE 21:03	5200 22:3	5 5
F11								ORIG BN.	5452 A 5325 DAB	ILM 5082	6 11:19 DSM		13::	54 ³⁸³⁴ 14:30	AE CR9 15:14 5265 16:00 MEM 5058 T	YS	AE 17:46 5271 18: XNA 5193 CVG	CR9 AE 3:30 19:06	5248 19:49		TERM	
F12								4850 AE 8:45	9 5317 9:50 RIG	AE 10:31 5055 BH	CR9 11:20 ^{HM} 3819 HSV				AE 0000 C 15:35 5208 16 LEX	R9 19 5153 BTR	AE CR9 17:04 5281 17:50 MYR 5313 BHM	TERM	SDF	5300	XNA	
F13								5	5071	AE 10: CVG	59 3909 11:50	8 DTW			AE 15:55 OMA 5421 DSM	5074 16:45 FPO	AE 5515 CR9 17:19 5182 18:05		AE 19:28 5163	5219	CR9 22:30 PULL	
F14								5	5509 LH 5213 VPS	AE 10:49 MYR 5389 SA	5458 W	CR9 8 13:00			AE 5451 CR9 15:20 16:00	AE 16:48	5105 17:45 SAV 5070 GSP	581	TERM 5337		4925	
F15								Al 8:	E 5183 9:50 ORIG	AE 10:22 5051 11:1 BTV 4649 RIC	89 10				319 TYS 53	0 05 VPS	AE 5070 CR9 17:09521417:50	VPS	M TERM		IND MS	Y
F16									5294	AE E75 10:214618 11:05 TUL 5196 ORF					AE 55 15:37 50 CAE 3960	65 16:45 GSP	TERM	AE 5385 18:38 5307	E75 19:50	YY	AE 4476 ET 21:39 22:3 4498 MDT	75 15
								1	5247 ORIG	AE 5196 CR9 10:20 5081 11:02					AE 3900 15:22 3833 SAT	E75 16:25	AE E75 17:06 5265 18:10 5587	TERM	LNK 50	AE 21:	2 4636 E75 22:20	
F18									5129						AE 16:0		5553		CR9 TE	RM		
F19					ORIG		RIG	EWR	EWR IAD	IAD	IAH 6165 IAH			EWR 364	2 EWR	ORD	823 ORD	IAD I.	IAD			6234
07					6238		357	8:34 ³⁶⁴⁸	9:09 9:42	6150 CR7 10:22	11:04 ⁶³¹⁰ 11:41 EW	/R3367EWR		UA 335 14:33 335 EWR 3314 IAH	E7W 6 15:30	48. 16:46 ⁴⁸	843 17:21 EWR ₂₄₀₁ EWR	6160 18:55 19	9:30			3395
08					3312		ORIG				11:	52 ³³¹¹ 12:27		UA 3315 E70 14:24 15:02			17:20 ³³⁴³ 17:56				302	TERM
09						ORIC	6113				LGA SOKO LGA		LGA 2888 LGA	14:09 ⁶¹²⁰ 14:44	LGA 5096 LGA		UA 6285 E7W 17:14 6285 18:05		.GA 6224 LGA	201	ERM	
010						3612					DL 5060 CR9		DL CR9 13:14 3642 14:00		DL CR9 15:06 5099 16:00		4554	D	9:18 6227 CR9	TEF	M	

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4128 TERM
4781 TERM
РП Т179 CL Ал Т180 33
*T199 CL T200 78
PSH CLT FNT T183 CL 170 AA T183 31 170 T184 319
RIC 319 AA T173 CL 319 AA T174 33
BIC PSH CLT ELP T177 CLT AA PSH 319 AA T177 CLT upon 881 319 AA T177 CLT
1920 001 21:13 21:35 117/6 25:5 CE 31
CLT ORD T209 CL 319 UA T210 730
21:35 22:47 12:10 23:5 11 PHL T185 CC: 19 AA T197 32
IS IP45 IT80 23:5 TPA T189 CII AA T100 32
1947 1190 23:5 LGA PVD T175 CI: 321 AA T172 32
19:55 20:10 1176 23:5 PHX T197 CU AA T100 32
19:54 1198 23:5 1 CL 2 22:5
2 23:5 CL 734
23:5 STT T171 CU AA 32
21.09 T172 23.5 T193 CL 73
T194335 CC 73
ATL T205 CL pl T205 731
PSH CLT (RZ) ATL T206 23:5 PSH CLT (RZ) ATL T207 CL DL 730 73
4925 21:50 23:06 T208 23:5
23:5 CL M9
23.5 T225 CL
T226 23:5 T213 CL
T214 23.5 MGM PSH CLT R7 T211
20:15 5304 22:05 T212 T221 CL CL
1222 23:5 CLT GRR T229 CL CR7 AE T229 CL
19.53 20.25 T230 23.5 T237 CL
T238 23:5 BTV T231 CL AE CL
19:12 T232 23:5 CLE T239 CL
T240
1240 23:5 MHT T233 CL AE CP
IP:18 1240 23:5 MHT T233 CL AE T234 CR 19:53 T234 23:9
IP:18 I 240 23.3 MHT T233 CL AE T234 CR (19.53) CLT 23.4 CH CH 23.4 T223 CLT 23.4
IP:18 IP:40 23:3 MHT T233 CL AE T234 23:5 CR9 21:40 CL T223 CR CL T223 CR CL T223 CR CL T223 CR CL T224 23:5 23:5 T227 CL CL
IP:18 I 240 23.3 AE T233 CL AE T234 CR IP:53 CLT CL 21:40 CL CL T224 CR CL T224 CL CL T227 CL CL T228 21:40 CL YIL T235 CL
IP:18 I 240 23-3 AE T233 CU AE T234 CR CR9 21-40 CU T224 CR CU T227 CU FR T228 C2-5 CU AE T236 CL IP-36 T236 CL
IP3:18 1240 23.3 MHT T233 CL AE T234 CR 19:53 CL CL CR9 23.4 CR 21:40 CL CL T223 CL CL T224 CR CL T225 CL CL AE T235 CL AE T236 23.9 VUL T236 CL CL CL CL AE T236 CL CL CL CL C
IP:18 I 240 23.5 AE T233 CL AE T234 CR IP:53 CLI 23.5 CLI CLI 23.5 CLI 21.40 CLI T224 CLI 21.40 T224 22.9 CLI T224 23.9 CLI T224 23.9 CLI T224 23.9 CLI T228 23.9 CLI IP:36 T236 CLI EM T236 CLI EM T235 CLI EM T236 CLI EM T236 CLI EM T236 CLI EM T195 CLI EM 20.40 T196 23.5

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CLT 2033 Gating Scenario 2

	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
												սիվոր				սիսիսիս	ուսիսիս	Լոլոիսի						ահորու
AADO																								
A21						CLTSC4 ORIG 5:15 2451 6:00	TPA AA 6:46		2	011 797	(RDU 321 11:20	ORD PHX AA 628 321 11:57 13:00	FLL AA 13:20			1051 275		1	PVD CLTS 321 19:10 19:45	C4 ORIG 2006 20:30	DEN AA 1873 21:18 2	321 2:15	
A22							SFO AA 6:14	89 20:	98 57	LAX 321 9:45	LGA AA 879* 10:00	PLS 321 11:40	RSW AA 12:00	445 580	DEN 321 14:20	BWI AA 15:15		1889 1798		PI 3 20:	HL PHL 21 AA 05 20:40	892 472 ₂	9HX 321 2:15	
A23							SMF AA 6:02	476 840*		MBJ 321 9:25	SYR MSY AA 1909 319 10:11 11:03			PHL 1 AA 13:18 1	789 MSP 321 855 14:50	1	PBI AA 6:00	294 1673	1	EWR 321 19:11	EWR AA 20:36	1245 JI 1608 22:	FK 38 10	
A24							SEA AA 6:15	624 LAS 658 8:00	BOS AA 8:28	1709 FLL 9:50	ORD 172 AA 196'	9 PUJ 7* 321 11:50	TPA 1 AA 629 12:06 1	BOS 321 3:10 TERM			R A II	AA 703 321 6:55 17:45		TUS 852 AA 843 2	TUS TP. 319 AA 20:10 20:	A 2039 DF 3:52 890 22:	21 10	
A25							SAN 579 AA 662	SFO 321 7:30		DTW 925 FNT AA 319 9:06 1109 9:52	RDU AA 10:38	1977 1936	EWR 321 12:10	ORD AA 13:23	695 TPA 321 1810 14:50	MCO AA (15:25	i37 LAS 321 16:45	EWR AA 470 17:01	SAN BWI 321 AA 18:15 18:39	416	FLL 321 20:20	JFK AA 1774 21:02	DTW 321 22:20	
A26							CLTS 6:45	C4 PHL ORIG 1956 7:30	ORD AA 68 8:20	PHX 80 321 9:40	FLL 1735 AA 826*	MBJ 321 11:30	PHX AA 1842 12:06 13	PIT SMF 321 AA 3:09 13:28	1154 SAN 321 1583 14:45		DFW 7. AA 16:31 8	20 PHL 321 30 17:30	PE A. 18	BI 1798 A 844	DFW 321 20:27	LGA AA 557 21:04	SFO 321 22:20	
A27							LAS 431 AA 428	DEN 321 7:35	SFO 1944 AA 1946	ORD 321 9:35	DCA AA 10:32	1837 RSW 11:55	MIA AA 1878 12:14	DFW BWI 321 AA 17 13:15 13:30	FLL 60 321 14:30			MSF AA 17:4	P 1836 40 1841	FLL 321 19:12		PHX 499 AA 1865	DEN 321 22:25	
A28							PHX 2020 AA 2091	DFW EV 321 A/ 7:30 7:	VR A 1866 55	PBI 321 9:20	IAH AA 10:35	FLL 1961 321 11:55	FLL AA 1970 12:19	BWI MIA 321 AA 13:19 13:35	2080 ORD 321 14:50	SEA 2107 AA 443	SEA SFO 321 AA 16:20 16:46	1908 5 1799	SFO ORD 321 AA 18:05 18:45	747	MCO 321 20:15	MCO BE AA 1704 32 21:03 22:0	DL 21 39	
A29							SLC 2014 AA 408	PHX 321 7:30	FLL AA 19 8:22	912 SEA 921 321 9:40	BUF AA 858 10:14	NAS 321 11:30	BOS AA 2044 12:04	MIA LGA 321 AA 13:20 13:37	581 MCO 321 14:45	LGA AA 494 15:00	PHX 321 16:15	TPA AA 17:20	730 LGA 321 1740 18:40	STL 1768 PIT AA 319 19:101747 19:54		SFO AA 1857 21:13	MCO 321 22:19	
A1							LAX AA 6:26 1	696 TPA 321 1813 7:45	LGA AA 1772 8:13	DFW 321 9:29	MIA AA 10:29	521 DEN 321 11:45	DEN TP/ AA 1808 32 12:03 13:01	A DH A A/ 2 13	W 2091 JFK 52 1972 14:55	TPA 5 AA 7 15:27 7	39 LAX 321 25 16:40	ATL 786 AA 16:57 678	LAX SAN 321 AA 18:16 18:4	487 3149 451 20	LC 21 05	DFW AA 1812 21:12 2	BOS 321 2:15	
A3							MCO AA 6:44	2062 LGA 321 7:59	DFW AA 8:34	835 321 9:50	PHL 826 AA 1735	LAS 321 11:20	MCO 1725 MCC AA 321 12:04 691 13:01	DEN AA 2059 13:21	MIA 321 14:20	SFO 704 L AA 2050 16	GA 321 :10		2 TI	2084 ERM		LAX FI AA 1717 3 21:09 22:	LL 21 10	
A5						CLTSC4 LG ORIG 5:20 2060 6:0	A EWR AA 05 6:47	EWR 1364 738 7:45	PHL AA 883* 8:10	CUN 321 9:25	DTW AA 885* 10:11	CUN 321 11:25	DFW AA 873 12:27	ATL LA 321 AA 13:24 13:	K 1810 PHL 321 30 2055 14:45	LAX 724 PH AA 32 15:00 559 16:0	L ORD 1 AA 5 16:39	622 TP/ 731 32 17:5	A SJU 8 11 AA 8 13 18:35 6	336 SFO BOS 321 AA 519 19:30 19:45	STL 793 319 20:33	277 TERM	973 TERM	
A7							AT AA 6:5	L ATL 469 321 2 8:00	BWI AA 192 8:20	25 321 9:35	BDL AA 10:31	52 SJU 321 11:45		PH A/ 13	1 BWI 2063 321 52 14:50	PHX 1 AA 15:35	.899 SFO 321 705 16:40	BOS 1787 AA 17:00 609	SEA 321 18:10	RIC MC AA 1769 315 19:11 20:00		SEA AA 1863 21:26	RSW 321 22:26	
A9					CLTSC 4:45	ORIG 823 5:30	DEN AA 6:37	1980 BOS 321 7:50	MCO AA 461 8:10	SFO 321 9:24	PVD AA] 10:32	831 MIA 321 11:45		BOS AA 89 13:30	DFW 1 321 14:25	DFW AA 1719 15:20	FLL 321 16:24	FLL 609 AA 17:00 1787	PDX 321 18:10	ATL RSW AA 1820 321 19:02 20:00		FLL AA 1737 21:21	LAX 321 22:20	
A11							CLTS 6:45	C4 RSW ORIG 928 7:30	PHX 423 AA 1965*	PUJ 321 9:25	RSW AA 679	PHX 321 11:25	ATL AA 2066	LGA PHX 738 AA 20	LGA 58 321 14-26	LAS 748 E AA 15:08 1999 16	OS 321	MCO AA 65	DEN 51 321 18:25	LGA 610 AA 19:20 178	5 BOS 321 3 20:29	BUF AA 1940 20:58 2	ALB 319 2:15	
A13							CLTSC4 MIA ORIG 6:15 1877 7:00		ATL 71 AA 41 8-21 41	3 ATL 3 321 3 9:35	MCO 790 AA 2053	TPA 321 11:20	IAH 382 AA 12:11 100	JFK 738 13:19	LAS 1458 SMF AA 1917 14:50	BOS D AA 1775	FW 321	DEN 1 AA 17:21	1811 DFW 321 565 18:30	FLL AA 1920	BWI 321 20:20	RSW 1805 14 AA 3 21:10 745 22:	10 TERM	
A12							CLTS 6:45	C4 SAT ORIG 1727 7:30	LAS 1955 AA 1905	MCO 321 9:19	TPA AA 1862	ORD 321 11:25	EWR 161: AA 12:23 144	5 EWR MCO 738 AA 7 13:26 13:45	2055 PHX 321 695 14:35	DEN 428 AA 15:24 1791	TPA 321 16:24	PHX 767 AA 460	7 SMF 321 6 18:20	SEA 633 AA 541	SEA 321 20:20	5069 TERM		
A10							C	LTSC4 ORIG 55 ¹⁷²⁵ 7:40	MSP AA 8:46	LGA 1910 321 9:55	MSY AA { 10:24	333 STT 320	LGA OR AA 893 7: 12:17 13:1	.D 38 05		MSP AA 2046	RSW M 321 A. 16:25 10	IIA 1799 C A 1908 II	ORD 321 8:00	SFO 662 AA 19:14 1975	LAX 321 20:20		783 TERM	
A8								CLTSC4 ORIG 7:05 PUJ 7:55	PBI AA 4 8-31	145 DEN 9:35	MSP AA 193	BOS 7 321 11:30	ROC 19 AA 12:19 2	007 ELP 319 54 13:45	SAN AA 14-5	4 823 LAS 321 65 15:49		PHL 79 AA 17:16	9 MCO 321 33 18:20	BDL T AA 1871 3 19:07 20	PA 321 -06	ORD AA 127' 21:27	MIA 7 738 22:30	
A6								CLTSC4 MCI ORIG 7:05 1906 7:50	LAX AA 8:43	BOS 1982 321 9:45	DFW AA 2	LGA 2064 321	PHL 1882 PHL AA 319 11:59 2054 13:00	MEM AA 13:39	SAT 1827 738 14:40	ORD 1999 MCO AA 12115:05 1899 16:00	LGA AA 16:44	436 PHX 17:45	DFW I AA 1752	DFW IAH 744 321 AA 19:10 19:25 1861	RDU 319	MSP 1897 AA 1998	BWI 320 22:30	
A4								CLTSC4 ORD ORIG 7:10 1916 7:55	TPA AA 8:41	1960 BWI 9:40	BOS 1967 AA 1729	MCO 321 11-20	PIT CI AA 2078 3 12:05 13:1	.Е 19 05	14.40	FLL ATL AA 504 321 15:05 15:59	10.44		CLTSC4 ORIG 18-29 1317	MSP 766 19:14 TERM	808 1 TERM	DCA AA 19	RIC 22 319 22:40	
A2							C	LTSC4 ORIG 55 3773 7:40	RSW 413 AA 713	MSP 321 9:20	EWR 1451 EWI AA 1458 733 10:02 1458 11:0	2	12,00			SRQ 1130 D AA 15:20 184 16	EN 321 :10		10.27	MCO 746 PHX AA 321 18:59 463 19:55		2043 TERM	22.30	
B1							CLI 6-50	SC4 FLL ORIG 525 7-35	CLE AA 178 8:30	MEM 34 319 9.24	SJU AA	1376 SRQ 321 1404 1140	BNA AUS AA 653 319			13.20 - 10	AX 819 SJU AA 972 321 6:00 972 16:50	MCI AA 170	MIA L.)1 738 A. 18-20 15	AS A 2075	MSP 321	ATL 1998 AA 1897	3 ATL 738 7 22:40	
B3						CLT: 5:50	ORIG PHL 2010 6:35	DCA PIT AA 1904 319 7:02 7:59	JAX AA 1722 8:17	DCA 2 738 9:30	BNA 821 AA 876*	AUA 320 11-30	ORF AA 1973	IND MCI 319 AA 11	ROC 319 14:35	EWR AA 379	MIA 1 738 16:25	PIT 1829 DFW AA 1829 321 16:57 721 17:40	CLTSC4 ORIG 18-28	PBI	17 TE	24 5563 RM TERM		
B5							SJC 661 PL AA 1872 7	7.52 7.57 38 05	MIA AA 8:47	EWR 1496 738 9:55	ATL AA 2065	IAH 738	BDL RD AA 1914 31 12:09 13:0	9 44	JFK 2530 AA 2249	EWR IND 1 738 AA 1 15:15 15:30 1	843 DCA 319 864 16:40	CLTSC4 ORI 17-25	IG RDU	844 TERM		LAS AA 1796	PHL 321 22:25	
B7							BWI AA 2	JFK 042 738 7:30	JFK AA 14 8:30	MIA 48 738 9:30	STL AA 1923	DTW 319	ALE AA 12:5	a 1756 ALB 1753 13:50	SNA 1767 LAS AA 278 15:00	MSY 1821 AA 1886 15:30	10.10	11120	1692 TERM	451 TERM	D A	TW LGA A 1981 738 0:55 22:04		
B9							RDU AA 1732	DCA 2 319 7:30	EWR 2531 JI AA 2529 9	FK 738	SAT AA 10:39	BNA 850 738		DCA AA 2 13-28	MSY)45 319 14:35	15.50 10		AUS AA 18	BDL 319 18:25	1976 TERM	SJU AA 20:23	753 M 2039 22:04	SP 21 10	
B11							CLI	SC4 LAX ORIG 1993 7-35	MSY AA 8:46	5330 ^{MHT} 5089 9:30	JFK AA 10:42	DFW DC 330 738 AJ	CA RIC A 2077 319	PIT AA 1.	BDL 14:30	MIA 2448 AA 15:16 1453	ORD LAS 738 AA 16:25 16:45	125 JFK 1577 17:45	ATL 527 AA 555	6 GRR 319	1954 TERM	MIA I AA 1384	2015	
B13							0.00	CLTSC4 RDU ORIG 2011 7:50	DTW AA 1942	BUF 319 9:10	10.12	ELP 281 ELP AA 281 319 11:07 1870 11:50	887 TERM	SAT AA 13:4	1633 8 296	FNT 319 5:11	FK 1577 SNA AA 738 6:00 1871 16:45	IAH AA 1711	EWR RI 738 A	DU A 8:55	861	ATL MCI 738 AA 1 21:19 21:40	ORF 785 319 22:40	18 TEI
B15								CLTSC4 SJ ORIG SJ 7:20 827 8:0	C BDL AA 17	780 CLE 9:40	AUS AA 10:39	19	64	JAX 1 319	DU 2069 PIT A 2084 319 3-56 2084 14-55	RDU AA 15:44	1962 ^{BWI} 1964 16:45	RIC 532	1 BNA 3 19 AA 3 18-10 18-35	786 AI 585 20	3Q 38 05	628 TERM	22.30	
B16							RIC AA 10	BDL 554 319 7:30	MEM AA 8:43	RSW 1853 319 9:55	10.55	IAD 5373 SAT AA 5373 319		DTW AA 13:45	756 319	BNA 1886 JAX AA 1886 JAX 15:14 2032 15:59	10.12		PDX 1853 AA 17:58 660 18	SJC BNA 194 738 AA 733 9:09 19:24 733	5 SAT 738 20:25	BDL AA 1952	BUF 738 22:25	
B14							PDX 19 AA 19 6:14 4	930 SAN 87 7:50	STI AA 8-5	L PIT 1677 319	MDT AA 10:33	1753 JAX 1753 319	PVD AA 657	IAH CLE 319 AA 1 13:20 13:37	RDU 934 319 14:30	RSW AA 1992	PVD D 319 A 16:30 10	CA IA A 673 31 6:54 17:5	H 19 54	JFK 101 AA 1390	EWR BWI 738 AA 20:10 20:38	864 2035	JAX 319 22:35	
B12							PIT AA 6:42	PVD 1903 319 7-35	ILM PHL AA 1839 319 8:04 9:00	FSD 784 AA 993	MCI LGA 319 AA 10:15 10:44	ALB 1988 319	CHS 1849 AA 12:25 1950	DCA 319		ATL 2032 AA 15:08 1821	DTW 319 16:30		LGA MSY AA 1809 320 18:02 18:55	MSY 732 AA 1885	BUF 738 20:15	1971 TERM	22.33	
B10							CLTS 6:45	C4 ROC ORIG 868 7:30	FNT 1751 AA 97	SLC 319 9:30	PIT AA 1730	DCA MCI 319 AA 11:30 11:45	1267 BUF 319 5 751 12:30	BUF AA 2002	BOS 319 14:15	BDL BN AA 1715 31 15:02 16:0	A JAX 9 AA	x DCA 1750 319		DFW JFK AA 2648 738 19:05 20:00		2035 TERM		
B8								BOS BNA AA 1817 319 7:12 8:00	RIC 1941 AA 829*	MEX 319 9:30	1924 TERM	PBI 2754 AA 2845	PBI 321 12:15		FNT AA 14:30		1974 1242	1	BUF 319 8:00	EWR 1598 AA 2483	IAH R 738 A 20:10 21	IC AI A 1893 3 0:55 22:	JS 19 10	
B6									BUF 829 AA 1941	DTW 319 9:19	PWM AA 1: 10:33	ATL 814 319 11:39			CHS DCA AA 1938 319 14:02 14:55	CLTSC4 ORIO 15:35	BDL 16:20	ALB AA 2052 17:01	PWM 319 18:05	JAX AA 19:15	1861 2043	F 3 22	PBI 19 11	
B4									IND AA 8:44	BDL 319 9:50	PBI AA 1847 10:10	PHL 319 11:15			CLTSC4 IAH ORIG 14:10 2069 14:55	DCA AA 1653 15:13	MCI 319 16:15	IND AA 76 17:11	5 319 AA 18:25 18:40	5210 5335	CLE 319 20:30	SYR I AA 1987 21:04 2	DCA 319 2:14	
B2									PIT AA 8:35	1978 NAS 319 852 9:40	OKC AA 10:42	5510 IAD 319 11:45				STL AA 15:43	5370 PNS 319 5094 16:44	CLE RI AA 2028 31 16:59 17:5	IO 19 54	CLTSC4 MDT ORIG 19:04 1720 19:49		MSY AA 1793 21:20	PIT 319 22:25	
C2									CLTSC4 ORIG 8-29	MSY 9-14	ALB 1707 AA 613*	SXM 319 11:25			2017 PUSH	DTW AA 1 15:39	MSY 302 319 16:30	BWI 1915 AA 2038	PVD DC 320 AA 18:15 18:	CA ILM A 1979 319 52 20:00	334 TERM			
C4									DCA AA 17 8:28	95 CHS 95 319 9:30	MCI 179 AA 10:28 197	7 IND 319 7 11:30				MCI AA 15:35		422 1540		ELP DFW 56 319 AA 19:15 19:35 61	0 DEN 321 6 20:20	ALB AA 2070 21:22	CLE 319 22:25	
C6									IAH AA 8:38	852 IAH 319 1978 9:35	ROC AA 1868 10:14	CHS 319 1:14				IAH 174 AA 15:35 184	15 ALB 319 13 16:24	P	1065 PUSH	MIA 760 AA 19:20 199) PVD 321 6 20:29	BOS AA 1' 21:39	ORD 321 22:35	
C8									ORF AA 1770 8:29	ORF) 319 9:15	BWI 876 AA 821*	GCM 320 11:25				NAS AA 853 15:10	BUF 321 16:29	NAS AA 859 17:04	PIT N. 319 A. 18:15 18	AS 605 PLS A 319 8:54 1029* 20:00		SAT AA 1870 21:25	ROC 319 22:16	
C10									PVD AA 865* 8:12	SXM 320 9:25	BDA AA 10:51	1840 MEX 319 1434* 12:00	x 9 00	CLTSC	PBI RIG 789 14:25	PHL AA 2(PBI 047 319 16:30		584 PUSH	ROC AA 1921 19:07	JAX CLTS 319 20:15 20:45	C4 MCI PHX PULL AA 170 21:30 21:50	RDU 1854 321 22:45	
C12										CLTSC4 JAX ORIG JAX 9:05 5247 9:50		DEN AA 11:15	1446 LAX 321 652 13:00	10.00		JAX AA 2036	SYR 319 16:19	RDU AA 2067 17:04	DTW SLC 319 AA 18:05 18:40		78 881	STL 319 22:00	2005 TERM	
C14											CL	ORIG MCI 0816 11:40	.5.00			RIC AA 15:41	1864 PIT E 319 A 745 16:35	ELP AA 6:55	1891 736	DTW 315 20:00		RDU PVD AA 2038 738 20:57 22:05		_
C16											CLTS	C4 BWI ORIG 1924 11:35					BUF AA 16:20		422 524	FSD 319 19:54	CLTSC4 PULI 20:32	L FNT CLTSC4 21:17 21:35 1971	SYR 22:20	
AAIN																								
l1									SDQ *183 AA 8:00 982*	9 UVF 321 9:45	N /	4EX *1844 SDC A 319 1:00 1853* 12:00	Q 9 0				HAV *1074 AA 16:05 1028	BDA 319 17:30	MEX AA 18:35	*828 MEM 315 1768 20:00	AU. 20-1	A *877 50 TERM 21:35		
12							C	LTSC4 ORIG 55 843* 7:45		GCM *860 HAV AA 319 9:00 1615* 9:45	CUN AA 10:50	*1283 SJO 1087* 11:55					PUJ * AA 16:21	*1963 ATL 787 738 17;50	GCM *8: AA 85 18:14 85	22 DCA 320 56 19:44	*1968 1954	SJO 21:5	CLTSC4 *1850 55 TERM 22:40	

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	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
	utulutu	hituluti	Jutulutu	hitulutu	hitulutu	hituliitu	latalati	սիսիսիս	Intributu	Intulut	սիսիսիս	hitulutu	hindutu	ntulutu	hutulutu	hitulutu	ntulutul	ntulutu	l Intulutu	hinhitu	hutulutu	hitulutu'	hitulutu	ntulutu
13													CLTSC4 12:40	ORIG 887* 13:30	SJO AA 14:35	*672 AU 617* 161	A 1 5		SXM AA 18:40	*866 BNA 320 1867 19:49	SXM *613 20:24 TERM 2	SC4		
14												PAP AA 11:00	*368 1826	NAS 319 13:15	M A. 14	IBJ *843 H A 4:53 2056 L	DU MBJ 321 AA	*869 749 1	LAS 221 //	MBJ *827 AA 1919	MIA 321 20:15			
15								CLTSC4 CUN ORIG 804* 7:45			PLS * AA 10:00 10	842 KIN 319 40* 12:00				KIN AA 15:40	*644 KIN 2456* 16:40	PUJ AA	*196	56 LA 31 3 20/1	AS CUN *888 21 05 20:20 TERM	LTSC4		
16								0.00 7.40			KIN *854 PAP AA 319 0.55 1647* 10.50	12.00		AUA AA	*1542	SJO 738	PAP *2364 AA 2541*	PAP 738	SDQ *639 AA 1865*	GCM 319	UVF #	*1342 SDQ 874* 320		
17											9:55 1047 10:50			13:30	023	15:40	CUN AA	*884 BOS 1806 1321	CUN AA	*886 PBI 2061 10.55	20:15	22:00		
18																	16:40	1000 17:55	18:40 P	PLS *880 OR AA 1851 32	RD 21			
110														FRA *705 CLTSC	24 39	FC	^O *721 ^{MAD} 748*		BCN AA	*745 744*	BCN 332			
111														13:00 PUSH 14:0	<u>10</u>	MAI AA	*74 *74	9 DI 3	18:20 JB LHR 32 AA	*733	20:45 LHR 789			
112								G	RU *1062 CLTSC4 A DUSU 332							15:5 FC A	0 *721 CLTSC4 789	18:	05 18:30	132.	20:15			
113								7	50 FUSH 8:50						CDG AA	*787	55 IEKIVI 16:55 FRA CI 332 A/	TSC4 PULL	FCO 789					
114															13:55	/04*	16:35 16 LHR AA	*731	18:25 LHR 789					
115														DUB AA		725	16:15	/30*	18:40 CDG 332	CLTSC4 PULL	GRU 332			
														13:05		786*			18:20	19:00 1568*	20:30			
01	1441				CLTSC	RIG HOU	SC4 MDW CL	LTSC4 IAH C	LTSC4 DEN ORIG		JFK 40	93 JFK			BNA 5136 BNA WN 738		sea 52	5 SEA H	OU ₁₇₄₇ HOU				1286	
02	TERM))			4:40	643 5:25 5:45 CLTSC4 IAH ORIG	CLTSC4 ORIG	45 516 7:30 7: K CLTSC4 ORIG	50 5290 8:35 MSP LGA39 DL	30 ^{LGA} CS1	10:38 ⁴⁰	⁵⁸ 11:15 LGA 5060 LGA DL CSI			14:00 684 14:45 MSP MSF 1503	2	16:30 52 MSP DL 13:	6 17:30 17 2 DTW 2 320	7:55 ¹⁴⁹³ 18:30 DTW 10:	DTW 57		3812	TERM	876
03	TEI	RM				5:05 1191 5:50 CLTSC4 ORIG AT	6:08 3612 6:53 L LA	3 7:20 2266 AS 165 MC K 3	8:05 8:35 38 20 ATT 20 DL	40 9:15 L ATL 2422 73H	JFK 219 JFK B6 219 E90	ATL ATL DL 2251 717	7		14:24 14:59	ATL ATL DL 2133 73H	16:40 IS. IAH NK	⁴ 17:20 135 FLL 320	18:40	19:15 DAL BWI 1721		TERM	357	TERM 614
04						5:15 612 CLTSC4 ORIG DTV	10 6:4 W	45 864 8: CLTSC4 SEA ORIG SEA	8:4	8 9:30 DTW DTW 2292	10:01 218 10:40	11:16 12:00 ISP 354 I F9 354 I	ISP 19			15:04 15:45 LGA 5096 LGA DL CSI	16:45 MDV	386 17:30 /853 ^{MDW}	1	8:55 19:30 ATL AT DL 1407 73	TL TTN 933	TTN 321	TERM 4128	TERN 19
05						5:15 1366 6:0	0 CLTSC4 ORIG ORD	6:50 681 7:35 SFO 170	14 SFO 739	9:04 9:39 MCO WN 1685	DEN 738	11:20 353 12:	DTW DTW DL 1629 319			15:06 5099 16:00 DEN 1711	16:5 DEN 739	LGA 5508 LGA		19:09 20:0 LGA 6224 LGA DL 6224 CS1	05 20:25 932 <u>2</u>	1:10	TERM 1076	TE
06							5:58 1712 6:48 CLTSC4 L ORIG	7:21 196	9 8:20 IG ATL	9:20 1 ORD 4	10:00 25 ORD 73G	BOS 1245 BOS	12:07 12:50 ATL DI 1095	ATL 717		PHL 1689	16:22 CO	JFK 4189 JFK	JFK	19:18 6227 20:00	MCO 344 LAS		8017	1974
013							6:15 3844 7	7:00 7:30 159	8:15	9:26 5	21 10:15	10:59 ¹²⁴⁶ 11:36	12:33	13:15		15:21 10	:09	17:193433 18:00	18:	50 1118 19:28	20:00 541 20:50		TERM	TERM
013						CLTSC4 OR	IG BOS	CLTSC4 FI	LL	BOS	8025 BOS	FLL 81	101 FLL F90				305 8021 BOS	BOS 1445 BOS					8103	
014						5:33 801	CLTSC4 ORIG	7:15 8104 8: ATL PDX	625 PD 73	9:24 X BWI	8020 10:51 DAL	11:30 81	102 12:30	ORD 1484 ORD		DTW	16:00 8016 17:00	BNA 2465	BNA 73W		CLE 486	CLE	TERM	522
018							6:15 2488 7	7:00 7:15 CLTSC4 ORIG SLC	626 <u>9:0</u>	9:35	10:10 ATL ATL DI 1454 739			LGA 3888 LG.	A	15:40 1	793 16:30 ATL 602 ATL DI 602 731	17:20 3113 1 SFO 11	8:10 76 SFO 739		20:20 489	21:20		5812
030						DEN	201	7:00 521 7:45 DEN			10:03 10:45 MCO PH			13:14 3642 14:0 ATL	2507 220		DE 2651 17:00 DEN MCO	17:31 16	598 18:30 ATL 826 7314			2808		TERM
027						5:10	200	7:20			10:11 10:5			13:42	14:30		16:20 17:00	17:5	50 18:45			TERM		
028																								
028																								
029																								
030																								
031																								
																	MUC	*428	MUC			LGW *	7751 LG	Y
121																	LH 16:20	429*	*201 KEF			21:05 77	752* 23:	5
																		17:40	202* ³²¹ 18:40					
							PHF	5190 PHF	LEX		5337	JAN CR7	OAJ 5176 OAJ	MGM 544	1 SDF	FAY 383	1 IND CP2	TYS	5119	FAY	HTS 5461 CRW	DAY	5156 PGV	
							6:30	5557 7:35	AE 8:30 MGM	5293 MGM	5514	BHM 3819 HSV	12:05 5314 13:00 CLE 5282 GNV	13:18 515	4 14:25 YS 5294 TYS F 5294 CP2	GPT 5095 CID	6 16:30 GNV 5	17:10 063 CA	5256	19:50 LH	20:15 ⁵⁰⁴⁹ 20:50	21:31 5	5118 22:40 5264 MGM	
							GSP DCA	GNV LEX	AE 8:38 FAY	5440 9:45 5273 TYS	CH/	10:59 3909 11:50 5277 EVV CD2	12:05 5063 12:50 CRW 5237 BHM	AI 13 DAY	5120 PHF	15:05 5096 15:50 EVV 5032	16:09 5 EWN	259 18:0 PHF 5052	LEX CP2	5366		AE 21:36	5298 22:41	
							5:57 6:32	6:52 5039 7:30 4738 OAJ	AE 8:40 FW	5297 9:35	AE 10:4 LEX	6 5032 11:35	12:15 5164 13:00 HSV 3906 CA	13:43	5052 14:25	15:23 5366 OAJ 531	16:14 4 MGM CP2	17:22 5264 FWA 5135 DAY	18:14 AVL	4769	TRI AGS	4001	GSP	
							6:22	4889 7:40 CAK ₅₃₅₅ CHA	TRI 48	52 LYH	10:40 PHF 5	463 11:20 557 TYS	BHM 5142	ILH FAY	AE 14:07 14:07 5463 VPS	ORIG	2 16:19	17:11 5156 18:00 BHM	5311 CHA	4895 TRI 4786	20:15 20:38 EWN	3795 CHO 5552	22:40 CRW	
D6							TYS	7:08 5277 7:43 GSP	AE 8:16 48 HTS_FLO_D. 4935	20 9:35 AY	5122	294 CR2 11:18 PHF	AE 12:30 5218 GNV 5371 TYS	CR2 AE 3:10 13:45 GPT	5 5453 CR7 5 5453 14:40 532	3973 20	OAJ	AE 17:45	5186 CR2 18:25 5486	AE 19:00 4755	CR7 20:30 GNV	AE 21:08 5177 TYS 5037	22:35 AVL	
							AE 6:24 CF	5354 CR7 7:45 RW	8:00 ⁴⁸⁵⁰ 8:30 5263	E 51 LFT	5364 MOI	CR7 11:45 55	12:25 ⁵³⁰⁵ 13:00	AE 13:37 SHV	522 CAE 5	26 327 EVV	CR7 16:14 5513	AE 17:05 IAD	5172 5031 TUL	PULL	CR2 20:25	AE 20:59 5100 JAN 5257	CR7 22:25 BTR	
<u> </u>							AE 6:4 EWN	E 45 4921 GSO	5335 PGV 5234	CR7 9:36 PGV	AE 10:4 SGF 3706 SGF	5 55 DAB 5603	514 RAP	CR7 13:15 LF	AE 14:03 5: T 5110	204 16:00 GNV HPN	PUSH 5526 HPN	AE 17:46 ROA 4820	5271 18:30 LYH	5147 HSV 3973	YUL A	AE 20:58 5407 VL 5326 C/	CR7 22:15 K MGM401AEX	
E2							AE 6:35	4826 7:50	AE 51251 8:11 5187	CR2 9:19 LIT	AE 3700 E75 10:09321310:50	AE 5005 11:05 5023 1	CR9 12:10 AVL 4751 LYE	AE 13 4 CVG 54	50 5459	CR7 AE 15:15 15:44 MGM 5366	5166 CR7 5166 17:00	4011 CAE	CR7 3 18:30	AE 19:21 3915	CR7 A 20:25 20 LFT 5411 SHV	e 5526 CR 0:55 5124 22:0	87 5292 05 22:27 22:59	
E3							TRI	4867 HHH	H 8:22 5033	CR9 9:15 150 MOB	5343 SHV	AE CR9 11:00 5220 11:45	AE 1751 CR 12:12 4804 13:03 5 BTR	AE 54 3 13:31 53	CR7 319 14:25 68 5263 DAY	AE 5500 14:57 5096 SDF 370	CR7 AE 16:20 16:2 R MKE TI	2 3775 18:00 H 5218 GNM	ORF	ERM	AE 5523 CR7 20:00 20:40 MEM 5275 MLB	DAJ 40'	1 ЦҮН	
E5							AE 6:39	4942 CR7 7:35 ROA	AE 52 8:22 52 PHF 5282	251 CR7 GPT	AE 10:44 GSP	5364 67 FPO	CR7 4 13:00 TYS 5207 M	AE 13: 10B	49 5123 14:41 HPN 5384 MLB	AE 379 15:17 395	CR7 AI 16:35 16 5138 HTS	55 5202 17:55 CRW 47	AE 18:43 19 OAJ MSN	5398 19:45 5437 CAK	AE 5265 CR9 20:05 20:45 LGA 44.0 BTV	AE 493 21:24 492 ROA 4807 RC	CR7 22 22:30	
E7								AE 4776 CR7 7:04 7:40 DAY CLF	AE 5383 8:10 5320	CR7 9:20 SBY	AE 54 10:10 55	93 CR7 11:45	AE 5297 10 12:20 5512 13 SAV 5105 CHA	CR7 3:10	AE CR7 14:02 5302 14:50	AE 15:5	5138 CR7 5200 17:00	AE 472 17:30 492	CR7 AE 31 18:25 18:43	5306 CR7 5306 19:45	AE 4460 E75 20:00 20:40	AE 4807 CF 21:00 4799 22: HHH	27 05 ННН	
E9								AE 5328 CR2 7:14 7:50	AE 4880 8:12 4831	CR7 9:20	AE 3900 10:21 377'	E75 11:19 220 CID	AE 5185 CR7 12:07 5582 12:50 HTS 4044 AGS	AE 13:-	48 4829 14:35	AE 4779 1 15:06 4779 1	CR7 610 5582 GPT	AE 0430 CF 17:04 5429 18:0	R7 AF 04 18	E 5230 CR7 19:54 CAK 502 C	VPS	AE 4943 21:15	CR7 22:20	
E11							CHS	4915 6:56 4763 7:30	A 8 EWN	AE 5215 CRT :53 5183 9:50 4884 TRI	AE 10:18	423 CR7 FLO	AE 4806 CR7 12:18 4805 13:01 GSP 50 CR LEX	AEX AEX	4800 4743 14:19	AE 15:40	5083 CR7 5083 16:40	AE 4939 17:24 4807	CR7 18:15 DAB 5215 OKC	AE 5036 19:18 5143	CR7 20:20 FLO	AE 21:35	5038 CR7 22:40	
E13							AE 6:18	5295 CR9 7:45	AE 8:32	4841 9:40	AE 4934 10:07 4904	CR7 11:33	AE 5067 CR7 12:17 5153 12:59	5375 13:14 13:44 13:46	FOGL LEX	AE 5364 15:13 5283 1	ER7 AE 10 16:48 5122 JAN	5105 CR7 5105 17:45	AE CR9 18:00 5258 18:45	AE 4907 1 19:09 4870 20	CR7 0:09	AE 5083 21:10 5393	CR7 22:14 DR EWN	
E15							MVD	5257 Cue	AE 8:42	5278 CR7 5396 9:45	AE 10:4	4889 CR7 6 4773 11:55	AE 4903 CR7 12:184765 12:59	AE 13:42	5251 CR7 5078 14:25	AE 15:44	5152 CR7 5257 16:35	AE 4759 CI 17:18 4813 18:	R7 A1 05 18	E 5226 CR7 8:53 5477 19:49	FAY THE HEV	AE 479 21:26 474	CR7 44 22:30	
E17							AE	5357 CR9	AE 5466	CR7	AE 534	CR7	AE 4820 4933	CR7 AE	5225 CR7	5569 A	5153 CR7	OR	AE AE	3853 CR7	AE 5105 CR7	AE 51	56 CR7	

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	00.00	01.00	02:00 03:00	04.00	05:00	06:00 07:00	08.00	09.00		12.00	13.00	14.00	15.00	16·00	17.00	18.00	19.00	20.00	21:00	22.00	23:00
		01.00		04.00	00.00		00.00	00.00		12.00	10.00	14.00	10.00	10.00		10.00	10.00	20.00	21.00		20.00
F19						SAV 5452 MYR AE CR9	AVL 5365	CHO CR7	MKE 3896 SDF AE 3896 CR7	TRI 4841 RO/ AE 4841 CR	A CRW 4824 HTS 47 AE 4824 CR7	MSN 5204 CAK AE 5272 CR7	TRI 4765 A		ORIG	<u> </u>	PGV 4869	LYH MLB 54 CR7 AE 54	31 MOB CR7		
E13						6:36 5389 7:40 AGS 5296 SDF AE 55296 CR7	8:21 5152 GSP 5235 AE 5235	9:19 IAD DCA GSF CR9 5260	10:48 3798 11:40 CAK 5468 GPT AE CR7	12:23 ⁴⁹²⁶ 13:0 EWN ₄₉₃₆ F	13:25 4759 14:05 FLO SBY 4831 CF AE 4831 CF	14:25 5272 15:05 RW CR7	FLO 4862 ROA AE CR7	5:24 DSM AE	5037	5378	19:15 4780 2 SAT CR9	0:10 20:30 52 FWA 54 AE	07 21:30 76 LEX CR7		
E16						6:31 5093 7:30 GSO MEM AE 5026 CR9	8:18 5509 CRW 5347 F AE	9:09 9:24 9:59 BHM CR7	10:50 5462 11:40 IND 4484 CMH AE E75	RDU 5415	3:06 13:39 ⁴⁷⁴⁹ 14 BNA ROA ₄₈₇₉ CR9	EWN	15:20 4842 16:05 LYH 4804	16:45 TRI LF CR7 AE	5064 MLB CR7	5036	20:00 FLO 4 AE	20:30 52	35 21:30 MOB 50 AE	060 LEX CR7	
F14						0RF 5460 CVG AE 5460 CR9	AGS 5439	9:10 BTR CR7	10:46 4457 11:45 BTR 5507 AGS AE 5507 CR7	12:19 5288 TLH AE 50	091 MSN MYF CR9 AE	9 14:25 R 3777 AVL CR7	CHO 5048 CAE AE 5048 CR7	16:30 16:	58 5376 17:40 HSV AE 5319	PHF CR7	LEX 5283 TYS AE 5283 CR7	767 20:30	21:40 5: TLH_5211LFT L	520 22:35 GA 5066 GSO CR9	
E17						6:27 5268 7:24 SDF 5342 STL AE 5342 CR9	8:21 5225 GP AE	9:09 T 5232 MSN CR7	10:34 5263 FLO 4850 AVL AE 4850 CR7	GRB 5674	437 13:34 14:01 PNS CHA CR9 AE	4011 14:40 A 5179 ORF CR7	15:30 5239 16:10 ROA 4926 CR	S 7	AEX 5060 FWA AE 5060 CB7	18:20	19:16 ⁵²²¹ 19:56 YYZ 3834	CAE E75	21:15 ²⁷⁶ 1:46 2 CAK 525	2:01 5112 22:45	
E12						6:46 5073 7:40 ILM 5096 CMH AE CR9	CAK 5	5242 JAN CR7	10:45 4800 11:25 MSN AE	12:20 5036 5231	13:15 [14:0]	HPN CR7	15:41 ⁴⁹⁰⁷ 16:1 PIA 5186 AE	9	MOB 5512 MOB AE 5512 CR7		19:17 3968 2 MGM AE	0:10	5222	8 22:30 MOB CR7	
F21						6:41 5061 7:29 IAD 5399 IAD AE CR9	8:37 5 BHM 534 AE	6 CRW CR7	ORIG SDF AE	5104	93	14:33 IND CR7	15:43 ⁵³¹⁰ 16:2 AGS 4805 PGV	20	17:10 ⁵⁰⁶⁰ 17:49 HHH AE		19:40 489	92	5304	22:40 TRI CR7	
F23						6:44 5373 7:30 CMH 4544 DTW AE E75	8:30 523	³⁷ 9:20 ³² 3850 CAE CR7	5632 11:05 GSO 4826 ROA AE CR7	STL 5073 ILM AE 5073 CR9	23	14:50 844 OR 842 AE	15:40 ⁴⁸⁶⁹ 16:16 RF 3773 BHM E75	c	17:31 HO ₄₉₁₈ FLO		GNV_BTR	25	CHS TY AE 5138 CR	22:25 8 9	
E25						6:38 4542 7:45 PHL 3899 CAE AE 3899 E75	HSV AE 532	0 3814 9:45 29 SAV CR7	10:30487911:14 HHH 4942 CRW	12:10 5345 12:59 JAX AE	5458 (⁸⁹² 14:30 15: CMH CR9	07 3865 16:05 JAN 5514 CRW	17	CHA AE	5508	19:18 ⁰²⁴ 19:50 OAJ CR7	HPN AE	21:00 22:0 3945 ORF 3945 CR7	9	
F27	-					6:58 3908 7:45	8:33 518	ORIG	10:4 ⁴⁸¹ 011:19 BTV 4649 RIC AE 4649 E75	12:10 XNA AE	5087 1 5388 TVC CR9	14:24 GRB 5531 ABE	15:40 ³¹⁴⁸ 16:15 4933	DS	17:21 M 5055	5233 DSM CR9	19:45 LIT 5 AE 5	20:5 5440 TUL CR9	0 ³⁹⁰⁴ 21:30 CAE 3775 MKE AE 1055 CR7		
F29						CAE 3967 BHM AE 2010 E75	CHO 4876 HTS	5294 S SBY AVL AE 4751 CR7	0MA 5253 AE 5253	12:30 3 SAV CR9	5158 14:05 CAK 524 AE 524	14:22 ³²⁸⁰ 14:59 45 PNS CR9	AVL AE	5086	58 5276 MDT CR9	18:45 BTR 5500 HS	19:30 5 V IAD 55(AE 520	02 MSY CR9	20:59 4056 22:05 5361		
F31						6:50 3819 7:35 ORIG	8:15 4866 9:00 MLB AE	9:15 ⁴⁷³¹ 9:50 35175 ^{HPN} CR7	10:41 5260 CVG 520 AE 521	6 12:59 68 DTW CR9	9 13:28 521 W ILM 9 AE	12 14:50 5386	15:29 CVG CR9	5180	17:55 PWM 5034 AE 5070	18:30 ³³⁰³ 19:0 ILM CR9	19:26 52: SAV ORF AE 5056 CR9	32 20:30	5049		
E33						5432	8:47 FLO 4 AE	5384 9:30 4914 EWN MLI 4026 CR7 AE	10:49 54: 5111 GRR CR9	IAD 5509	0 13:52 9 CAK GSO 5372 CR9 AE 512	2 MEM CR9	16:14 MYR AE	5053	17:10 5070 LGA TVC CR9 AE	18:25 5216 DAB CR9	19:00 20:00 DAB AE	533	35	CHA CR9	
E35						CVG AE	5341	0KC CR9	5514 11:30 BHM 5356 PVD AE 5474 CR9	AUS 5171 LIT AE 5205 CR9	3 13:15 13:33 5494 TVC BTV TUL 5314 AE	4 14:40 5357 GRB 5227 CR9	15:33 CVG 5166 CH AE 5220 CF	5066 IS 29	17:25 17:40 OMA AE 5131	5480 18:50 SAV MEN CR9 AE	19:36 ⁴ 5494 CHS CR9	GSP AE	5214 5224	22:20 BNA CR9	
 F38						6:56 CHA AE 5165	JAX CR9	9:20 CVG AE	10:13 54/4 11:50 5128 OMA CR9	PULL	JAX AE 5247	0 5227 14:55 DAB CR9	CHS 5084 AE 5000	LIT BNA CR9 AE	17:06 5288 SDF CR9	18:20 18:50 PNS AE	5212 CVG CR9	19:59	5336 MYR 5449 AE 5114	22:40 CHS CR9	
E36						6:29 5457	8:50 SRQ 5390 TLH AE 5001 CR7	9:10 4 SGF 7 AE	5504 11:20 5177 TVC 5027 CR9	FAY 5487 CHS AE 5084 CR9	II3:32 5315 SRQ 5139 AE 5151	14:25 SAV MHT CR9 AE	15:30 5088 TLH 5072 CR9	16:30 16:45	SYR AE 5377	CHS CR9	0 5303 19:45 TYS SAV AE 5144 CR9		LLM 5451 AE 5200	22:35 LIT CR9	
E34							8:04 5091 9:00 CLTSC4 BDA ORIG 682	0 9:15 A BHM AE	5037 11:24 5204 OKC CR9	MYR 5289 MYR AE 5052 CR9	AUS 543 AE 515	14:27 15:02 33 CHS CR9	CLE 5436 MY AE 5170 CF	R 29	DTW AE 5249	18:20 MYR II CR9 A	19:01 19:55 ND 5189 GSP LE 5155 CR9		AUS 5200 AUS 5301 AE 5200	22:35 MEM CR9	
E32							8:15 002 9:00 SAV 5130 AE 5267	9:15 MKE LNK CR9 AE	5033 11:20 5415 PNS 5575 CR9	MEM SYR AE 5184 CR9	9 13:45 517 GR AE	RR 5533 ATL CR9	SAV 5266 AE 5060	STL CAK CR9 AE	5243 CLE 5221 CR9	18:20 1 GSO AE	8:58 5155 19:50 5418 DAY 5101 CR9	GSO AE	21:05 5299 5121 DAY 5274 CR9	22:35	
E30						IND 4661 IND AE 4531 E75	8:16 3207 IAD 5 AE 5	9:14 9:33 5327 GRR 5327 CR9	VPS 5157 CHA AE 5170 E75	12:07 12:50 MSN 550 AE 52	65 SBY LIT 50 27 E75 AE 50	033 MKE MI CR9 AE	DT CMH 5064 CR9	16:35 16:53	PNS 529 AE 527	18:49 1 EYW CR9	TLH AE 5420	GSO CR9	ORF 5455 AE 5000	AVP CR9	
E28						6:51 4331 7:55	CHS 5207 AE 5289	MYR CR9	ID:06 5179 II:14 SRQ 5102 AVP RAP AE 5322 CR9 AE	DAB 5514 CR9 5255 to a se	27 13:30 13:51 J MKE AE	5267 ABE 5140 CR9	OKC 5116 SDF AE 5300 CR9		ILM 5285 ORF AE 5455 CR9	1 18:30	MYR 5170 PNS AE 5103 CR9	0:10 P? Al	VS 5094 CVG E 5109 CR9	22:20	
E26							B:09 JAN AE	9:30 5194 IND 5568 CR9	MHT 5162 CVG AE 5166 CR9	PGV 5187 CHO AE 5048 cm	OKC MYR AE 5504 CR9	SYR 5223 CI AE 5349 CI	LE ILM 5345 C R9 AE 5418	GSO CR9	IAD IAD AE 5286 CR9		CMH MH AE 5047 CF	11 R9	4796		
E24							SDF AE	5495 PNS 5255 CR9	XNA 5350 BHM AE 5178 U.20	ILM 5107 AV AE 5189 D	13:18 13:57 VP PNS R9 AE	5255 DTW B 5434 LLLC A	HM 5178 IAD E 5502 IC 69	6:25 PVD AE	5125 CR9		CHS SRQ AE 5227 CR9	05	IAD 5286 AE 5451	SAV CR9	
E22							8:32 MYR AE	5431 SYF 5260 1000	MEM 5474 PWM AE 5034 US0	MDT 49 AE 47	932 BMI ORF E75 AE	5081 MYR 5313 L445	PIT SAV AE 5043 CR9	16:51	CMH 50 AE 17:41 51	87 GSO CR9 21 18-20	CVG 5169 I AE 10:26 53072	DAB CR9	CVG 5281 AE 5211	22:30 BHM CR9 22:30	
E20							GSO AE	5417 CAK 5245 CR9	CLE MDT AE 5080 CR9	CMH 453 AE 467	38 MCI DAB 5317 E75 AE 1240 5031	IAD CR9	IAD DAB AE 5035 CR9		(NA 5193 CVG AE CR9 704 5281 1750	21 18:30	CHO ₄₈₀₉ ROA	0.10	XNA 52 AE 51	36 MYR 61 22:40	
E8							LIT AE 8:45	5158 SDF 5330 9:50	AVP 5160 STL AE 5370 CR9	DTW 4542 *	MDT E75 13:10	14.23	AVP 5322 X AE 5236 U	(NA CR9 6-25	MYR 5313 BHM AE CR9 17:19 5182 18:05		DTW 5435 AE 5169	ABE CR9 20:15	LIT 5088 AE 5334	SDF CR9 22:40	
E6							PNS AE 8:38	5343 FAY 5487 9:40	DSM 5129 ILM FWA AE CR9 10:19 5270 11:16 11:40	5645 MKE E75 5983 12:25	IND AE 14:01	5568 AUS CR9 15301 14:45	DAY 5115 MEM AE CR9 15:14 5265 16:00	0.23	SDF 51 AE 17:46 53	154 AVL CR7 32618-30	^{YH} 4779 ^{CHO} AE CR7 18:59 4885 19:49	20.15	SRQ 51 AE 51 21:39 52	61 JAN 61 CR9 33 22:35	
E4							BN/ AE 8:49	A 5325 DAB CR9 5317 9:50	SAV 5504 DAY AE CR9 10:38 5115 11:35	IND 4470 E	ABE 5191 AE 5191 13:445035	CVG LNI CR9 AE 14-25 15-0	K 5084 LIT CR9 05 5100 15:50	MD AE	^T 4510 JAX 6 4662 17:59	10.50	BHM 38 AE 40	865 HPN CR7 023 20:40	CLE 52 AE 52 21:39 52	31 ILM 50 22:35 50 22:35	
F1								ICT 5316 AE 5164	CMH DAY 5042 XNA CR9 AE CR9 10:30 10:54 5193 11:50	CAE 3814 E AE 3814 E 12:22 3831 13-	AY SAV 505 E75 AE 537	RIC 51 CR9 72 14:30	MEM 5058 TY AE CR 15:35 5208 16:1	S 9 9	SAV 5070 GSP AE CR9 17:09 5214 17:50	5546 TERM	5 EVV AE 19:5	5006 ^{MGM} 5006 ^{CR7} 50 ⁵⁴⁶⁸ 20:30	PULI 5503	-	
F2							ORIG 5531	5292 PUSH	CMH 5061 PIT AE CR9 10:50 5522 11:45	AGS 5396 AE 5135	FWA SAT 5046 CR7 AE 5265 13:10 13:48	6 CR9 A 14:26 1:	WM 5572 GRR E 5567 CR9 5:10 15:50	CV Al 17	/G 3 :00	5398 5040	10 Cl 20:	CT R9 06	MKE 3959 AE 21:37 4010	CAE CR7 22:20	
F3							GRF AE 8:49	R 5534 RDU CR9 9 5415 9:40	CHS 5309 GSO AE 5309 CR9 10:27 5350 11:20	CHO 5152 A AE C 12:12 5086 13:	VL IC CR9 AI :05 14	CT 5103 MHT E 5565 CR9 4:07 14:45	OMA 5431 DSM AE 5165 CR9 15:20 16:00	SHV 58 AE 53 16:40 53	15 SHV E75 79 17:35	ILM AE 18:50	4572 E75 0 19:45		GNV AE 21:20 5202 5287	CHO E75 22:30	
F4							DAB 53 AE 53 8:35 51	352 SRQ CR9 139 9:24	YUL 3916 GSP AE 3989 CR7 10:06 3989 11:35		5092 PUSH		PNS AE 15:22	5592 5004	· · ·	AUS CR9 18:25	ABE 5140 OMA AE 5248 CR9 19:06 5248 19:49		VPS 5065 AE 5349 2	E75 2:15	
F5							ORIG 5371	ROA 4790 GSO AE 4790 CR7 9:15 4903 9:55	TUL TUL AE 5054 CR9 10:50 11:40		CMH 14:00	H TUL 5414 0 ⁵⁵⁴² 14:35	DAB AE 15:30		5460 5053	LIT CR9 19:00	SDF AE 19:28	53) 52	00 19	XNA CR9 22:30	
F6							CMH 45 AE 8:36 4	547 YYZ 546 9:27	EVV 5241 MLB AE CR2 10:23 5132 11:40		BNA 4 AE 13:42 4	4695 OMA E75 4556 14:55	CMH 4457 ILM AE E75 15:21 4674 16:09		5431 TERM	JA AE 18	^N 5315 ^I 55 5732 2	LAN E75 0:10	CMH 4554 CM AE 4579 22:0	H 5 9	
F7						ORIG 5547	CAE 3826 AE 3906	E75 9:09	ILM 5082 DSM AE CR9 10:31 5055 11:20				AUS AE 15:30	5 5	200 456	SGF CR9 18:50	5163 TERM		5186 TERM		
F8								ORIG 5129	MYR 5389 SAV AE CR9 10:22 5051 11:10		RIC AE 14:0	4618 GSO 2 4695 E75 14:45	MLI AE 15:39		5267 5514	RAI CR5 19:03	MKE 5098 IA AE 19:21512720:0	AD R9 05	525 TEF	6 M	
F9							0	RIG 071	ABE 5134 MEM AE CR9 10:39 5058 11:25		SHV 5767 JAN AE 5326 E75 13:15 13:55		GRR AE 15:50		5043 5236		BHM P CR9 19:30 5	ULL 421	5182 TERM		
F10						ORIG 5261	LFI AE 8:42	53 50	390 CAE 002 11:19		GSP 39 13:54 ^{38:}	989 YYZ 3 ³³⁴ 14:30	SAI AE 16:00		5587 5553		LNK CR9 19:45		HSV 5050 PIA AE 5050 CR7 21:06 21:45		
F11						ORIG 5082	AE 4669 8:08 4538	E75 9:10	AE 5586 SHV AE 575 10:05 5328 10:55		hree		AE 16:00	5851 MSN E75 5321 16:45	$\begin{array}{c} \begin{array}{c} \text{LEX} & 5078 \\ \text{AE} \\ 17:25 \end{array} \begin{array}{c} \text{C} \\ 18 \end{array}$	E75 AE 8:15 18	4675 CMH E75 E75 E75 E75 E75	kup	5099 TERM		
F12						5279 PUSH		ORIG 5452	PULL 5117		VPS AE 13:49	5183 5223	E75 16:00	F	5253 PUSH	VPS AE 18:38	5385 E75 19:50	CID 5 AE 5 20:40 5	530 GP1 50 (491 21:30 TEI	90 RM	
F13						ORIG 5079	0.010	AE 5864 5 9:20 5378 10	AE 5196 CR9 1020 5081 11:02		AE 5071 13:47	¹ CR7 ⁸ 14:27	AE 4867 15:25 4837	E75 A 16:40 1	AE 3957 AGS E 275 7:03 4001 17:55	AE 4687 18:30 4685	ECP E75 5 19:20	5337 ГЕRM	21:33 ⁴⁵⁵⁴ 22:	0	
F14						opus.	ORIG 5573	AE 4464 BNA 9:19 4684 9:59	10:21 ⁴⁸⁴⁴			AE 4627 E 14:25 4373 15:	AE 20 60	5 VPS E75 5 16:45	5181 TERM	PAR SIDE VNA	AE 5148 FWA 19:05 5405 19:49		DMA 1555 DID		
F15						ORIG 5252	AVP AE 8:47	5294 CR9 5525 9:25	AE CR9 CR9 10:10 5331 10:55 5502			SDN 5 to 5 EWA	CAE 3960 AE 3960 15:22 3833 10	E75 AE 6:25 16	4522 E75 59 17:50	AE 5126 CR9 18:10 5321 19:00	T	5077 TERM	AE 4556 E75 21:05 4495 22:05	Mey	
F16	_					5290	F	PUSH	AE 5290 CEP 10:45 5436 11:35 OPE	5050		AE 5485 FWA E75 14:30 5926 15:15	AE 4327 15:30 4378	E75 16:30	MSY 4552 CMU	E75 18:20	2814 TERM	5070	AE 44 21:39	76 E75 22:35	
F17							51	36 BIG	AE 10:47	5252 5285		CR9 14:35 YYZ 4546 164	AE 4537 15:30 4498 1 ISGE S	E75 16:27 SGF	AE 4662 E75 17:08 4506 17:50 YOW 5542 YOW	AE 18:43	4842 CR7 4835 19:50	5382			
F18							5.	509	AE 4659 E75 10:10 4781 11:05			AE 4546 E75 14:19 4566 15:15	3190 5 15:55 16	5:24	AE 5343 E7 17:06 5265 18:1	75 53 10 TEI	RM T	ERM	YYZ 4400	MDT	
F19					OBIC							EWR 2642	TERM	ORD	ORD YYZ	YYZ EWR	2268 EWR		AE 4498 21:22 4636	E75 22:20	
07					6238			IAD	4845 11:06 11:36 IAD YYZ, YYZ E	WR		UA 3042 14:33 3356	E7W 15:30	482 16:46 LWB	3 3 17:21 8011 LWB	48 49 18:20 18:45	3365 _{19:30}		TERM		
08					3312			UA (9:42	5150 CR7 10:22 10:39 ⁻¹ 1:10 LGA ₂₂₂ LGA IAH IAH IAH	³³⁶⁷ 1:52 ³³¹¹ 12:27		YU	L	VC 16:54	1181 18:06						
09						OPIC			9:57 10:30 11:04 6165 11:41 9:57 10:30 MSP MSP	BKW		2030	7350 05 ⁷³⁵¹ 15:40	BKW	UA 6245 E7W 17:14 6285 18:05				4791		
010						4663			3966 10:32 11:07	VC 12:00		2140		EM2 17:05					TERM		

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Date:04/11/2019 Time:12:56

	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
	utulutu	ntulutu	hindutu	hitulutu	ntulutu	ntulutu	ntulutu	hitulutu	hitulutu		utulutu	ntulutu	ntulutu	hitulutu	ntulutu	utulutu	ntulutul	dulutu	ntulutu	hilidada		ուսիսիս	սեսիսես	hitulutu
O11							•	ORIG 3357	EWR 3697 8-34 3648	WR 9-09	LWB 8010 LWB VC ER4 10:16 1180 11:01				IAH 6115 IAD 6120 14:44			EWR ₃₄₀₁ EWR 17:20 ³³⁴³ 17:56	17	AD IAD 6160 8:55 19:30				3395 TERM
O12								ORIG 6113	BKW BK 2010 8:35 ²¹²⁰ 9:	W 05	BOS 5168 DL 5465	BOS CR9			EWR IAH UA 3314 E70 14-24 15-02			4554						6234 TERM
O15																								
O23																								
O24																								
O25																								
O26																								
HS									l											1	1			
R01	CLT UA 0:00			O28: O28	5 6			DEN 319 7:50	GRU AA 8-50	U				*PSI 1568	H S				CLT 332 19:00	PIT AA 19·24		T305 T306		CLT 319 23:59
R02	CLT DL 0:00			O293 O294			SEA 319 6:50		AE PS	SH CLT CR7 43 9-55					RA AA 14:00	*PSH 720	CLT 789 16:55		STL AA 18:17	PSH 1002	CLT 319 20:32	PIT AA 21:19	T313 T314	CLT 319 23:59
R03	CLT AA 0:00						0.50	1	0.00	O263 O264	3						10.00	1	10.17	RIC 319 19:45	20.52	ELP AA 21:35	T307 T308	CLT 319 23:59
R04	CLT AA 0:00									O275 O276									ME 3	DT 19 04				T345 T346
R05	CLT AA 0:00							O271 O272								BDL 319 15:35			BUF AA 18:40	PSH 170	CLT 319 20:45		FLL NK 22:40	T337 CLT T338 320 T338 23:59
R06	CLT AA 0:00						()273)274						14	AH MSY 319 AA :10 14:31			PS 19	SH 71			CLT 319 21:35	ORD UA 22:43	P T331 CLT 73G 7 T332 23:59
R07	CLT UA 0:00		O287 O288		IAI 31 5:0	H 19						JAX AA 10:59						T327 T328	<u>.</u>					CLT 319 23:59
R08	CLT NK 0:00			O283 O284			IAH 320 6:45			BT AE	TR PSH E 55 5172	CLT CR9 11:50			TPA AA 14:08				T	[*] 303 *304				CLT 321 23:59
R09	CLT AA 0:00						0.45		·	O267 O268	<u>.</u>			· · · · ·	14.00				PBI 321 18:28	PHL AA 19-45		T315 T316		CLT 321 23:59
R10	CLT AA 0:00						O277 O278							PBI 321 13:40			LIT AE 16:5]	PSH 5147	CLT TPA CR9 AA 19:22 19:4	7	T319 T320	 	CLT 321 23:59
R11	CLT DL 0:00			O291 O292				MSP 717 7:20		AEX AE 9:24	PSH 5502	CLT CR9		13.46				,		P A	, HX A 9:54	T32 T32	1 2	CLT 321 23-59
R12	CLT AA 0:00							7.20	,	O265 O266					· · · · ·	I		I	MSP 738 18-29		PVD AA 20:10	T	309 310	CLT 321 23-59
R13	CLT AA 0:00								O269 O270									RDU 738 17:25	10.23		LAX AA 20:40		T323 T324	CLT 321 23-59
R14	CLT DL 0:00			O295 O296				ATL 738 7:30										EYW AE 17:31	PSH 5421	CLT CR9 19:47	20.10	STT AA 21:09	T311 T312	CLT 321 23-59
R15	CLT WN 0-00		O279 O280		HOU 73H 4:40			CHO AE 6:58	PSI 511	H 7	CLT E75 10:55			JFK AA 13-10	I		<u>I</u> _	17.51	T325 T326	1941	<u> </u>	21.09		CLT 738 22-59
R16	CLT WN		0280 028	1	4.40	MDW 73W		0.38			10.55			[13.10					ORD AA			T317 T318		23.39 CLT 738 22.59
R17	0.00	ATL DL	020.			3.43	I	1	1	<u> </u>			T329 T330	11		I	 		10.44			1910		23.39 CLT 739
R18	CLT DL 0-00	1.02	C)289)290		J. C	JFK CS1 08						1000		SDF AE			PSF 550	H 3			CLT CR9 21:40		ATL T341 CLT DL T342 73H
R19	0.00	MDW WN		,2,10				1	1	<u> </u>			T333 T334	11	14.15							21.40		CLT 73W 23:59
R20	CLT B6 0-00	1.20		O297 O298				FLL E90 7:15					1551									LG/ DL	T33	35 CLT 36 CS1 36 23-59
R21	CLT AE 0-00			0270				O299 O300	1	<u> </u>				<u> </u>	I	HSV CR2						21.	JFk DL	K T339 CLT S1 T340 23:59
R22	CLT AE 0:00								O301 O302							15.25	I	TRI CR7 17:40					BO B6	^S T343 ^{CLT} 50 T344 23:59
R23	CLT AE 0:00								O303 O304									TYS CR7 17:40		BTV AE 19:12	I I	T349 T350		CLT CR9 23:59
R24	CLT AE 0:00				O307 O308					XNA CR9 9:20						HS AE 15:	V 55			T3 T3	65 66			CLT CR7 23:59
R25	CLT AE 0:00				O3 O3	05 06				YUL E75 10:01								OKC AE 17:39			T351 T352			CLT CR9 23:59
R26																		CHS AE 17:47			T357 T358			CLT CR9 23:59
R27																				CLE AE 19:18		T363 T364		CLT CR9 23:59
R28																				M A	HT E 0:53	T35 T35	3 4	CLT CR9 23:59
R29																					GRR AE 20:25		T359 T360	CLT CR9 23:59
R30																					GRB AE 20:27		T355 T356	CLT CR9 23-59
R31																				BDA AE 19:20	I provide I	T347 T348		23.59 CLT E75 23.59
R32																				YUL AE		T361 T362		23.39 CLT E75 22-59
R33																				17.00				23.39
R34																								
R35																								
		1	1				I		1					1						1	1			

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CLT 2033 Gating Scenario 3

CLT 2033-Scenario 3

[00:00 01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00 23:00
				ulululu			lutulutu			ուսիսի				htulutu	ուսիսիս	սիսիսիս				աստ		
AADO					oursed pro						DDI	000									DEN	
A21					5:15 2451 6:00	AA 6:40	5	2011 1793	1 7		RDU 321 11:20	AA 628 321 11:57 13:00	FLL AA 13:20			1051 275		1	9:10 CL1S 321 9:10 19:45	ORIG 2006 20:30	AA 1873 21:18 2	221 2215
A22						SFO AA 6:14	8	398 057	LAX L 321 A 9:45 10	.GA A 879* 0:00	PLS 321 11:40	RSW AA 12:00	445 580	DEN 321 14:20	BWI AA 15:15		1889 1798		PI 3 20:	HL PHL 21 AA 205 20:40	892 472 ₂	HX 321 2:15
A23						SMF AA 6:02	476 840*		MBJ 321 9:25	1924 TERM	DEN AA 11:15	1446 LAX 652 13:00	PHL 1 AA 13:18 1	789 MSP 321 855 14:50		DFW 7 AA 16:31 8	20 PHL 321 30 17:30		EWR 1598 AA 19:16 2483 2	IAH EWR 738 AA 20:10 20:36	1245 7 1608 22:	K 18 0
A24						SEA AA 6:15	624 LA 658 8:0	S BOS AA 17 0 8:28	FLL 321 9:50	ORD 172 AA 196	29 PUJ 321 7* 11:50	TPA 1 AA 629 12:06 1	BOS 321 3:10 TERM	[R A 1	SW BWI A 703 321 6:55 17:45	LGA MSY AA 1809 320 18:02 18:55	TUS 852 AA 843 2	TUS TP 319 A4 20:10 20	$ \begin{array}{cccc} A & 2039 & DF \\ A & 2039 & 3 \\ 52 & 890 & 22 \end{array} $	W 21 .0
A25						SAN 579 AA 662	SFO 321 7:30	р р р	OTW 925 FNT AA 319 0:06 1109 9:52	RDU AA 10:38	1977 1936	EWR 321 12:10	ORD AA 13:23	695 TPA 321 1810 14:50	MCO AA 6. 15:25	37 321 16:45	ewr aa 470 17:01	SAN BWI 321 AA 18:15 18:39	416	FLL 321 20:20	JFK AA 1774 21:02	DTW 321 22:20
A26						CLT 6:45	ORIG 1956 7:30	ORD AA 680 8:20	PHX 321 9:40	FLL 1735 AA 826*	MBJ 321 11:30	PHX AA 1842 12:06 13	PIT SMF 321 AA 3:09 13:28	1154 SAN 321 1583 14:45				Pi A 13	³¹ 1798 A 844	DFW 321 20:27	LGA AA 557 21:04	SFO 321 22:20
A27						LAS 43 AA 42	1 DEN 321 8 7:35	SFO 1944 AA 1946	ORD 321 9:35	DCA AA 10:32	1837 RSW 11:55	MIA AA 1878 12:14	DFW BWI 321 AA 17 13:15 13:30	FLL 321 14:30			MSP AA 17:40	1836 1841	FLL 321 19:12		PHX 499 AA 1865	DEN 321 22:25
A28						PHX AA 2020 6:09 209	D DFW 1 321 1 7:30	EWR AA 1866 7:55	PBI 321 9:20	IAH AA 10:35	FLL 1961 321 11:55	FLL AA 1970 12:19	BWI MIA 321 AA 13:19 13:35	2080 ORD 321 14:50	SEA 2107 AA 443	SEA SFO 321 AA 16:20 16:46	1908 SFC 32 1799 18:0:	ORD AA 18:45	747	MCO 321 20:15	MCO BE AA 1704 32 21:03 22:0	L 1 9
A29						SLC AA 6:10 408	4 PHX 321 7:30	FLL AA 1912 8:22	SEA 321 9:40	BUF AA 858 10:14	NAS 321 11:30	BOS AA 2044 12:04	MIA LGA 321 AA 13:20 13:37	581 321 14:45	LGA AA 494 15:00 1	9HX 321 16:15	TPA 730 AA 17:20 174	0 LGA 321 10 18:40	STL 1768 PIT AA 319 19:101747 19:54		SFO AA 1857 21:13	MCO 321 22:19
A1						LAX AA 6:26	696 TPA 321 1813 7:45	LGA AA 1772 8:13	DFW 321 9:29	MIA AA 10:29	521 DEN 321 11:45	DEN TPA AA 1808 321 12:03 13:02	A DF 1 A/ 2 13	W 2091 JFK 321 52 1972 14:55	TPA 53 AA 53 15:27 72	39 LAX 321 25 16:40	ATL 786 AA 678 16:57 678	LAX SAN 321 AA 18:16 18:4	4 487 51 31 320	LC 321 305	DFW AA 1812 21:12 2	30S 321 2:15
A3						MCC AA 6:44	2062 LG/ 2062 32 7:5	A DFW 1 AA 8 9 8:34	335 321 9:50	PHL 826 AA 1735	LAS 321 11:20	MCO 1725 MCO AA 691 321 12:04 691 13:01	DEN AA 2059 13:21	MIA 321 14:20	AA 704 10 AA 2050 16	3A 21 10		CLTSC4 ORIG 18:29 1317	MSP 19:14		LAX FI AA 1717 3 21:09 22:	L 21 0
A5					CLTSC4 LO ORIG 5:20 6:	GA EW AA 05 6:4	r EWR 1364 738 7 7:45	PHL AA 883* 8:10	CUN 321 9:25	DTW AA 885* 10:11	CUN 321 11:25	DFW AA 873 12:27	ATL LA 3 321 AA 13:24 13:	X 1810 PHL 321 50 2055 14:45	LAX 724 PHI AA 724 321 15:00 559 16:05	ORD AA 16:39	622 TPA 321 731 17:53	SJU 8 AA 18:35	336 SFO BOS 321 AA 19:30 19:45	5TL 793 319 20:33	277 TERM	783 TERM
A7						A A 6	TL AT A 469 32 52 8:0	L BWI AA 1925 0 8:20	TPA 321 9:35	BDL AA 10:31	752 SJU 321 11:45		PH A/ 13	A 2063 321 52 14:50	PHX 1 AA 15:35	899 SFO 321 705 16:40	BOS 1787 S AA 609 18	EA 321 310	RIC MCI AA 1769 319 19:11 20:00	1	SEA AA 1863 21:26	RSW 321 22:26
A9				CLTS0 4:45	ORIG 823 5:30	DEN AA 6:37	1980 BOS 321 7:50	MCO AA 461 8:10	SFO 321 9:24	PVD AA 10:32	MIA 1831 321 11:45		BOS AA 89 13:30	DFW 321 14:25	DFW AA 1719 15:20	FLL 321 16:24	FLL 609 PI AA 3 17:00 1787 18	DX 21 10	MIA 760 AA 19:20 199	0 PVD 321 6 20:29	FLL AA 1737 21:21	LAX 321 22:20
A11						CLT 6:45	SC4 ORIG 928 7:30	PHX 423 AA 1965*	PUJ 321 9:25	RSW AA 679 10:13	PHX 321 11:25	ATL AA 2066 12:02	LGA PHX 738 AA 20 13:12 13:31	68 121 14:26	LAS 748 BO AA 3 15:08 1999 16:	OS 21 10	MCO AA 651 17:16	DEN 321 18:25	LGA 616 AA 19:20 178	5 BOS 321 3 20:29	BUF AA 1940 20:58 2	ALB 319 2:15
A13						CLTSC4 MI ORIG 6:15 1877 7:0	A 00	ATL 713 AA 413	ATL 321 9:35	MCO 790 AA 2053	TPA 321 11:20	IAH 382 I2:11 100	JFK 738 13:19	LAS 1458 SMF AA 1917 14:50	BOS DF AA 1775 3 15:09 16:	W 21 10	DEN 1811 AA 565	DFW 321 18:30	FLL AA 1920 19:12	BWI 321 20:20	RSW 1805 14 AA 1805 3 21:10 745 22:	H 550 21 TERM
A12						CLT 6:45	SC4 ORIG 1727 7:30	LAS 1955 M AA 1905	4CO 321 9:19	TPA AA 1862 10:18	ORD 321 11:25	EWR AA 12:23 144	5 EWR MCO 738 AA 7 13:26 13:45	2055 PHX 321 695 14:35	DEN 428 AA 1791	TPA 321 16:24	PHX 767 AA 466	SMF 321 18:20	SEA 633 AA 541	SEA 321 20:20	5069 TERM	
A10							CLTSC4 MCO ORIG 6:55 ¹⁷²⁵ 7:40	MSP AA 8:46	1910 LGA 9:55	MSY AA 10:24	833 320 11:50	LGA OR AA 893 73 12:17 13:0	1D 38 05		MSP AA 2046 15:25	RSW M 321 A 16:25 10	IIA 1799 ORD A 321 5:54 1908 18:00		SFO 662 AA 19:14 1975	LAX 321 20:20	DCA AA 19 21:29	RIC 22 319 22:40
A8							CLTSC4 PUJ ORIG 7:05 7:55	PBI AA 445 8:31	DEN 321 9:35	MSP AA 193 10:26	BOS 37 321 11:30	ROC 19 AA 12:19 2	907 ELP 319 54 13:45	SAI AA 14::	$\begin{array}{cccc} & & & & & & \\ & & & & & & \\ & & & & & $		PHL 799 AA 1733	MCO 321 18:20	BDL T AA 1871 3 19:07 20	PA 321 :06	ORD AA 127' 21:27	MIA 738 22:30
A6							CLTSC4 MCI ORIG 7:05 7:50	LAX AA 1 8:43	BOS 321 9:45	DFW AA 10:37	2064 LGA 321 11:40	PHL 1882 PHL AA 319 11:59 2054 13:00	MEM AA 13:39	SAT 1827 738 14:40	ORD 1999 MCO AA 1211 15:05 1899 16:00	LGA AA 16:44	436 PHX 321 17:45	DFW AA 1752 18:11	DFW IAH 744 AA 9:10 19:25 1861 2	RDU 319 20:10	MSP 1897 AA 1998 21:04 1998	BWI 320 22:30
A4							CLTSC4 ORIG 7:10 ¹⁹¹⁶ 7:55	TPA AA 19 8:41	960 ^{BWI} 9:40	BOS 1967 AA 1729	MCO 321 11:20	PIT CL AA 2078 31 12:05 13:0	LE 19 05		FLL ATL AA 504 321 15:05 15:59		^{BWI} 1915 AA 2038	PVD 320 18:15	ATL RSW AA 1820 321 19:02 20:00	808 TERM	1	973 TERM
A2										CLT: 10:50	SC4 BWI ORIG 1924 11:35				$\frac{3}{4}$ $\frac{1130}{15:20}$ $\frac{1130}{184}$ $\frac{1130}{16:16}$	EN 21 10			MCO 746 PHX AA 321 18:59 463 19:55		2043 TERM	
B1						6:	ORIG 50 525 7:35	RSW 413 AA 713 8:28 713	MSP 321 9:20	SJU AA 10:50	1376 SRQ 0 1404 11:40	BNA AUS AA 653 319 11:58 12:54			L A I	AX 819 SJU A 321 6:00 972 16:50	MCI AA 1701 17:13	MIA I. 738 A 18:20 1	AS A 2075 8:55 2	MSP 321 20:10	ATL 1998 AA 1897 21:16 1897	ATL 738 22:40
B3					CL1 5:51	ORIG 2010 6:35	DCA PIT AA 1904 31 7:02 7:5	Г JAX 9 AA 1722 9 8:17	DCA H 738 A 9:30 1	^{3NA} 821 AA 876*	AUA 320 11:30	ORF AA 1973 12:23	IND MCI 319 AA 1 13:12 13:27	860 319 14:35	EWR AA 379 15:05	MIA 738 16:25	PIT 1829 DFW AA 321 16:57 721 17:40	CLTSC4 ORIG 18:28	PBI 19:13	17 TE	24 5563 RM TERM	
B5						SJC 661 AA 6:00 1872	PDX 738 7:05	MIA AA 8:47	EWR 1496 738 9:55	ATL AA 2065 10:12	IAH 738 11:19	BDL RD AA 1914 31 12:09 13:0	U 19 04	JFK 2530 AA 2249	EWR IND 18 738 AA 18 15:15 15:30 18	343 DCA 319 364 16:40	CLTSC4 RI ORIG 17:25 ¹⁹¹⁵ 18	DU 2 10 T	ERM		LAS AA 1796 21:26	PHL 321 22:25
B7						BWI AA 6:36	JFK 2042 738 7:30	JFK AA 148 8:30	MIA 1 738 / 9:30 1	EWR 1451 EW AA 1458 73 10:02 1458 11:0	7R 38 05	ALE AA 12:5	³ 1756 ALB 319 319 319 319 3150	SNA 1767 LAS AA 738 14:10 278 15:00	MSY 1821 R AA 1886 3 15:30 16:1	IC 19 09		1692 TERM	451 TERM	D A 2	TW LGA A 1981 738 0:55 22:04	
B9						RDU AA 172 6:17	32 319 7:30	PVD AA 865* 8:12	SXM 320 9:25	SAT AA 10:39	BNA 850 738 11:40		DCA AA 2 13:28	045 319 14:35	NAS AA 853 15:10	BUF 321 16:29		SJC AA 18:35	786 AE 585 20:	BQ SJU 738 AA 205 20:23	753 M 2039 22:	3P 11 .0
B11						CI 6:	CRIG LAX ORIG 1993 50 7:35	MSY 53: AA 8:46 50	30 ^{MHT} 319 89 9:30	JFK AA 10:42	DFW D 330 738 A 11:35 1	DCA RIC AA 2077 319 1:52 12:45	PIT AA 17 13:31	BDL 700 319 14:30	MIA 2448 AA 1453	ORD LAS 738 AA 16:25 16:45	125 JFK 738 1577 17:45	ATL 527 AA 5555 18:05 555	6 GRR 319 3 19:45	1954 TERM	MIA 1 AA 1384 21:13 2	WR 738 2:15
B13							BOS BN. AA 1817 31 7:12 8:0	A EWR 2531 JFK 9 AA 2529 9:06 8:16 2529 9:06			ELP 281 ELP AA 1870 11:50	887 TERM	SAT AA 13:4	1633 8 296 1	FNT JI 319 A 5:11 1	FK 1577 ^{SNA} A 738 6:00 1871 16:45	IAH EWF AA 1711 738 17:15 18:0:	с Р 8 Д 5 1	DU A 8:55	861	ATL MCI 738 AA] 21:19 21:40	ORF 18 785 319 22:40 TE
B15							CLTSC4 ORIG 7:20 827 8	SJC BDL AA 1780 8:05 8:21	CLE 319 9:40	AUS AA 10:39	19 18	964 849	JAX 1 319 13:15	RDU 2069 PIT AA 319 3:56 2084 14:55	P A I	BI A 6:00	294 1673		EWR 766 321 19:11 TERN	1	628 TERM	
B16						RIC AA 6:34	BDL 319 7:30	MEM AA 8:43	1853 319 9:55		$^{IAD}_{AA}$ 5373 $^{SAT}_{319}$ 11:10 5210 11:55		DTW AA 13:45	51L 756 319 14:40	BNA 1886 JAX AA 319 15:14 2032 15:59		PI A. 17	^{DX} 1853 A 1853 1:58 660 1	SJC BNA 194 738 AA 194 9:09 19:24 733	.5 SAT 738 20:25	BDL AA 1952 21:12	BUF 738 22:25
B14								CLTSC4 ORIG 8:29 1957 9:	14	MDT AA 10:33	1753 JAX 1753 319 11:50	PVD AA 657 12:28	IAH CLE 319 AA 1 13:20 13:37	934 319 14:30	RSW AA 1992 15:03	PVD D 319 A 16:30 10	CA IAH A 673 319 5:54 17:54		JFK 101 I AA 1390 2	EWR BWI 738 AA 20:10 20:38	864 2035	JAX 319 22:35
B12						PIT AA 6:42	PVD 1903 319 7:35	ILM PHL AA 1839 319 8:04 9:00	FSD 784 9:23 993 1	MCI LGA 319 AA 10:15 10:44	ALB 1988 319 11:55	CHS 1849 AA 12:25 1950	DCA 319 13:15		ATL 2032 AA 15:08 1821	DTW 319 16:30	NAS AA 859 17:04	PIT 319 18:15	MSY 732 AA 1885	BUF 738 20:15	1971 TERM	
B10						CLT 6:45	868 7:30	AA 1751 8:03 97	319 9:30	AA 1730	0 319 AA 11:30 11:4	1267 BUP 319 5 751 12:30	AA 2002	319 14:15	AA 1715 31 15:02 16:0	JA) 9 AA 6 16:	1750 319 50 17:50		AA 2648 738 19:05 20:00		2035 TERM	
B8						ļ,	CL1 SC4 RDU ORIG 7:05 2011 7:50	AA 1941 8:15 829*	MEX 319 9:30	AA 1909 319 10:11 11:03	9	CLTSC4 12:40	ORIG 887* 13:30	1974 PUSH	RDU AA 15:44	1962 319 16:45	17:15 1242 18:00	4	AA 1921 19:07	319 A 20:15 2	A 1893 3 0:55 22:	2005 0 TERM
B6						lana	6:55 3773 7:40	AA 829 8:08 1941	319 9:19	AA 1 10:33	814 319 11:39			AA 1938 319 14:02 14:55	CL15C4 ORIG 15:35	16:20	ALB PWN AA 2052 319 17:01 18:09		JAX AA 19:15	1861 2043	22 22	BI 19 11
B4						AA 6:14	1930 321 487 7:50	AA 8:44	1756 319 9:50	AA 1847 10:10	319 11:15			ORIG 14:10 ²⁰⁶⁹ 14:55	AA 1653 15:13 I	319 16:15	AA 765 17:11	319 AA 18:25 18:40	5210 5335	319 20:30	AA 1987 21:04 2	219 1:14
B2								AA 19 8:35 85	78 1045 52 9:40	AA 10:42	5510 319 11:45				AA 15:43	5370 ¹¹⁰⁵ 5094 16:44	AA 2028 319 16:59 17:54		0RIG 19:04 1720 19:49		AA 1793 21:20	319 22:25
C2								AA 1942 319 8:08 9:10	and	ALB 1707 AA 10:23 613*	7 319 11:25		CI TOO	2017 PUSH	AA 18 15:39	302 319 16:30	AA 5321 B 17:19 5563 18	19 A/ 10 18	1979 319 52 20:00	334 TERM		
C4								AA 1795 8:28	319 9:30	AA 10:28 197	97 100 319 77 11:30		13:40	BRIG 1789 14:25	AA 15:35	- 41 D	422 1540	- 1	319 19:15 19:35 61	0 321 6 20:20	ALB AA 2070 21:22	319 22:25
C6								AA 85. 8:38 197	2 319 78 9:35	AA 1868 10:14	319 11:14				AA 174 15:35 184	5 ALB 319 3 16:24	PUS	H	1976 TERM	20:32	L AA 1' 21:17 21:39	288 321 22:35
C8							OTTO CITY	AA 1770 3 8:29 9:	119 15	AA 876 10:20 821*	320 11:25				bu	AA 16:20	4	122 524	FSD 319 19:54		AA 1870 21:25	2:16
C10							6:55 7:45	AA 1784 8:30	319 9:24	AA 1923 10:27	319 11:20	PDI			AA 20	47 319 16:30		584 PUSH	844 TERM	20:45	PULL MCI PHX 170 21:30 21:50	1854 321 22:45
C12							6:55 ^{843*} 7:45	STL AA 8:51	1677 319 9:45		AA 2754 11:15 2845	321 12:15			AA 2036	319 16:19	AA 2067 319 17:04 18:0:	SLC AA 18:40		78 881	STL 319 22:00	
C14									TTSC4 LAN	10 10	0:55 ¹⁹⁶⁴ 11:40	-			RIC 1 AA 15:41 1	864 319 A 745 16:35 1	A 6:55	1891 736	DTW 319 20:00		AA 2038 738 20:57 22:05	SVB
C16								9	ORIG 5247 :05 5247 9:50	BD/ AA 10:5	1840 ME 31 51 1434* 12:0	19 00					AA 1840 17:15	319 A 18:25 11	A 605 PLS A 319 3:54 1029* 20:00		21:35 ¹⁹⁷¹	22:20
AAIN								SDO	INT		MEX		4114			HAV	BDA	harv	*002 MEN			CLTSC4
l1								*1839 8:00 982*	321 9:45		AA 1844 SD 11:00 1853* 12:0	19	AA 13:30	*1542 625*	738 15:40	AA *1074 16:05 1028	319 17:30	AA 18:35	*828 MEM 1768 20:00		21:5	*1850 TERM 22:40
12								GCI AA 9:00	*860 319 0 1615* 9:45		AA 11:00	*368 1826	319 13:15	A/ 14	*843 RI 53 2056 16	21 AA 10 16:	*869 L 50 749 18	21 AA 10 18:40	*866 BNA 320 1867 19:49	*1968 1954		

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CLT 2033-Scenario 3

	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
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13										K	A *854 PAP				SJO AA	*672 AUA 617* 321	A 1		GCM *	*822 DCA 320	CUN *888	LTSC4		
14										<u>v</u>	PLS #	*842 KIN 040* 12.00			14:35	16:02	PUJ *	1963 ATL 738 787 1756	18:14	MBJ *827 AA 1919	MIA AU/ 321	A CLTSC4 *877		
15											10:00 1	12:00				KIN s AA	*644 KIN 2456* 319	PUJ AA	*19	966 L	20:15 20:5 AS 321	21:35		
16											C	UN *1283 SJO A 1087* 321				15:40 2	PAP *2364 AA 2541*	17:42 PAP 738	SDQ *639 AA 1865*	GCM 319	UVF AA	*1342 SDC 874* 321		
17											<u>n</u>	0:50 1087 11:55					16:15 2.541 CUN AA	17:15 *884 BOS 321	18:00 1805 CUN AA	*886 PBI 321	20:15 SXM CLT *613 TERM	374 22:00 SC4		
																	16:40	1800 17:55	18:40	PLS *880 OF AA 1951 3	20:24 11:00 21 RD 321	1:09		
110								GRI AA	*1062 CLTSC4 332					FRA *705 CLTSC4 AA DUGU 789			LHR AA	*731	LHR 789	18:55 1851 20:	:05			
 								7:50	_{:0} FUSH 8:50					13:00 PUSH 14:00		FCC	16:15 0 *721 MAD 789	/30*	18:40					
112																15: MAD AA	255 /48* 16:40 *74	19 DU 3:	JB LHR 32 AA	*733	LHR 789			
 																15:50 FCC AA	0 *721 CLTSC4 789	4 18:	05 18:30 BCN AA	*745	20:15 BCN 332			
 														CI A/	DG A	*787	55 IEKM 16:55 FRA CI 332 A/	A PULL	18:20 FCO 789	CLTSC4 PULL	20:45 GRU 332			
 														DUB AA	:55	704*	16:35 16	5:55 /20*	18:25 CDG 332	19:00 I 568*	20:30			
OADO														13:05		/86*			18:20					
01	1441					CLTSC4 ORIG 1366	CLTSC4 ATL ORIG 2488	CLTSC4 ORIG 2266	ISP		JFK 4	093 JFK	DTW DTW DL 1629 319			DTW 6	03 MSP 319	LGA 5508 LGA		LGA 6224 LGA	A J			522
02	TERM					5:15 6:00	6:15 2400 7:00 CLTSC4 JFK ORIG 2612	7:20 2:200 8:	LGA393	0 ^{LGA} CS1	ATL ATL DL 1454 739	LGA 5060 LGA DL 5060 CS1	12:07 12:50 ATL DL 1095	ATL 5 717	MSP MSP 1503	15:40 17	/93 16:30 DL 152 DL 152	17:12 5135 18:00 22 24 320	DTW	19:18 0227 20:00 DTW 1057	4	3812		876
03							6:08 5012 6:53 CLTSC4 LGA 0RIG 2844	CLTSC4 ORIG	8:35 384 3 ATL ATL DL	ATL 2422 73H	10:03 10:45	ATL ATL DL 2251 717	12:33	LGA 3888 LGA DL CS1	14:24 14:59	ATL ATL DL 2133 73H	ATL 602 ATL DL 2001 73H	ATL DL	18:40 ATL 826 73H	19:15		TERM	1076	TERM
04							6:15 7:00	7:30 CLTSC4 SLC ORIG SLC	8:15 8:48	9:30 DTW DTW 2292		11:16 12:00		13:14 3642 14:00 ATL DL 2	ATL 597 320	15:04 15:45 LGA 5096 LGA DL CS1	16:18 ²⁰⁵¹ 17:00	JFK 4189 JFK DL 2422 CS1	0 18:45	ATL A DL 1407 7	ат. 73н		4128	19
05							CLTS	7:00 521 7:45 SC4 SEA		9:04 9:39				13:42	14:30	15:06 5099 16:00		17:19 ³⁴³³ 18:00		19:09 20:	:05	2808	TERM	TE
06						CLTSC4 IAH	6:50	SFO 1704	4 SFO 739	ORD 425	ORD 73G			ORD 1484 ORD UA 319		DEN 1711 UA	DEN 739	SFO 11 UA	76 SFO 739			TERM	1286	1974
013						5:05 1191 5:50 CLTSC4 ORIC	BOS	7:21 1969	8:20	9:26 521 BOS B6	10:15 8025 BOS E90	FLL 81 B6	01 FLL E90	13:00 1140 13:45		15:10 1199 B	16:22 30S 8021 BOS 36 E90	17:31 16 BOS 1445 BOS B6 1445 E90	98 18:30 JF BI	FK JFK 1119 E90			TERM 8017	TERM
014						5:33 8022	6:18	CLTSC4 FLL ORIG	L	9:24	8020 10:51 JFK 219 JFK B6 219 E90	BOS 1245 BOS	02 12:30			1	16:00 8016 17:00	17:18 1446 18:00	18	8:50 1118 19:28			8103	
018						c	ORIG ORD	7:15 8104 8:00 CL1	0 TSC4 DEN ORIG DEN		10:01 2 18 10:40	10:59124611:36											TERM	5812
019	9				CLTSC4	stig HOU	:58 1712 6:48	7:50	8:35	BWI 3055	DAL						MDV	W853 853						TERM
020	TERM				4:40	CLTSC4 ATL				9:35 1 MCO DEN WN 1685 738	10:10 4 8				BNA 5136 BNA WN 738		16:5 DEN MCO WN 1362 738	17:25	OU ₁₇₄₇ HOU	DAL BWI 1721				614
027						5:15 612 6:00 CLTSC	A MDW			9:20 10:00	0				14:00 684 14:45		16:20 17:00	BNA 2465	7:55 ¹⁴⁹⁵ 18:30 3NA 73W	18:55 19:30				TERM
028						5:45 DEN F9	201	DEN 319			MCO PH F9 1028 32	IL ISP 354 ISP 355 ISP	3P 19			PHL MC F9 1689 3	CO 320	17:20 3113 1	8:10		CLE 486	CLE 320		
029						5:10	200	7:20			10:11 10:	59 <u>11:20</u> 353 12:1	05			15:21 16:	:09				20:20 489	21:20 TTN 321		
030							LAS NK	165 MCO 320	D 0								IAH NK	135 FLL 320			MCO 344 LAS NK 344 320	21:10	357	
031							6:45 CLTSC	804 8:00 ORIG 516	0								16:45	380 17:30			20:00 541 20:50		IEKM	
032							6:45	7:30 PDX AS	625 PDX 73H	C 4							SEA 52	25 SEA 737						
OAIN								7:15	626 9:00	0							16:30 52	26 17:30						
121																	MUC LH	*428	MUC 359			LGW *	7751 LG [*]	W 88
122																	16:20	429* KEF WW	18:35 *201 KEF 321			21:05 7	/52* 23:0	05
AEDO																		17:40	202* 18:40					
D13							PHF 51	90 PHF 57 CR2	LEX AE	533	37	JAN CR7	OAJ 5176 OAJ AE 5214 CR2	MGM 5441	SDF CR2	FAY 383	1 IND CR2	TYS AE	5119	FAY CR2	HTS 5461 5049	DAY AE	5156 PGV CR2	
D12							6:30 55 LYH 472 AE 400	38 OAJ CR7	8:30 MGM AE	5293 MGM 5440 CR2		BHM 3819 HSV AE 2000 CR2	CLE 5282 GNV AE 5062 CR2	13:18 5154 TYS AE	5294 TYS 5110 CR2	GPT 5095 CID AE 5006 CR7	GNV AE	17:10 5063 CA 5250 CR	5250 K SHV 5514 5254	19:50	PULL 5172	21:31 LEX AE	5264 MGM 5208 CR2	
D10						G	6:22 480 SP DCA GNV 3802 AE	5228 CR2 5039 CR2	8:38 FAY AE	5273 TYS 5297 CR2	CH	A 5277 EVV CR2	CRW 5237 BHM AE 5164 CR2	DAY 5	120 PHF 052 CR2	EVV 5032 E	16:09 2 EWN CR2	PHF 5052 AE 5264	LEX CR2	5366 TEDM	FAY 5105 HSV AE 5224 CR7	CAK 5 AE 5	259 AGS AGS CR2	
D8						5	6:52 6:52	7:30	8:40 CLTSC4 ORIG 682	A BHM AE	5204 5032	0KC CR9	HSV 3906 C/ AE 3960 Cl	AE R2	PGV 5117 FAY AE 5486 CR2	OAJ 5314	16:14 4 MGM FPO CR2 AE	5077 FAY 5105 CR7	18:14 AVL AE	4769	19:59-22420:40 TRI AGS CR7 AE	4001	GSP CR7	
D6								CAK 5355 5277	8:15 9:00 TRI 485 AE 482	9:15 52 LYH CR7	PHF	11:20 TYS 5557 CR2 5294 CR2	12:25 13: BHM AE 5142 5218	TLH FAY CR2 AE	5463 VPS 5453 CR7	ORIG	<u>← 16:19</u> 16:48	BHM AE	18:42 5311 CHA 5186 CR2	TRI 4786 AE 4755	20:15 20:38 EWN CR7	CHO 5552 AE 5177	22:40 CRW CR7	
D4							AE 53	7:08 7:43 GSP 354 CR7	8:16 482 HTS_FLO_DA 4935 AE	9:35 W	5122 5364	11:18 PHF CR7	GNV TYS 5305	13:10 13:45 GPT AE	5320)	OAJ CR7	5486 DUSU	RAP 5126 XN AE 5221 CH	19:00 4755 NA BHM 31 AE 31	20:30 865 HPN CR7	TYS 5037 AE 5100	22:35 AVL CR7	
E1							6:24 CRW AE	7:45	8:00 8:30 8:5 5263	LFT CR7	MO AE	B 55	12:25 ⁻⁰⁰ 13:00	13:37 SHV CR7	CAE 532 AE 532	27 EVV CR7	5513	CHA	5508	04 0AJ CR7	LFT SHV AE 5411 CR7	JAN 5257 AE 5407	22:25 BTR CR7	
E2							6:45 EWN AE	4921 GSO 4826 CR7	PGV 5234	9:36 PGV CR2	SGF 3706 SGF AE 3212 E75	DAB 5603	14 RAP CR9	LFT AE	5110 520	GNV HPN CR7 AE	5526 HPN 51(C CR7	ROA 4829	5233 LYH CR7	HSV 397. AE 201	20:00 20:40 2 3 YUL A CR7 A	20:58 5407 VL 5326 C LE 5124	22:15 AK MGM_AEX R7 5491 5292	
 E3							6:35	4820 7:50	8:11 5187	9:19 ICT 5316 AE 516	10:09.521.5 10:50 CMH CR9	LIT 5183 EYW AE 5220 CR9	AVL 4751 LY AE 4904 CR	H CVG 546 AE 526	0 5459 1 66 HSV MC 0 CR7 AE	15:15 15:44 IGM 5366 E 500 C	5100 17:00 LFT AVI CR7 AE	17:16 4798 L 4011 CAE 2775 CR7	18:30 ROA AE	4842 SBY 4825 CR7	20:25 20	0:55 5124 22: JAX 4636 4554	05 22:27 ^{2,7} 22:59	
E5							TRI 4	867 HHH CR7	HPN 51	9:03 5164 50 MOB CR7	10:30 SHV AE	11:00 5220 11:45 5546	12:12 4804 13:0 BTR CR7	13:31 531 AGS AE	5263 DAY 5122	SDF 3798 AE 2055	16:20 16:: 8 MKE TI CR7 AI	52 3775 18:00 LH 5218 GNV E 5202 CR7	18:43 ORF AE	3 4835 19:50 5209 AGS 5209 CR7	MEM AE 5265 5141 CR9	OAJ 49: AE	2:10 31 LYH CR7	
E7							6:39 4	ROA FAY AE 4776 CR7	8:22 52 PHF 5383 AE 5383	GPT CR7	GSP 5- AE	4 5364 467 FPO CR7	TYS 5297 M AE 5510	MOB CR7	HPN 5384 MLB AE 5202 CR7	15:17 3959 VPS AE	16:35 16 5138 HTS 5200 CR7	5:55 5202 17:55 CRW 474 AE	18:43 19 OAJ MSN CR7 AE	3 5398 19:45 5437 CAK 5206 CR7	20:05 20:45 LGA BTV AE 4460 E75	ROA 4807 ROA 4700 C	22 22:30 DA R7	
 E9								7:04 7:40 DAY CLE AE 5328 CR2	8:10 5320 LYH 4886 AE 4021	9:20 SBY CR7	10:10 5: CAE 390 AE 255	7 E75	12:20 5512 1 SAV 5185 CHA AE 5582 CR7	3:10 FLO AE	4904 ROA 4820 CR7	EWN 4773 LM AE 4770 C) 5200 17:00 YH CR7	CID 5456 CI AE 5420 CR	D 18:25 18:43	3 5506 19:45 MLB MSN AE 5230 CR7	20:00 20:40	21:00 4/99 22: HHH AE 4943	05 HHH CR7	
E11							HE	7:14 7:50 ¹ H ₄₉₁₅ ROA 4763	8:12 483	9:20 LH 5213 VPS E 5182 CR7	10:21 377 CID AE	5320 CID CR7	HTS 4866 AGS AE 4805 CR	13:48 7	+027 14:35	15:06 4779 16: CHA 4 AE	5582 GPT 5082 CR7	EWN 4939 AE 4907	ROA CR7	CAK 5036 AE 5112	VPS CR7	21:15 BTR AE	22:20 5074 EVV 5028 CR7	
E13							CHS 524 AE 524	46 SAV CR9	EWN 4 AE	53 5185 9:50 4884 TRI 4841 CR7	10:18 FAY 493 AE 400	4 FLO CR7	GSP 5067 LEX AE 5152 CR7	AEX_AEX 5375 5144		PHF 5364 LI AE 5202 C	5085 16:40 EX IR7	17:24 4807	18:15 DAB 5315 OKC AE 5359 CR9	AGS 4907 AE 4070	20:20 FLO CR7	GPT 5083 AE 5003	SRQ CR7	
E15							6:18 529 5279	90 7:45	8:32 4 MOB AE	4041 9:40 5278 AGS 5206 CR7	10:07 490	4 11:33 PULL	GSO 4903 TRI AE 4705 CR7	13:14 ¹⁴ 13:46 MOB 5: AE	251 LEX 078 CR7	15:13 5283 16: MLB 4 AE	5132 JAN 5257 CR7	AE 4759 HH	18:00 5258 18:45 IH 87	OAJ 5226 SDF AE 5477 CR7	.0:09	21:10 5393 LYH 47 AE	22:14 98 EWN 44 CR7	
F17							MYR 53 AE	357 CHS CR9	0AJ AE 5113	5396 9:45 CVG CR7	PIA 534	511/ 49 PIA CR7	12:184765 12:59 LYH AE 4820	GSP BTR CR7 AE	5225 BHM 5211 CR7	15:44 5 IA 5569 ICT LEX 5196 AE	525/ 16:35 X 5153 BTR 5074 CR7	17:18 4813 18: OR	IG GS	18:53 5477 19:49 SP 3833 MKE E 2800 CR7	+	21:26 47 MDT 51 AE 51	44 22:30 80 PHF CR7	
	I I I	1	I	1	I		6.20 53	109 7.40	8.13 5466	9-20	10.26 54	11-10	12.22 4933	12-12	3311 14-30	55 15.22	55 20/4 16.45	470	10	8.40 5889 10.44	1	b1.20 55	20 22-20	1

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	ntolotolotoloto	hitulutu	hitulutulutulutulutulutu	հռահուհերի	սիսականվունվուն	վորորդիրիներիներին	հուսիսիսի	ulutulutulu	ահմահուների	lutulutulut	nhitulutulutu	hitulutu	hitulutulutu	ntulutulutu
E19				SAV 5452 MYR AE 5389 7:40	AVL 5365 CHO AE 5152 CR7 8:21 5152 9:19	MKE 3896 SDF AE 0:48 3798 11:40 12	I 4841 ROA CRW 4926 CR7 AE 4824 23 13:01 13:25	HTS MSN CAK CR7 AE 5204 CR7 14:05 14:25 5272 15:05	TRI 4765 AVL AE CR7 15:38 4769 16:24	ORIG 5037	PGV 4869 AE 4780	LYH MLB 54 CR7 AE 52 20:10 20:30 52	431 MOB CR7 207 21:30	
E18				AGS 5296 SDF AE 5093 7:30	GSP 5235 IAD AE CR9 8:18 5509 9:09 9:24 00	3SP CAK 5468 GPT AE CR7 10:50 5462 11:40	EWN ₄₉₃₆ FLO SBY AE 12-29 ⁴⁸⁶² 13:06 13:30	4831 CRW 4749 CR7 4749 14-19	FLO 4862 ROA AE CR7 15-20 4842 16-05	SDF 5154 AE 17:465326	AVL LYH 4779 CHO CR7 AE CR7 18:30 18:59 4885 19:49	FWA 54 AE 52	476 LEX CR7 235 21:30	
E16				GSO MEM AE 5026 CR9	CRW 5347 BHM AE 5142 CR7	IND 4484 CMH RDU AE 4457 E75 AE	5415 BNA 5288 CR9	ROA ₄₈₇₉ EWN	LYH 4804 TRI AE 4786 CR7	LFT 5064 MLB AE 5376 CR7	FLO AE	4777 HTS 4767 cR7	5186 TERM	
E14				ORF 5460 CVG AE 5268 CR9	AGS 5439 BTR AE 5225 CR7	BTR AGS AE 5263 CR7	TLH 5091 MSN ME 5437 CR9	MYR 3777 AVL AE 4011 CR7	CHO 5048 CAE AE 5239 CR7	HSV 5319 PH AE 5361 CR	IF LEX TYS AE 5283 CR7	CID AE	5530 GPT 5401 CR7 AE 5112	GSO CR9
F12				6:27 5208 7:24 SDF 5342 STL AE 5772 CR9	B:21 3223 9:09 GPT 5232 MSN AE 5232 CR7	10:34 11:14 FLO AVL GRI AE 4850 CR7 AE	2:28 3437 13:34 3 5674 PNS CR9	14:01 14:40 CHA ORF AE 5179 CR7	15:30 16:10 ROA 4926 AGS AE 4907 CR7	AEX 5060 FWA AE 5060 CR7	CRW 5148 FWA AE 5148 E75	20:40 - HPI AE	^N 3945 CR7 5090	22:45
E10				6:46 5073 7:40	CAK 5242 JAN AE CR7	10:45 10:00 11:25 12:2 MSN AE	0 5036 13:15 5231	14:01 14:40 HPN CR7	15:41 ⁴⁵⁰⁷ 16:19 PIA 5186 AEX	17:05 3524 17:45 MOB MOB AE 5512 CR7	19:05 5405 19:49	20::	50 504 21:30 1ERM	
F21				6:41 5061 7:29 IAD 5399 IAD AE CR9	8:37 5071 9:30 BHM 5346 CRW AE 5346 CR7	ORIG SDF AE	5104 5093	14:33 IND CR7	15:43 ³³¹⁰ 16:20 AGS 4805 PGV	17:10 ⁵⁰⁶⁰ 17:49 HHH AE	48	SH 392	21:13 ²⁷ 21:46 5304 TRI CR7	
E22				6:44 5373 7:30 CMH 4544 DTW	8:30 5237 9:20 MKE 3850 CAE	5632 11:05 GSO 4826 ROA AF 4826 ROA	5323 073 ILM CD2	14:50 HHH ₄₈₄₄ HHH	15:40 ⁴⁸⁶⁹ 16:16 3909	17:31 CHO4918 FLO	PULL GNV ₅₂₅₂ BTR	025	22:25 CHS TYS	
E23				6:38 4542 7:45 PHL 3899 CAE	HSV 5329 SAV	10:304879 11:14 12:10 5 HHH 4942	345 12:59 5458	13:56 ⁴⁸⁹ 74:30 CMH	JAN 5514 ^{CRW}	17:01 ⁴⁷⁷⁷ 17:35	5514 19:18 ⁰²⁴ 19:50	ABE	AE 5138 CR9 21:00 22:09	Y
E23				6:58 3908 7:45	8:33 5185 9:19 ORIG	10:4 ⁴⁸¹⁶ 11:19 BTV 4649 RIC	5087 ^{XNA} 5388	TVC GRB 5531 ABE	15:40 ⁵¹⁴⁸ 16:15	DSM 5055	DSM LIT	20:15 5440 TUL	CAE 3775 MKE	5
E27				CAE 3967 BHM	CHO 4876 HTS SBY 4770 AVL	АЕ 10:21461811:05 ОМА 5253	AE 12:30 5158 SAV CAK	14:05 14:22 ⁵²⁸⁶ 14:59 5245 PNS	4809 AVL 5086	AE 16:58 5276 MDT	18:45 IP:30 BTR 5500 HSV IAD 55	5880 20:40	AE 20:59 4056 22:05	
E29				AE 3819 E75 6:50 3819 7:35	AE 1070 CR7 8:15 4866 9:00 9:15 4751 9:50 MLB 5175 HPN	AE 5266 10:41 5266 CVG 5268	CR9 AE 12:59 13:28 DTW	5212 CR9 5212 14:50	AE 5000 15:29 5180	CR9 17:55 PWM 5034	AE 19:26 52	CR9 232 20:30	TERM 5049	
E31				5432	AE CR7 8:47 5384 9:30 FLO 4014 EWN MLI	AE 5200 10:49 5458	CR9 13:00 IAD 5500 CAK GSO	AE 5500 13:52 5244	CR9 16:14 MYR 5052	AE 5054 (17:10 5070 18 LGA TVC 52	CR9 AE 5056 CR 3:25 19:00 20:0 16 DAB DAB	9 0 52	TERM	
E33				love.	AE 4914 CR7 8:43 4936 9:24 9:40	5111 CR9 5514 11:30	AE 5509 CR9 AE 12:29 5243 13:15 13:33	5372 CR9 5494 14:40	AE 5055 15:33 5066	CR9 AE 52 17:25 17:40 54	AE 80 18:50 19:36	53 52	238 CR9 22:20	NA
E35				AE 6:56	5341 CR9 5116 9:20	AE 5356 CR9 10:13 5474 11:50 12:05 539	05 12:50 13:10 ⁵¹⁶⁷ 13:10 ⁵¹⁴	AE 5357 CR9 14:00 5227 14:55	AE 5106 CR9 15:14 5229 16:20	AE 5131 CR 17:06 18:2	AE 5494 CR9 18:50 5318 19:44	AE 19:59	5214 5336 2	2R9 2:40
E38				6:29 5457	JAX CVG CR9 AE 8:50 9:10	5128 OMA PULL 5504 CR9 5172 5172	AE 13:32	5247 DAB 5315 CR9 5315 14:25	CHS 5084 L11 BNA AE CR9 AE 15:30 5088 16:30 16:4	5288 SDF CR9 5 5049 17:54	AE 5212 CVG AE CR9 18:50 5303 19:45		AE 5449 CI 20:59 5114 22:	s 9 5
E36					SRQ 5390 1LH AE CR7 AE 8:04 5091 9:00 9:15	5177 TVC FAY 54 CR9 AE 5037 11:24 12:1050	187 CHS SRQ CR9 AE 18412:54 13:37	5139 SAV CR9 AE 5151 14:27 15:02	5072 CR9 2 15:59	AE 5377 CR 17:16 18:2	AE 5144 CR9 19:01 19:55		AE 5451 L 21:03 5200 22:	1 9 5
E34					GRR 5534 RDU AE 5534 CR9 8:49 5415 9:40	LEX 5039 FAY MYR AE 5463 CR2 AE 10:40 11:20 12:15	5289 MYR AI CR9 AI 5053 12:59 13	US 5433 CHS E CR9 E45 5181 14:35	CLE 5436 MYR AE CR9 15:25 5170 16:20	DTW MY AE 5249 CR 17:22 18:2	R IND 5189 GSP AE 5155 CR9 18:58 5155 19:50		AUS 5301 ME AE 5299 22:	M 9 5
E32					SAV 5130 MKE LNK AE CR9 AE 8:16 5267 9:14 9:33	5415 PNS MEM 5575 CR9 AE 511 12:07	SYR 34 CR9 12:50	GRR 5533 ATL AE 5533 CR9 14:05 5192 14:55	SAV 5266 STL AE 5266 CR9 15:42 5069 16:35	CAK 5243 CLE CR9 6:53 5331 17:50	GSO 5418 DAY AE 5101 CR9 18:49 5101 19:40	GSO AE 20:45	5121 DAY CR9 5374 22:05	
E30				IND 4661 IN AE 4531 E7 6:51 4531 7:5	AE 5327 GRR AE 5327 CR9 55 8:43 5533 9:25	VPS 5157 CHA AE 5157 E75 10:06 5179 11:14	SN 5565 SBY E 5327 E75 E25 5327 13:30	LIT 5033 MKE AE 5098 14:40 15	OT CMH 5064 CR9 07 15:59	PNS 5291 AE 5271	EYW TLH CR9 AE 5420 18:30 19:19	GSO CR9 20:10	ORF 5455 AVP AE CR9 21:09 5099 22:20	
E28					CHS 5207 MYR AE CR9 8:09 5289 9:30	SRQ AE 5102 CR9 AVP AE RAP 5514 DAB CR9 10:10 5322 11:20 11:40 5255 12:20		MKE 5267 ABE AE CR9 13:56 5140 14:45	OKC 5116 SDF AE CR9 15:14 5300 16:05	LLM 5285 ORF AE 5285 CR9 17:14 5455 18:05	MYR 5170 PNS AE CR9 19:00 5103 19:50	P A 2	2NS 5094 CVG AE CR9 00:55 5109 22:05	
E26					JAN 5194 IN AE 5568 CH	D MHT 5162 CVG PGV 518 19 AE 5162 CR9 AE 516 10:30 5166 11:40 12:05504	7 CHO E75 8 12:49 OKC 5504 M AE 5504 C	YR SYR 5223 C R9 AE 5349 IS	LE ILM 5345 GSO R9 AE CR9 15:35 5418 16:35	IAD IAD AE 5286 CR9	CMH M AE 5047 C	HT CR9	CVG 5281 BHM AE 5281 CR9 21:22 5211 22:30	
E24					SDF 5495 PNS AE 5255 CR4	XNA 5350 BHM AE 5178 U20	13.18 13.	PNS 5255 DTW AE 5434 UKP	HM 5178 IAD E 5502 ICR9 A	VD SRQ E 5125 CR9	CHS SRQ AE 5227 CR9		IAD 5286 SAV AE 5451 2230	
E22					MYR 5431 AE 5260	SYR MEM 5474 PWM CR9 AE 5024 CR9	MDT 4932 BMI AE 4731 E75	ORF 5081 MYR AE 5212 CR9	PIT SAV AE 5043 CR9	CMH 5087 AE 5121	GSO PULL CR9 5236	5382 TEPM	21:21 5451 22:30	
E20					GSO 5417 CAK AE 5245 CR9	CLE MDT AE 5080 CR9 4	ID:30 4751 13:30 IMH 4538 MCI DAE LE 4675 E75 AE	3 5317 IAD 5021 CR9	IS:24 16:14 IAD DAB AE 5035 CR9	XNA 5193 CVG AE 5291 CR9	18:30 52.50 CHO ₄₈₀₉ ROA 4810	I LKWI	XNA 5236 M	IYR CR9
F8					8:36 5245 9:45 LIT 5158 SDF AE 5330 CR9	AVP 5160 STL DT AE 5050 CR9 AE	2:27 46/5 13:24 13:4 W 4542 MDT E75	0 50 51 14:25	AVP 5322 XNA AE 5322 CR9	MYR 5313 BHM AE 5102 CR9	19:10 ⁻⁰¹ 9:44 PULL	5076	LIT 5088 SDF AE 5020 CR9	2:40
E6					8:45 5330 9:50 PNS 5343 FAY AE 5343 CR9	DSM 5129 ILM AE CR9 CR9 AE 5645 MKE AE CR9 CR9 AE E75	23 4510 13:10	IND 5568 AUS AE CR9	DAY 5115 MEM AE CR9	17:19 5182 18:05 IAD 5031 AE	TUL ILM IND CR9 AE 4572 E75	TERM	21:18 5334 22:20 SRQ 5161 JA AE 5161 CI	N 9
F4					8:38 5487 9:40 BNA 5325 DAB AE 5325 CR9	10:19 5270 11:16 11:40 5983 12:25 SAV 5504 DAY AE 5504 CR9 AE	4470 GSO AE	14:01 5301 14:45 BE 5191 CVG CR9	15:14 5265 16:00 SAT AE	17:465271 5587	18:30 18:50 19:45 LNK CR9		21:39 5333 22: CLE 5331 IL AE 5331 CI	5 M 9
E1				LEX	8:49 5317 9:50 5058	10:38 5115 11:35 12:12 MGM DAY 5042 XNA CR7 CR7 CR7 CR9 CR9	4537 13:05 13 E 3814 FAY E75	44503514:25 SAV 5051 RIC AF 5051 CR9	16:00 MEM 5058 TYS AF	5553 SAV 5070 GSP AF 5070 CR9	19:45 5546 EV	V 5006 MGM	21:39 5250 22: PULL	5
E2				7:30	5343 ORIG 5292	10:30 10:54 5193 11:50 12: CMH 5061 PIT AE CHO	22 3831 13:05 5152 AVL 5152 CP8	13:50 5372 14:30 AT 5046 CP0	15:35 5208 16:19 WM 5572 GRR E 5572 CR9	17:09521417:50 CVG	5398 TERM 19	50 5468 20:30	OMA 4556 IND AE 4556 E75	
Γ <u>2</u> Γ2					TYS 5344 LIT	CHS 5309 GSO ILM	5086 13:05 5107 AVP	3:48 ⁵²⁶⁵ 14:26	OMA DSM SHV	17:00 5815 SHV	5040 20	0:06	GNV 5202 CHO	
<u>гэ</u>					AE 5033 9:15 DAB 5352 SRQ	10:27 5350 11:20 12:13 RIC 5290 CLE AGS	5189 13:04 5396 FWA	14:07 ⁵⁵⁶⁵ 14:45 5092	AE 5165 CK9 AE 15:20 16:00 16:40 PNS 559	5379 17:35	AE 5585 E75 18:38 19:50 AUS ABE 5140 OMA		VPS 5065 TLH	
F4					0RIG ROA 4790 GS	AE 10:45 5436 11:35 12:16 0 TUL TUL	5135 CR/ 13:10 F	USH CMH ₅₄₁₄ TUL	AE 15:22 500 DAB	04 18 5460	LIT SDF	53	AE 21:06 5349 22:15 300 XNA	
F5					5371 AE 4903 9:1 CMH 4547 YYZ	EVV 5241 MLB	BN	14:00 ⁵⁵⁴² 14:35 A 4695 OMA	AE 15:30 CMH 4457 ILM	5053 FWA 5135 DAY	CR9 AE 19:00 19:28 JAN 5315	52 LAN	219 CR9 22:30 CMH 4554 CMH	
F6				ORIG	AE E75 8:36 4546 9:27 CAE 3826 HSV	AE CR2 10:23 5132 11:40	AE 13: AVI	42 4556 14:55	AE E75 15:21 4674 16:09 AUS	AE CR2 17:11 5156 18:00	AE 5515 18:55 5732 SGF CVG 5169	E75 20:10 DAB	AE E75 21:14 4579 22:09	
F7				5079	AE 5020 E75 8:21 3906 9:09	AE 5052 CR9 10:31 5055 11:20 MYR 5380 SAV	13:	4300 42 ⁴⁷⁴³ 14:19 RIC 4618 GSO	AE 15:30 5267 DSN	5456	CR9 18:50 19:26 5307 SAT AE 19:26 5307 SAT	CR9 20:10 T	TERM	
F8					5129	AE 5367 CR9 10:22 5051 11:10 ABE 5124 MEM	SHV and JA	AE 4010 E75 14:02 4695 14:45	PUSH 16:4	5 5421	5036 CR 20:0	9 0	YYZ 4408 MDT	
F9				ORIC	5071	AE 5154 CR9 10:39 5058 11:25	AE 5767 E 13:15 5326 13:	AE 5465 E75 55 14:30 5926 15:15 GSP YYZ	PUSH	TERM	TERM	AD	AE 4498 E75 21:22 4636 22:20	
F10				5547	AE 8:42	5390 CR7 5002 11:19		3989 AE 13:54 ³⁸³⁴ 14:30 15:0	5084 CR9 05 5100 15:50	AE 4510 E75 16:56 4662 17:59	AE 5098 C 19:21512720	CR9 0:05	AE 5050 CR7 21:06 5041 21:45	
F11				5082	AE 4669 E75 8:08 4538 9:10	AE 5586 515 10:05 5328 10:55 5502		AE 15	107 3865 16:05	AE 5078 E75 17:25 5552 18:15	AE 4675 E75 18:55 4624 19:44		TERM	
F12					ORIG 5452	10:21 ⁴⁸⁴⁴ 10:55		AE 5183 13:49 5223	E75 16:00	AE 16:56	5253 5421	CR9 20:22	AE 3959 CR7 21:37 4010 22:20	4
F13					ORIG 5573 AE 5864 9:20 5378	SBN I UL 5196 ORF E75 AE 5081 (R9) 10:05 10:20 5081 11:02	, A 1	AN CHA E 5071 CR7 3:47 14:27	AE 4867 E75 15:25 4837 16:40	CAE 3957 AGS AE E75 17:03 4001 17:55	AE E75 18:30 4685 19:20	5337 TERM	AE 5060 LE 21:40 5520 22:	7 5
F14				ORIG 5261	YYZ 4464 ^H AE 9:19 4684 9	NA OAJ 4889 EWN E75 AE CR7 559 10:46 4773 11:55		ECP 4627 MI AE 14:25 4373 15:	TYS 5305 VPS 75 AE 5305 E75 20 15:37 5065 16:45	5181 TERM	YYZ 3834 AE 19:17 3968	CAE E75 20:10	4796 TERM	
F15				ORIG 5252	AVP 5294 ILM AE 5294 CR9 8:47 5525 9:25	EYW 5579 LNK AE CR9 10:10 5331 10:55			CAE 3960 GSP AE E75 15:22 3833 16:25	GSO IND AE 4522 E75 16:59 17:50		5077 TERM		
F16				ORIG 5290	5117 PUSH	ORF AE 10:47	5252 5285	ILM CR9 14:35	BTV 4327 BMI AE 4327 E75 15:30 4378 16:30	MKE 5684 SB AE E7 17:35 5783 18-3	5814 TERM			
F17					ORIG 5136	YUL 3916 GSP AE CR7 10:06 3989 11:35			GSO 4537 YYZ AE E75 15:30 4498 16:37	MSY 4662 CMH AE E75 17-08 4506 17-50	2344 TERM			
F18					ORIG 5509	ECP 4839 ECP AE E75 10:10 4781 11:05		YYZ 4546 LGA AE 4566 E75	SGF SGF 3190	YOW 5543 YOW AE 5265 F75	5307 TERM			
F19					FWA 5406 OAJ AE 5176 CR2			14:19 4000 15:15	SBY 5851 MSN AE 5321 E75	(17.00 0200 18:10	. 1/1/1			
07			ORIG	ORIG 2257	8:49 9:26 EWR 3697 UA 3648 UA	0 IAD IAH 6165 IAH 6150 CR7 6310		IAH 6115 IAD	16:00 JJ21 16:45 ORI	0RD 4823 4843	EWR 3368 EWR UA 2265 E7W			3395 TEDM
08			ORIU	335/ G	[8:34 9:09 9:4:	2 10:22 [11:04 ⁵⁵¹⁰ 11:41] EWR ₃₃₆₇ EWR		EWR 3314 IAH UA 3315 E70	16:4	6 17:21 IAH 6245 IAH UA 6285 E7W	IAD IAD 6160			6234
09			331	ORIG		11:52,31112:27		EWR 3642	EWR E7W	EWR 23401 2343	18:55 19:30		6302	IERM
010				ORIG		BOS 5168 BOS DL 5168 CR9		14:33 3356	15:30	17:20 ³³⁴³ 17:56			4781	
0.0		1	i I I	400.5	1 1	10:30 3403 11:15	1	1	1		1	1	1 EKM	1

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Date:04/11/2019 Time:12:43

CLT 2033-Scenario 3

	00:00 01:00	02:00 03:00 04:00	0 05:00 06:00 07:00	08:00	09:00 10:00	11:00	12:00 13:00	14:00	15:00 1	16:00 17:00	18:00 19	9:00 20:00	21:00	22:00 23	3:00		
						անսիսնո									dutu		
O11					MSP N 3966 10:32 11	ISP :07											
O12					LGA ₃₃₃₇ LGA 9:57 ³³⁹ 10:30	CVG CVG 4845 11:06 11:36											
O15				BKW B 2010 8:35 ²¹²⁰	CW LWB 8010 LWF VC ER4 10:16 1180 11:01		BKW VC 12:00	2030 2140		BKW EM2 17:05							
O23										LWB 8011 LW VC 1181 EF 16:54 1181 18:	VB R4 06						
O24					YYZ 10:35 ⁷³⁴	1:10			YUL ₇₃₅₀ YUL 15:05 ⁷³⁵¹ 15:40	YYZ 17:4	7348 7348 7349 18:20						
O25																	
O26																	
HS																	
R01	CLT UA 0:00	O247 O248	DEN 319 7-50	GF A/ 8-5			*P 15	SH 568			CLT 332 19:00		CLT 319 23:55				
R02	CLT CLT AA 0:00		O233 O232	1	•				BDL 319 15:35	FCO AA 16:55	17.00	*T269 T270			CLT 789 23-55		
R03	CLT DL 0.00	O239 O240	DTW 319 5-15		BTR PSH AE 9:55 5172	CLT CR9 11:50		FRA AA 14:00	*PSH 720	CLT 789 1655	STL PS AA 10 18:17 10	SH CLT 319 002 20.32	PIT AA 21:19	T251 T252	CLT 319 23:55		
R04	CLT AA 0-00				O221 O222	11.50		14.00		10.53	18.17	RIC 319 10-45	ELP AA	T247 T248	CLT 319 23-50		
R05	CLT AA 0-00				0235 0236						MDT 319 19:04	PHL AA 10:45	A T267 CT AA T267 321 10.45 T268 225				
R06	CLT DL 0.00	O243 O244	MSP 717 7-20			JAX AA 10:59				T243 T244			1200 23 CC				
R07	CLT AA 0:00		0233 0234	I		10.07		IAH MSY 319 AA 14-10 14-31		P	PSH 971		CLT ORD T279 319 UA 22:43 22:47 T280				
R08	CLT AA 0-00		0237 0238				PBI 321 1340		FNT PSF AA 1242	H CLT 319 12 17:15	BUF AA 18:40	PSH CLT 319 170 2045	STT AA 21-09	T249 T250	CLT 321 23-50		
R09	CLT AA			15.10 12.1	17.13	PBI 321	TPA AA 10.47	T257 T258	1200	23.39 CLT 321							
R10	CLT AA		O229 O230*		0220		CUN 321	TPA AA			T245 T246	19.47					
R11	CLT AA				O223 O224		12.40	14.08			MSP 738	PHX AA	рнх Т265 лл Т265 19:54 Т266				
R12	CLT AA 0-00			O227 O228						RDU FAY 738 AE 17:25 17:40	PSH 5172	CLT PVD CR2 AA	T26	3 4	CLT 321 23-50		
R13	CLT DL	O245 O246	ATL 738 7.20	0220	AEX PSH AE 5502	CLT CR9				GRR PSH AE 5236	CLT CR9	19.30 20.10 LAX		T259 T260	23.39 CLT 321		
R14	ATL DL		7.50				T271 T272		1 1	10.25	16.55	20.40			23.35 CLT 739		
R15	CLT DL	O241 O242	ATL CHO 73H AE	PS 51	CLT E75 17				NA A	MLI PSH AE 5514	CLT ORD CR9 AA		T255 T256		23.39 CLT 738		
R16	CLT WN 0-00	O249 HOU O250 73H			10.55					LIT AE 16-55	PSH CLT 5147 19:22		ATL DL 21:48	T277 T278	CLT 73H 23-50		
R17	MDW WN 1-20					1	T281 T282		1 1	10.55	19.22		21.40		CLT 73W 23-50		
R18	CLT AE 0:00		O253 O254						HSV CR2			MGM AE 20:15	PSH CLT 5304 22:05	JFK T2 DL T2	275 CLT 276 CS1 276 23-50		
R19	CLT AE 0-00			O25: O25	5				13.23	TRI CR7 17-40	EWN T285 C						
R20	CLT AE 0-00			025 025	7					TYS CR7 1740	BTV AE	2	T291 T292		CLT CR9 23-50		
R21	CLT AE 0-00		O259 O260		YUL E75 10.01				HSV AE	17,995	19.12	T287 T288			CLT CR7 23:55		
R22	CLT UA 0-00	O251 O252	EWR E7W 6-50		10.01				10.55	OKC AE		T293 T294			CLT CR9 23-50		
R23										CHS AE	7	T299 T300)		CLT CR9 23-50		
R24										10.99		MHT AE 19-53	T295 T296		CLT CR9 23-50		
R25												GRB AE 20:27	1 1 1	297 298	CLT CR9		
R26								SDF AE	1 1	PSI 550	H D3	20.27	CLT CR9	2,0	T283 T284		
R27								14.10				ICT AE	21:40	T289 T290	CLT CR9		
R28							JFK AA				T261 T262	20:43	,		23:59 CLT 738		
R29							13:10				1202		LGA DL	T273 T274	23:59 CLT CS1		
R30													µ1:51	12/7	23:59		
				1		1					I I						

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DORA (Direction, Oversight, Review & Agree) Coordination

Meeting #1 Materials Meeting #2 Materials Meeting #3 Materials Meeting #4 Materials



CLT DORA (Direction, Oversight, Review & Agree) Meeting #1 March 25, 2020



Agenda

- Introductions
- Meeting Objectives
- DORA Process
- EA Process Overview
- Review of Calibration
- 2019 Baseline & Future No Action Airfield Modeling Assumptions
- Next Steps



Meeting Objectives



Meeting Objectives

- To present an overview of the DORA process
- To present an overview of the Environmental Assessment (EA) process
- To present the 2019 Baseline and Future No Action modeling assumptions
- To present the next steps in the overall project

A) process assumptions

DORA Process



Charlotte Douglas International Airport EA DORA Process Overview

Prepared for: CLT EA DORA Meeting #1

By: Kent Duffy

Date: March 2020



Federal Aviation Administration

What is DORA?

• DORA =

Direction, Oversight, Review and Agree

- Obtaining and understanding controller input on operational issues and viability of proposed alternatives is a key to airport capacity development
- DORA has been applied successfully to other large-scale airport and airspace modernization efforts (e.g., O'Hare Modernization Program)



al issues and y development airport and h Program)

Federal Aviation Administration

Objectives: Why are we here?

- Ensure collaboration w/ATO on simulation activities as needed to complete EA
 - Obtain input development of the simulation model ____
 - Revise and refine simulation model, rather than develop new alternatives

Build from successful process used during planning phase \bullet

- Update with recent changes: forecast trends, CRO, metroplex, heading usage, Atlantic coast routes, etc.
- Validate operating assumptions used in the simulation model
 - Airspace flows and procedures, Runway usage and balancing, Aircraft separation and buffers, Taxiflows and ground movement, etc.
- Review and validate airspace's ability to accommodate new runway throughput
- Collaboration ensures the simulation results can be used in the EA analyses with confidence ٠



Planning Phase DORA Letter



The additional analysis identified above is part of the normal maturation process as the potential airfield alternatives are further refined and assessed. The FAA considers the results of the first phase of the ACEP to be reasonable given the information that is currently available.

2/2/2016

FAA, Division Manager Airports Southern Region

Prostell Thomas, CLT Air Traffic Manager

2/1/2016 Date

Documentation of DORA Process, Charlotte-Douglas International Airport Airfield Capacity Enhancement Plan

This letter summarizes the process used by the Federal Aviation Administration (FAA) Office of Airports (ARP) and Air Traffic Organization (ATO) to obtain necessary input on operational feasibility of potential design alternatives considered as part of the Charlotte-Douglas International Airport (CLT) Airfield Capacity Enhancement Plan (ACEP). The ACEP is the first step of a long-term modernization effort to add significant capacity to CLT. The Direction, Oversight, Review, and Agree (DORA)



Federal Aviation Administration

Desired Result: 2nd DORA Letter



- FAA Letter signed by ATO and ARP
- **Explains process and summarizes meetings**
- Identifies further analyses required in subsequent phases (e.g., design/ implementation), as needed
- Desired findings:
 - Modeling approach is reasonable
 - Modeling assumptions accurately reflects operational perspectives
 - Subsequent capacity, throughput and delay <u>results are reasonable</u> representations of the proposed airfield and airspace designs

Active ATC participation



Federal Aviation Administratio

DORA Process Relationship to Modeling



~ July 11, 2017 (EIS)

~Today

~TBD

~*TBD*



Federal Aviation Administration

EA Process Overview



EA Process Overview - Background

- The CLT Environmental Impact Statement (EIS) that the Federal Aviation Administration (FAA) began was cancelled on February 27, 2019.
- The FAA cancelled the EIS because a runway length analysis determined only a 10,000 foot runway is required to meet the purpose and need.
- The FAA determined that this was a sufficient change to warrant cancellation of the EIS and conversion to an Environmental Assessment (EA).
- The City of Charlotte (Airport Sponsor) is responsible for preparing the EA.
- FAA is still the lead agency.
- Similar to the EIS, the EA will evaluate the potential direct, indirect, and cumulative environmental impacts that may result from the Proposed Action.

EA Process Overview – Proposed Action

- -4th Parallel Runway (10,000 feet long)
 - North and South End Around Taxiways
- Extensions of Concourse B and C
 - Decommissioning Runway 5/23
 - Crossfield Corridor
 - Dual Taxilanes Around Ramp
 - Requires the removal of gates off the end of Concourse D and E



EA Process Overview





EA Process Overview - Simulations

- Simulations will:
 - Be used in developing the Purpose and Need, noise modeling, and air quality modeling.
 - conducted for the following scenarios:
 - 2016 Calibration
 - 2019 Baseline
 - 2028 Future No Action
 - 2033 Future No Action
 - 2028 Alternative(s)
 - 2033 Alternative(s)
 - use forecast of operations approved by the FAA.
 - include 3 independent projects as part of the Future No Action.
 - Deice Pad and crossfield taxiway
 - North End Around Taxiway around Runway 18C/36C and hold pads
 - Concourse A Phase II


Review of Calibration



Review of Calibration Findings

- As part of the EIS, the SIMMOD simulation model was calibrated for the 2016 existing conditions
- The calibrated model was approved by the FAA and shared in the EIS DORA meetings
- For purposes of the EA, the simulation model has been changed to the AirTOp simulation model and the previously approved 2016 calibration has been validated with AirTOp
- The AirTOp models produces results which are consistent with the previous calibration assessment
- The following slides summarize the results of the AirTOp calibration

Rolling Hour Operation Throughput

- Throughput rates are calibrated to 2016-2017 FAA ASPM or Aerobahn data and compared to the previous EIS calibration effort
- While the maximum throughput is achievable under certain circumstances, it is not a good indication of capacity. Therefore, the 90th percentile hourly rates is used as a measure of capacity per previous DORA stakeholder group recommendations

Total Operations Throughput

 Simulated hourly throughput are within 10 percent of ASPM and EIS simulation effort

Airport Throughput						
ASPM – 90 th * EIS – 90 th * AirTOp – 90 th						
North VMC	121	118	117			
North IMC	114	116	114			
South VMC	121	121	117			
South IMC	112	116	115			

* Source: Capacity/Delay Analysis and Airfield Modeling Technical Memorandum, CLT EIS ASPM data, 2016-2017

Arrival and Departure Throughput

- Simulated hourly arrival and departure throughput match closely with ASPM and results of EIS simulation effort
- The FAA's Capacity Airport Arrival Rates or called arrival rates in VMC are much higher than actual hourly counts

Arrival and Departure Throughput							
	Operation	ASPM - Called Rate*	ASPM - Max*	ASPM - 90th	EIS - Max*	AirTOp - Max	AirTOp - 90th
North VMC	Arr	92	79	63	73	76	67
	Dep	69	82	67	78	82	63
North IMC	Arr	75	76	64	73	72	64
	Dep	65	79	62	68	78	59
South VMC	Arr	92	78	63	77	77	68
	Dep	82	81	66	78	83	64
South IMC	Arr	75	77	64	74	77	66
	Dep	65	74	58	68	79	61

* Source: Capacity/Delay Analysis and Airfield Modeling Technical Memorandum, CLT EIS ASPM data, 2016-2017

A variety of called rates were found in ASPM for a particular runway configuration, the most frequent called rate for each configuration is included in the table 90th percentile data was not provided in the EIS calibration report

South VMC Heat Map



North VMC Heat Map



South IMC Heat Map



North IMC Heat Map



Aircraft Taxi Time Analysis

- A key metric in the calibration analysis are aircraft ground taxi times
- The FAA ASPM database was queried for data from 2016 regarding total taxi in (arrivals) and taxi out (departures) times
- AirTOp ground speeds are adjusted to ensure that the model produces taxi times which are within an acceptable range of actual data

2016 Average Total Taxi Times from FAA ASPM Database (min					
	Arrival Taxi In Time	Departure Taxi Ou			
North Flow ASPM	11.0	20.3			
North VMC Simulation	11.9	20.2			
South Flow ASPM	12.4	19.5			
South VMC Simulation	11.6	17.6			



Calibration Simulation Modeling Results

- Taxi time and delay metrics are presented for each runway configuration
- Annualization is calculated by averaging the metrics using the runway configuration use percentage

ualization
11.9
19.4
5.8
10.9
7.3
9.2
10.1

* Based on ASPM configurations and called rates

onfiguration e runway

Runway Configuration Changes

 Significant increase in percent of north flow operations and decrease in south flow operations over the past few years



Based on ASPM configurations and called rates

2019 Baseline and Future No Action Airfield Modeling Assumptions



2019 Baseline and Future No Action Modeling Scenarios

- The use of Runway 5/23 has changed since the 2016 calibration
- In this section of the presentation, we review the assumptions of how the airfield is operating today
- These assumptions will be applied to the following simulation scenarios:
 - 2019 Baseline
 - 2028 Future No Action
 - 2033 Future No Action

2019 Baseline and Future No Action Summary of Experiments

– Baseline Modeling Experiments

- 2019 South VMC
- 2019 South IMC

– Future No Action Modeling Experiments

- 2028 South VMC
- 2028 South IMC
- 2028 North VMC
- 2028 North IMC
- 2033 South VMC
- 2033 South IMC
- 2033 North VMC
- 2033 North IMC



Airfield Layouts for Simulation

2019 Baseline Airfield Layout

2028/2033 Future No Action Airfield Layout



Notes: The 2019 baseline airfield layout will include the new aircraft holdpad/deicing pad located north of the new Concourse A Phase 1 expansion

Simulation Flight Schedules

- Total Daily Operations
 - 2016: 1,563
 - 2019: 1,626*
 - 2028: 1,860
 - 2033: 1,978

*2019 schedule currently in development





Rolling Hour Arrival and Departure Demand

Review of 2019 Baseline and Future No Action Modeling Assumptions

– Airfield Operating Assumptions

- Terminal/Concourse Layouts
- Airfield Deicing/Hold Pad Usage
- Runway Operating Configurations
- Aircraft Taxi Flows
- Aircraft Ground Speeds
- Airspace Operating Assumptions
 - Airspace Route Structure
 - Intrail Separations (Wake RECAT)
 - Airspace Route Structure



Terminal/Concourse Layout Assumptions

- Aircraft gate layouts will be input into AirTOp and will include airline assignment and aircraft size restrictions to simulate actual gate usage
- General Aviation and Cargo (FDX/UPS) operations were simulated and parked at their primary facility located on the existing airfield
- Aircraft holdpad and towing areas simulated
- Modeling of future gate capacity

Airline Gating Assignment Assumptions (2019 Baseline)				
Concourse A	AA, DL			
Concourse A (Phase 1 Expansion)	OALs			
Concourse B & C	AA Mainline			
Concourse D	AA Mainline, LH			
Concourse E	AA Regional			

Airline Gating Assignment Assumptions (2028/2033 Future No Action)				
Concourse A AA				
Concourse A (Phase 1 Expansion)	OALs			
Concourse A (Phase 2 Expansion)	OALs			
Concourse B & C	AA Mainline			
Concourse D	AA Mainline, LH			
Concourse E	AA Regional			



Airfield Deicing/Hold Pad Usage

 Airfield deicing/hold pads will be simulated to accommodate arrivals waiting for gates, RON operations and aircraft towing operations





South VMC/IMC Runway Configuration

- 2019 Baseline and Future No Action runway use will be identical
- Primary Arrival Runways:
 - VMC: 18L & 18R
 - IMC: 18L & 18R
 - 18C (Trips)/Offload
- Primary Departure Runways:
 - 18C North & West
 - 18C International Heavy Eastbound
 - 18L East & South
- Runway 05/23 is used as a taxiway



North VMC/IMC Runway Configuration

- 2019 Baseline and Future No Action runway use will be identical
- Primary Arrival Runways:
 - 36L & 36R
 - 36C (Trips)/Offload
- Primary Departure Runways:
 - 36C North & West
 - 36C International Heavy Eastbound
 - 36R East & South
 - Single jet departure heading, no fanning
 - Prop aircraft make turn immediately after becoming airborne
- Runway 05/23 is used as a taxiway



South Flow Aircraft Taxi Flows







2028/2033 Future No Action Airfield Layout

North Flow Aircraft Taxi Flows

2019 Baseline Airfield Layout





2028/2033 Future No Action Airfield Layout

Airfield Ground Speed Assumptions – Baseline



High Speed Exits **Outer Perimeter Taxiways** Runway Crossings Taxiways Ramp Area Taxilanes Ramp Area Taxilanes





- 32 knots
- 20 knots
- 18 knots
- 15 knots
- 12 knots
- 10 knots

Airfield Ground Speed Assumptions – Future No Action



High Speed Exits **Outer Perimeter Taxiways*** Runway Crossings Taxiways Ramp Area Taxilanes Ramp Area Taxilanes





*North EAT and south cross field taxiway are also assumed to have 20 knot speed limits

Airspace Operating Assumptions



Airspace Operating Assumptions/Overview

- The simulated airspace encompasses the CLT Metroplex terminal airspace which is an approximate 40nm radius around the Airport
- Currently published RNAV arrival and departure procedures were analyzed and used as the basis for constructing the simulation airspace
- Existing radar data was analyzed and used to determine origin/destination city pair airspace fix assignments for input into the simulation flight schedule
- -6 nm intrail separations were applied at arrival corner post fixes for transition from the center airspace to the terminal environment
- When operating a mixed used runway operation, arrivals block departures 2.3 nm from the runway threshold
- During mixed arrival/departure operation, minimum of 4.5 nm arrival intrail separation is kept to ensure one departure between every arrival



Intrail Separation Minimums – Wake RECAT

- Simulation of FAA Wake RECAT separation criteria will be applied to the Baseline and Future No Action scenarios
- Previous simulation modeling and intrail separation analyses indicate minimum arrival separations on final approach range between 3.3nm (VMC) and 3.8nm (IMC)

					•	•				
		Follower								
		А	В	С	D	E	F	G	Н	I
	Α		4.5 NM	6 NM	6 NM	7 NM	7 NM	7 NM	7 NM	8 NM
	В		3 NM	4 NM	4 NM	5 NM	5 NM	5 NM	5 NM	5 NM
	С					3.5 NM	3.5 NM	3.5 NM	5 NM	5 NM
<u> </u>	D		3 NM	4 NM	4 NM	5 NM	5 NM	5 NM	5 NM	5 NM
ade	E									4 NM
Le	F									
	G									
	Н									
	I									

TBL 5-5-2 Wake Turbulence Separation for On Approach



Source: JO 7110.126A - Consolidated Wake Turbulence (CWT) Separation Standards Effective Date: September 28, 2019

TBL 5-5-1 Wake Turbulence Separation for Directly Behind

Follower				
E	F	G	Н	I
7 NM	7 NM	7 NM	7 NM	8 NM
5 NM	5 NM	5 NM	5 NM	6 NM
3.5 NM	3.5 NM	3.5 NM	5 NM	6 NM
5 NM	5 NM	5 NM	6 NM	6 NM
				4 NM
				4 NM

South Flow Arrival Airspace





Note: Arrivals can be offloaded to other runways during busy periods

North Flow Arrival Airspace





Note: Arrivals can be offloaded to other runways during busy periods

Sample Origins by Arrival Routing

Arrival Route	Origin Examples*				
	<u>North</u>				
PARQR TAFTT	MDW, CLE, MSP, ORD, SEA				
	<u>East</u>				
CHSLY LYH	BOS, EWR, FRA, JFK, LHR				
<u>South</u>					
BANKR	JAX, MIA				
West					
JONZE BESTT	ATL, IAH, MEX				
FLIPZ COMDY	DEN, DFW, LAX, PDX, SFO				

*Note that these lists are not all-inclusive. They merely contain examples of some of the major airports that use each route.



South Flow Departure Airspace







Note: KRITR departures can be offloaded to 18L during busy periods

North Flow Departure Airspace







Note: BEAVY, ICONS, and KWEEN departures can be offloaded to 36C during busy periods

Sample Destinations by Departure Routing

Departure Route	Destination Examples*			
<u>North</u>				
JOJJO DODGE	MDW, ORD, PDX, SEA			
KRITR FILDS	BUF, PIT, YYZ			
	<u>East</u>			
KILNS	BWI, IAD, EWR, PHL			
BARMY RDU	BOS, FRA, LGA			
<u>South</u>				
ICONS	JAX, MIA			
West				
ESTRR	AUS, DAL, IAH, MEX			
BOBZY BNA	DEN, DFW, LAX, PHX, SFO			

*Note that these lists are not all-inclusive. They merely contain examples of some of the major airports that use each route.



Next Steps

- Provide comments to EA Team by March 31, 2020
 - Send comments to spotter@landrum-brown.com
- Incorporate comments from DORA Team
- Conduct 2019 Baseline & 2028 & 2033 Future No Action simulations
- Conduct alternatives evaluation
- DORA Meeting #2 present results of the 2019 Baseline & Future No Action simulations
 - Tentative 3rd week of April (week of the 20th)
- Continue preparation of the Draft EA




CLT DORA (Direction, Oversight, Review & Agree) Meeting #2 June 11, 2020





Agenda

- Introductions
- Meeting Objectives
- DORA Process
- EA Process Overview
- No Action Modeling Simulation Overview
 - Airfield Operating Assumptions
 - Airspace Operating Assumptions
- Proposed Action Modeling Assumptions
 - Airfield Operating Assumptions
 - Airspace Operating Assumptions
- -Next Steps



Meeting Objectives



Meeting Objectives

- To present and review Future No Action modeling assumptions and simulation modeling results
- To present the Proposed Action airfield modeling assumptions
- To present the next steps in the overall project

DORA Process



Charlotte Douglas International Airport EA DORA Process Overview

Prepared for: CLT EA DORA Meeting #2

By: Kent Duffy

Date: June 2020



Federal Aviation Administration

What is DORA?

• DORA =

Direction, Oversight, Review and Agree

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Federal Aviation Administration



Objectives: Why are we here?

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Build from successful process used during planning phase •

- Update with recent changes: forecast trends, CRO, metroplex, heading usage, Atlantic coast routes, etc.
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Planning Phase DORA Letter



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FAA, Division Manager Airports Southern Region

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Federal Aviation Administration

Desired Result: 2nd DORA Letter



- FAA Letter signed by ATO and ARP
- Explains process and summarizes meetings
- Identifies further analyses required in subsequent phases (e.g., design/ implementation), as needed
- Desired findings:
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 - Modeling assumptions accurately reflects operational perspectives
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Active ATC participation



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DORA Process Relationship to Modeling





~ July 11, 2017 (EIS)



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EA Process Overview - Background

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- -4th Parallel Runway (10,000 feet long)
 - North and South End Around Taxiways
- Extensions of Concourse B and C
 - Decommissioning Runway 5/23
 - Crossfield Corridor
 - Dual Taxilanes Around Ramp
 - Requires the removal of gates off the end of Concourse D and E



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EA Process Overview





EA Process Overview - Simulations

- Simulations will:
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 - Conducted for the following scenarios:
 - 2016 Calibration
 - 2019 Baseline
 - 2028 Future No Action
 - 2033 Future No Action
 - 2028 Alternative(s)
 - 2033 Alternative(s)
 - Use forecast of operations approved by the FAA.
 - Include 3 independent projects as part of the Future No Action.
 - Deice Pad and crossfield taxiway
 - North End Around Taxiway around Runway 18C/36C, hold pads and threshold displacement (1,235 feet)
 - Concourse A Phase II



No Action Modeling Simulation Overview



Follow Up Comments Addressed From DORA #1

- The following items were identified for further discussion by Scott O'Halloran with FAA Local Air Traffic and have been addressed:
 - The use of the new west hold pads may be limited as most aircraft without a gate would have taxied past those positions by the time they are notified they need to hold.
 - The use of Taxiway B and west on Runway 05/23 was identified as a route that doesn't happen or is not common within the existing airfield.
 - Safety issues regarding the Future No Action taxi flows in South Flow (i.e. the use of Taxiway B and Runway 05/23, the amount of flow on the ramp, and one-way flow on Taxiway E).



No Action Airfield Layout for Simulation

South Flow Experiments

- 2028 South VMC
- 2028 South IMC
- 2033 South VMC
- 2033 South IMC

- North Flow Experiments

- 2028 North VMC
- 2028 North IMC
- 2033 North VMC
- 2033 North IMC



Simulation Flight Schedules



Rolling Hour Arrival and Departure Demand



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Terminal/Concourse Layout Assumptions

- Aircraft gate layouts will be input into AirTOp and will include airline assignment and aircraft size restrictions to simulate actual gate usage
- General Aviation and Cargo (FDX/UPS) operations were simulated and parked at their primary facility located on the existing airfield
- Aircraft holdpad and towing areas simulated
- Modeling of future gate capacity





Airline Gating Assignment Assumptions (2028/2033 Future No Action)

lui	iture no Action		
	AA		
	OALs		
	OALs		
	AA Mainline		
	AA Mainline, LH		
	AA Regional		

North VMC/IMC Runway Configuration

- Primary Arrival Runways:
 - Runways 36L & 36R
 - Runway 36C (Trips)/Offload
- Primary Departure Runways:
 - Runway 36C North & West
 - Runway 36C International Heavy Eastbound
 - Runway 36R East & South
 - Single jet departure heading, no fanning
 - Prop aircraft make turn immediately after becoming airborne
- Runway 05/23 is used as a taxiway

Configuration	36L, 36C, 36R	36C, 36R
	AAR	ADR
VMC	87	69
IMC	80	69



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South VMC/IMC Runway Configuration

– Primary Arrival Runways:

- Runways 18L & 18R
- Runway 18C (Trips)/Offload

– Primary Departure Runways:

- Runway 18C North & West
- Runway 18C International Heavy Eastbound
- Runway 18L East & South

– Runway 05/23 is used as a taxiway

Configuration	18L, 18C, 18R	18C, 18L
	AAR	ADR
VMC	87	69
IMC	80	69



North Flow Aircraft Taxi Flow Animation



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South Flow Aircraft Taxi Flow Animation



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Airfield Ground Speed Assumptions – Future No Action



High Speed Exits **Outer Perimeter Taxiways*** Runway Crossings Taxiways Ramp Area Taxilanes Ramp Area Taxilanes





*North EAT and south cross field taxiway are also assumed to have 20 knot speed limits

No Action Airspace Operating Assumptions



Airspace Operating Assumptions/Overview

- Simulated airspace is the CLT Metroplex airspace that was modeled in the simulation calibration modeling analysis
- Existing radar data was analyzed and used to determine origin/destination city pair airspace fix assignments for input into the simulation flight schedule
- -6 nm intrail separations were applied at arrival corner post fixes for transition from the center airspace to the terminal environment
- When operating a mixed used runway operation, arrivals block departures 2.3 nm from the runway threshold
- During mixed arrival/departure operation, minimum of 4.5 nm arrival intrail separation is kept to ensure one departure between every arrival



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- Simulation of FAA Wake RECAT separation criteria will be applied to the Baseline and Future No Action scenarios
- Previous simulation modeling and intrail separation analyses indicate minimum arrival separations on final approach range between 3.3nm (VMC) and 3.8nm (IMC)



TBL 5-5-2 Wake Turbulence Separation for On Approach



Source: JO 7110.126A - Consolidated Wake Turbulence (CWT) Separation Standards Effective Date: September 28, 2019

TBL 5-5-1 Wake Turbulence Separation for Directly Behind

Follower				
E	F	G	Н	I
7 NM	7 NM	7 NM	7 NM	8 NM
5 NM	5 NM	5 NM	5 NM	5 NM
3.5 NM	3.5 NM	3.5 NM	5 NM	5 NM
5 NM	5 NM	5 NM	5 NM	5 NM
				4 NM

Follower				
E	F	G	Н	I
7 NM	7 NM	7 NM	7 NM	8 NM
5 NM	5 NM	5 NM	5 NM	6 NM
3.5 NM	3.5 NM	3.5 NM	5 NM	6 NM
5 NM	5 NM	5 NM	6 NM	6 NM
				4 NM
				4 NM

Sample Airport Route/City Pairs

Arrival Route	Origin Examples*	Departure Route
	<u>North</u>	
PARQR TAFTT	MDW, CLE, MSP, ORD, SEA	JOJJO DODGE
	<u>East</u>	KRITR FILDS
CHSLY LYH	BOS, EWR, FRA, JFK, LHR	
	<u>South</u>	KILNS
BANKR	JAX, MIA	BARMY RDU
	<u>West</u>	
JONZE BESTT	ATL, IAH, MEX	ICONS
FLIPZ COMDY	DEN, DFW, LAX, PDX, SFO	

BOBZY BNA

*Note that these lists are not all-inclusive. They merely contain examples of some of the major airports that use each route.

Destination Examples* North MDW, ORD, PDX, SEA BUF, PIT, YYZ East BWI, IAD, EWR, PHL BOS, FRA, LGA South JAX, MIA <u>West</u> AUS, DAL, IAH, MEX DEN, DFW, LAX, PHX, SFO

North Flow Arrival Airspace





Note: Arrivals can be offloaded to other runways during busy periods

North Flow Departure Airspace







Note: BEAVY and ICONS departures can be offloaded to 36C during busy periods

South Flow Arrival Airspace





Note: Arrivals can be offloaded to other runways during busy periods

South Flow Departure Airspace







Note: BEAVY and ICONS departures can be offloaded to 18C during busy periods

No Action Simulation Modeling Results



No Action Simulated Airport Throughput

- A key metric in the simulation analysis is an assessment of the peak hour and total airport throughput achieved in each scenario simulated
- While the maximum throughput is achievable under certain circumstances, it is not a good indication of capacity. Therefore, the 90th percentile hourly rates is used as a measure of capacity per previous DORA stakeholder group recommendations

90th Percentile Simulated Throughput			
2016 2 (1,563 ops.) (1,86		2028 (1,860 ops.)	2033 (1,978 ops.)
Peak Hour (Arr. & Deps.)	117	130	133
Peak Hour Arrival	67	71	73
Peak Hour Departure	63	69	70

Maximum Simulated Throughput				
2016 2028 2033				
Peak Hour (Arr. & Deps.)	127	140	140	
Peak Hour Arrival	76	78	79	
Peak Hour Departure	82	85	86	

Ar

* Annualized based on the most frequent called rate for each ASPM configurations and configuration use percentage for 2019

nnualized Call Rates*			
AAR	86		
ADR	69		
No Action Weighted Aircraft Throughput



No Action Simulation Modeling Results

- Aircraft delay and taxi time metrics are presented for each simulated demand level and runway configuration
- Annualization is calculated by averaging the metrics using the runway configuration use percentage for 2019
 - North VMC: 51.8%
 - North IMC: 11.7%
 - South VMC: 27.5%
 - South IMC: 9.0%

* Based on ASPM configurations and called rates

	2028 Demand Level (1,860 Daily Ops.)				
	North	North	South	South	
Metrics	VMC	IMC	VMC	IMC	Annualization
Avg. arrival taxi time (total)	13.7	14.6	15.0	15.8	14.4
Avg. arrival taxi time (unimpeded)	8.7	8.6	10.4	10.4	9.3
Avg. arrival taxi delay	5.1	6.0	4.6	5.4	5.1
Avg. departure taxi time (total)	21.5	25.6	18.3	21.8	21.1
Avg. departure taxi time (unimpeded)	13.5	13.6	11.5	11.6	12.8
Avg. departure taxi delay	8.0	12.0	6.8	10.1	8.3
Avg. taxi time	17.6	20.1	16.6	18.8	17.7
Avg. arrival air delay	8.4	10.7	10.1	10.6	9.3
Avg. arrival delay	13.5	16.8	14.6	16.0	14.4
Avg. departure ground delay	9.8	14.3	9.3	12.8	10.5
Avg. aircraft delay	11.6	15.5	12.0	14.4	12.4
	20	033 Dema	nd Level (1,978 Dail	ly Ops.)
	North	North	South	South	
Metrics	VMC	IMC	VMC	IMC	Annualization
Avg. arrival taxi time (total)	15.4	15.8	17.6	17.9	16.3
Avg. arrival taxi time (unimpeded)	8.9	8.8	10.7	10.7	9.5
Avg. arrival taxi delay	6.6	7.0	6.9	7.3	6.8
Avg. departure taxi time (total)	23.6	28.7	19.8	25.0	23.3
Avg. departure taxi time (unimpeded)	13.5	13.7	11.6	11.8	12.9
Avg. departure taxi delay	10.1	14.9	8.1	13.2	10.4
Avg. taxi time	19.5	22.2	18.7	21.5	19.8
Avg. arrival air delay	9.8	15.1	12.7	14.5	11.7
Avg. arrival delay	16.4	22.1	19.7	21.7	18.4
Avg. departure ground delay	12.5	17.9	11.4	17.1	13.2
	14 5	20.0	15.5	19.4	15.8

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No Action Average Arrival Delay



No Action Average Aircraft Delay



No Action Average Departure Delay



No Action Average Aircraft Delay



No Action Average Aircraft Taxi Times



Proposed Action Modeling Assumptions



Proposed Action Airfield Layout

- Proposed Action Airfield includes all facilities in the No Action airfield as well as new facilities including:
 - Proposed Runway 01/19
 - Full End-Around Taxiway (EAT)
 - Removal of existing Runway 05/23
 - Additional aircraft gates
 - Additional taxilanes/taxiways
- EAT usage assumes that arrivals overthe-top of departures is not permitted
- The 2028 and 2033 demand levels will be simulated for the four airport operating configurations



North VMC/IMC Runway Configuration

- Primary Arrival Runways:
 - Runways 36L, 36C & 36R
- Primary Departure Runways:
 - Runway 01 North & West
 - Runway 01 International Heavy Eastbound
 - Runway 36R East & South
- Maintain current departure headings





South VMC/IMC Runway Configuration

- Primary Arrival Runways:
 - Runways 18L, 18C & 18R
- Primary Departure Runways:
 - Runway 19 North & West
 - Runway 19 International Heavy Eastbound
 - Runway 18L East & South
- Maintain current departure headings





Aircraft Taxi Flows – Proposed Action



Arrivals

Departures

Mixed-Use

18C ····· VMC Only Runway 19 departures held short of arrivals approaching Runway 18C 18L

Proposed Action Airspace Modeling Assumptions





Intrail Separation Minimums – Wake RECAT

- Simulation of FAA Wake RECAT separation criteria will be applied to the Baseline and Future No Action scenarios
- Previous simulation modeling and intrail separation analyses indicate minimum arrival separations on final approach range between 3.3nm (VMC) and 3.8nm (IMC)



TBL 5-5-2 Wake Turbulence Separation for On Approach



Source: JO 7110.126A - Consolidated Wake Turbulence (CWT) Separation Standards Effective Date: September 28, 2019

TBL 5-5-1 Wake Turbulence Separation for Directly Behind

Follower				
E	F	G	Н	I
7 NM	7 NM	7 NM	7 NM	8 NM
5 NM	5 NM	5 NM	5 NM	5 NM
3.5 NM	3.5 NM	3.5 NM	5 NM	5 NM
5 NM	5 NM	5 NM	5 NM	5 NM
				4 NM

Follower				
E	F	G	Н	I
7 NM	7 NM	7 NM	7 NM	8 NM
5 NM	5 NM	5 NM	5 NM	6 NM
3.5 NM	3.5 NM	3.5 NM	5 NM	6 NM
5 NM	5 NM	5 NM	6 NM	6 NM
				4 NM
				4 NM

Sample Airport Route/City Pairs

Arrival Route	Origin Examples*	Departure Route
	<u>North</u>	
PARQR TAFTT	MDW, CLE, MSP, ORD, SEA	JOJJO DODGE
	<u>East</u>	KRITR FILDS
CHSLY LYH	BOS, EWR, FRA, JFK, LHR	
	<u>South</u>	KILNS
BANKR	JAX, MIA	BARMY RDU
	<u>West</u>	
JONZE BESTT	ATL, IAH, MEX	ICONS
FLIPZ COMDY	DEN, DFW, LAX, PDX, SFO	

BOBZY BNA

*Note that these lists are not all-inclusive. They merely contain examples of some of the major airports that use each route.

Destination Examples* North MDW, ORD, PDX, SEA BUF, PIT, YYZ East BWI, IAD, EWR, PHL BOS, FRA, LGA South JAX, MIA <u>West</u> AUS, DAL, IAH, MEX DEN, DFW, LAX, PHX, SFO

South Flow Departure Airspace – Proposed Action





Note: Departures to north and south fixes can be swapped between runways to balance the airfield

North Flow Departure Airspace – Proposed Action







Note: Departures to north and south fixes can be swapped between runways to balance the airfield



offloaded to other runways

North Flow Arrival Airspace – Proposed Action





Note: Arrivals can be offloaded to other runways during busy periods

Next Steps

- Provide comments to EA Team by June 18th, 2020
 - Send comments to spotter@landrum-brown.com
- Incorporate comments from DORA Team
- Conduct the Proposed Action modeling analysis
- Conduct alternatives evaluation
- DORA Meeting #3 present results of the Proposed Action and Alternatives modeling analysis (tentative mid-July 2020)
- Continue preparation of the Draft EA





CLT DORA (Direction, Oversight, Review & Agree) Meeting #3 November 6, 2020



1

Agenda

- -Role Call
- Meeting Objectives
- DORA Process
- EA Process Overview
- Proposed Action Modeling Results
- Alternatives Modeling Assumptions
 - Alternatives Development and Screening
 - Alternatives Airspace Assumptions
 - Alternatives Taxi Flow Assumptions
- -Next Steps

Meeting Objectives

Meeting Objectives

- To present the Proposed Action simulation modeling results
- To present the alternatives modeling assumptions
- To present the next steps in the overall project

DORA Process

Charlotte Douglas International Airport EA DORA Process Overview

Prepared for: CLT EA DORA Meeting #3

- By: Kent Duffy
- Date: November 6, 2020



What is DORA?

• DORA =

Direction, Oversight, Review and Agree

- Obtaining and understanding controller input on operational issues and viability of proposed alternatives is a key to airport capacity development
- DORA has been applied successfully to other large-scale airport and airspace modernization efforts (e.g., O'Hare Modernization Program)



Objectives: Why are we here?

Ensure collaboration w/ATO on simulation activities as needed to complete EA

- Obtain input development of the simulation model
- Revise and refine simulation model, rather than develop new alternatives

Build from successful process used during planning phase

- Update with recent changes: forecast trends, CRO, metroplex, heading usage, Atlantic coast routes, etc.
- Validate operating assumptions used in the simulation model
 - Airspace flows and procedures, Runway usage and balancing, Aircraft separation and buffers, Taxiflows and ground movement, etc.
- Review and validate airspace's ability to accommodate new runway throughput
- Collaboration ensures the simulation results can be used in the EA analyses with confidence



Planning Phase DORA Letter



This letter summarizes the process used by the Federal Aviation Administration (FAA) Office of Airports (ARP) and Air Traffic Organization (ATO) to obtain necessary input on operational feasibility of potential design alternatives considered as part of the Charlotte-Douglas International Airport (CLT) Airfield Capacity Enhancement Plan (ACEP). The ACEP is the first step of a long-term modernization effort to add significant capacity to CLT. The Direction, Oversight, Review, and Agree (DORA)



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The additional analysis identified above is part of the normal maturation process as the potential airfield alternatives are further refined and assessed. The FAA considers the results of the first phase of the ACEP to be reasonable given the information that is

12/2016

FAA, Division Manager Airports Southern Region

11/2016

Desired Result: 2nd DORA Letter



- FAA Letter signed by ATO and ARP
- Explains process and summarizes meetings
- Identifies further analyses required in subsequent phases (e.g., design/ implementation), as needed
- Desired findings:
 - Modeling approach is <u>reasonable</u>
 - Modeling assumptions accurately reflects operational perspectives
 - Subsequent capacity, throughput and delay <u>results are reasonable</u> representations of the proposed airfield and airspace designs



Federal Aviation Administration

DORA Process Relationship to Modeling





Federal Aviation Administration

EA Process Overview

EA Process Overview - Background

- The CLT Environmental Impact Statement (EIS) that the Federal Aviation Administration (FAA) began was cancelled on February 27, 2019.
- The FAA cancelled the EIS because a runway length analysis determined only a 10,000 foot runway is required to meet the purpose and need.
- The FAA determined that this was a sufficient change to warrant cancellation of the EIS and conversion to an Environmental Assessment (EA).
- The City of Charlotte (Airport Sponsor) is responsible for preparing the EA.
- FAA is still the lead agency.
- Similar to the EIS, the EA will evaluate the potential direct, indirect, and cumulative environmental impacts that may result from the Proposed Action.

EA Process Overview – Proposed Action

- -4th Parallel Runway (10,000 feet long)
 - North and South End Around Taxiways
- Extensions of Concourse B and C
 - Decommissioning Runway 5/23
- Dual Taxilanes Around Ramp
 - Requires the removal of gates off the end of Concourse D and E
- Crossfield Corridors



EA Process Overview - Simulations

- Simulations will:
 - Be used in developing the Purpose and Need, noise modeling, and air quality modeling.
 - Conducted for the following scenarios:
 - 2016 Calibration Complete
 - 2019 Baseline Complete
 - 2028 Future No Action Complete
 - 2033 Future No Action Complete
 - 2028 Alternative(s) Underway
 - 2033 Alternative(s) Underway
 - Use forecast of operations approved by the FAA.
 - Include 3 independent projects as part of the Future No Action.
 - Deice Pad and crossfield taxiway
 - North End Around Taxiway around Runway 18C/36C, hold pads and threshold displacement (1,235 feet)
 - Concourse A Phase II



Proposed Action Simulation Modeling Results
Proposed Action EAT Usage Assumption

- Aircraft taxiing on the North and South EATs require large arrival gaps on Runway 18C/36C approach
 - 8nm gap for NEAT
 - 9nm gap for SEAT
- -Arrival gap requirement may hinder efficient operations
 - Reduced arrival capacity on Runway 18C/36C
 - Increased ground holding times for aircraft holding short of the EAT as arrivals over-thetop of taxiing aircraft is not currently permitted
- Therefore, two EAT scenarios were evaluated
 - Scenario 1: All operations use EATs (no runway crossings)
 - Scenario 2: Departures use Taxiway V and arrivals use EATs

Proposed Action Scenario	Advantages	Disadvantages
Scenario 1	Avoid runway crossings	 Long departure taxi distance Departures on EAT hold short of approach Gap needed in arrival stream
Scenario 2	Short departure taxi distance	 Runway crossings Queue for crossing extends into apron area during peak in south flow

Proposed Action – North Flow, Scenario 1





Proposed Action – South Flow, Scenario 1





Proposed Action – North Flow, Scenario 2





Proposed Action – South Flow, Scenario 2





Proposed Action Weighted Aircraft Throughput



Prop. Act. Scenario 1: All operations use EATs (no runway crossings)

Prop. Act. Scenario 2: Departures use Taxiway V and arrivals use EATs

Proposed Action Total Time Including Delay



Prop. Act. Scenario 1: All operations use EATs (no runway crossings)

Prop. Act. Scenario 2: Departures use Taxiway V and arrivals use EATs

Proposed Action Average Aircraft Delay



Prop. Act. Scenario 1: All operations use EATs (no runway crossings)

Prop. Act. Scenario 2: Departures use Taxiway V and arrivals use EATs

Proposed Action Average Aircraft Delay



Prop. Act. Scenario 1: All operations use EATs (no runway crossings)

Prop. Act. Scenario 2: Departures use Taxiway V and arrivals use EATs

Alternatives Development and Screening

Proposed Action

- Proposed action alternative developed based on existing FAA Order 7110.65 criteria for parallel runways:
 - 3,900' of separation required for simultaneous triple approaches
 - 700'-1,200' of separation required for simultaneous VFR operations by ADG V aircraft
- -4,300' of separation exists between 18L/36R and 18C/36C
 - Insufficient to allow triple approaches to new runway
 - New runway sited to provide 1,200' of separation to Runway 18C/36C
- New runway would therefore be used for departures and arrivals would occur on Runway 18C/36C
 - Results in arrivals on runway to "inboard" runway and departures to "outboard" – not a typical operation



New FAA Rules for Parallel Runways

- New FAA operating rules for lateral separation between parallel runways expected in spring 2021 revision for FAA Order 7110.65
 - Allow 3,200 feet for simultaneous dual approaches (vs current 3,600 feet)
 - Allow 3,400 feet for simultaneous triple approaches (vs current 3,900 feet)
- Allows for different runway separations to be considered between CLT's new runway and Runway 18R/36L
 - Affects intended runway use (primary departure or arrival)
 - Which in turn affects runway length requirements

3,200' Between Runways 18R/36L and 01/19

- Same runway use as the Proposed Action
- Potential for simultaneous triples in future (would require rule change)



Notes:

Diagram is not to scale.

Runway length may vary depending on the use of the runway.

3,400' Between Runways 18R/36L and 01/19

- Allows simultaneous triple approaches to new runway



Notes:

Diagram is not to scale.

Runway length may vary depending on the use of the runway.

Runway Length Requirements

- -Runway length will vary depending on how the runway is being used
- Conducted a runway length requirements analysis based on
 - CLT future fleet
 - FAA guidelines
 - Airline input
- -Length requirements:
 - Departures: 10,000 feet
 - Arrivals: 7,300 feet
- Lengths can be longer if required for other operational reasons

Alternatives with Alternative Runway Separations



Runway Alternatives Screening Process

	Alternative	Meet Purpose and Need (< 7 Minutes Average Runway Delay)?	Reasonable and Feasible Alternative Based on Timeframe and Cost?	Carried Forward for Further Analysis?
1		Yes	Yes	Yes
2		Yes	Yes	Yes
3		Yes	Yes	Yes
4		Yes	No	No

Alternatives Airspace Assumptions

Alternatives Airspace Assumptions

– Alternatives will use same assumptions as Proposed Action:

- Apply FAA Wake RECAT separation criteria
- Minimum arrival separations on final approach 2.5 nautical miles (VMC) and 3.8 nautical miles (IMC)
- Allocation of city pairs to airport routes
- Allocation of fixes to runways
- Straight out departure headings

Alternative 1 (Proposed Action) – North Flow 10,000' Runway / 3,100' Separation to 18R/36L



- Proposed Action
- 3,100 feet of separation between new midfield runway and Runway 18R/36L
- -Arrivals:
 - Runways: 36L, 36C, 36R
 - Simultaneous triple independent approaches permissible in all weather conditions
- Departures:
 - Runways 01 and 36R
 - 10,000-foot long Runway 01/19
- Runway capacity:
 - Simultaneous triple approaches

Alternative 1 (Proposed Action) – South Flow 10,000' Runway / 3,100' Separation to 18R/36L



- Proposed Action
- 3,100 feet of separation between new midfield runway and Runway 18R/36L
- -Arrivals:
 - Runways: 18R, 18C, 18L
 - Simultaneous triple independent approaches permissible to RVR 4500
- Departures:
 - Runways 19 and 18L
 - 10,000-foot long Runway 19
- Runway capacity:
 - Simultaneous triple approaches

Alternative 2 – North Flow 10,000' Runway / 3,200' Separation to 18R/36L



- Opportunity for "future proofing" for possible additional reductions in triple runway spacing requirements
- 3,200 feet of separation between new midfield runway and Runway 18R/36L
- -Arrivals (same as Alt. 1):
 - Runways: 36L, 36C, 36R
 - Simultaneous triple independent approaches permissible in all weather conditions
- Departures (same as Alt. 1):
 - Runways 01 and 36R
 - 10,000-foot long Runway 01/19
- Runway capacity:
 - Simultaneous triple approaches

Alternative 2 – South Flow 10,000' Runway / 3,200' Separation to 18R/36L



- Opportunity for "future proofing" for possible additional reductions in triple runway spacing requirements
- 3,200 feet of separation between new midfield runway and Runway 18R/36L
- -Arrivals (same as Alt. 1):
 - Runways: 18R, 18C, 18L
 - Simultaneous triple independent approaches permissible to RVR 4500
- Departures (same as Alt. 1):
 - Runways 19 and 18L
 - 10,000-foot long Runway 01/19
- Runway capacity:
 - Simultaneous triple approaches

Alternative 3 – North Flow 8,900' Runway / 3,400' Separation to 18R/36L



- Opportunity to change runway use through the use of proposed runway spacing criteria
- <u>3,400</u> feet of separation between new midfield runway and Runway 18R/36L
- -Arrivals:
 - Runways 36L, <u>01</u>, and 36R
 - <u>8,900</u>-foot long Runway 01/19
 - Simultaneous triple independent approaches permissible in all weather conditions (assumes CAT II/III on Rwy 01)
- Departures:
 - Runways <u>36C</u> and 36R
- Runway capacity:
 - Simultaneous triple approaches
- Does not allow for a full taxiway between Runway 01/19 and 18C/36C

Alternative 3 – South Flow 8,900' Runway / 3,400' Separation to 18R/36L



- Opportunity to change runway use through the use of proposed runway spacing criteria
- <u>3,400</u> feet of separation between new midfield runway and Runway 18R/36L
- -Arrivals:
 - Runways 18R, 19, and 18L
 - <u>8,900</u>-foot long Runway 01/19.
 - Simultaneous triple independent approaches permissible (assumes CAT II/III on Rwy 19) to RVR 4500
- Departures:
 - Runways <u>18C</u> and 18L
- Runway capacity:
 - Simultaneous triple approaches
- Does not allow for a full taxiway between Runway 01/19 and 18C/36C

Alternatives Taxi Flow Assumptions

Aircraft Taxi Flows – Alternatives 1 and 2

- Taxi flows for the Proposed Action (Alternative 1) were presented earlier
- Taxi flows for Alternative 2 will be identical to the Proposed Action with one exception
 - Taxiway V cannot be used by ADG V aircraft when visibility is less than a half mile due to the 1,100-foot separation between Runways 01/19 and 18C/36C

Arrivals Aircraft Taxi Flows – Alternative 3 Departures Mixed-Use ····· VMC Only 19 18C 18L 18R 36L 36C 36R 01 Taxiway limited to Taxiway limited to ADG IV or smaller ADG IV or smaller / when visibility when visibility <1/2 mile <1/2 mile **South Flow North Flow** 44

Next Steps

Next Steps

- Provide comments to EA Team by November 20, 2020
 - Send comments to spotter@landrum-brown.com
- Incorporate comments from DORA Team
- Conduct alternatives modeling analysis
- DORA Meeting #4
- Continue preparation of the Draft EA



CLT DORA (Direction, Oversight, Review & Agree) Meeting #4 January 27, 2021



Agenda

- -Role Call
- Meeting Objectives
- DORA Process
- EA Process Overview
- Present Alternatives Modeling Results
- -Next Steps

DORA Process

Charlotte Douglas International Airport EA DORA Process Overview

Prepared for:	CLT EA DORA Meeting #4

- By: Kent Duffy
- Date: January 27, 2021



What is DORA?

• DORA =

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- Obtaining and understanding controller input on operational issues and viability of proposed alternatives is a key to airport capacity development
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- Revise and refine simulation model, rather than develop new alternatives

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Planning Phase DORA Letter



This letter summarizes the process used by the Federal Aviation Administration (FAA) Office of Airports (ARP) and Air Traffic Organization (ATO) to obtain necessary input on operational feasibility of potential design alternatives considered as part of the Charlotte-Douglas International Airport (CLT) Airfield Capacity Enhancement Plan (ACEP). The ACEP is the first step of a long-term modernization effort to add significant capacity to CLT. The Direction, Oversight, Review, and Agree (DORA)

7

12/2016

FAA, Division Manager Airports Southern Region

11/2016

Desired Result: 2nd DORA Letter



- FAA Letter signed by ATO and ARP
- Explains process and summarizes meetings
- Identifies further analyses required in subsequent phases (e.g., design/ implementation), as needed
- Desired findings:
 - Modeling approach is <u>reasonable</u>
 - Modeling assumptions accurately reflects operational perspectives
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Federal Aviation Administration

DORA Process Relationship to Modeling



Administration

EA Process Overview

EA Process Overview - Background

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- Crossfield Corridors



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 - 2033 Alternative(s) Complete
 - Use forecast of operations approved by the FAA.
 - Include 3 independent projects as part of the Future No Action.
 - Deice Pad and crossfield taxiway
 - North End Around Taxiway around Runway 18C/36C, hold pads and threshold displacement (1,235 feet)
 - Concourse A Phase II



Alternatives Simulation Modeling Results

Alternatives Overview



Comparison of Alternatives



Alternative 1 (Proposed Action) Refinement

- Added runway crossing points to let two departing aircraft cross Runway 18C/36C simultaneously
 - Reduces Runway 01/19 departure delay
 - Allow more arrivals on Runway 18C/36C
- Rebalanced runway usage to optimize delay and throughput
 - Offload arrivals from Runway 18L/36R to Runway 18C/36C
 - Balance departures between Runway 01/19 and Runway 18L/36R



Alternative 1 (Proposed Action)/Alternative 2

– Alternatives 1 and 2

- Same runway use and procedures
- Same performance with the exception of slight differences in taxi times
- Closely spaced parallel runways:
 - Runways are dependent in IMC
 - Arrivals block departures 2 miles out



Note: Diagram is not to scale.

Alternative 1 (Proposed Action) – North Flow





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Alternative 1 (Proposed Action) – South Flow





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Alternative 3

- Assumes that new FAA rules for parallel runways allow simultaneous triple approaches to new runway
- Alternative 3 will use same the airspace assumptions and procedures as Alternative 1 (Proposed Action)



Note: Diagram is not to scale.

Alternative 3 – North Flow





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Alternative 3 – South Flow





23

Alternatives Weighted Aircraft Throughput



Alternatives Taxi Time (Including Delay)



Alternatives Average Aircraft Delay



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Alternatives Total Time Including Delay



Alternatives Average Aircraft Delay



Next Steps

Next Steps

- Send questions to sarah.potter@landrumbrown.com
- Complete DORA compliance letter
- Continue preparation of the Draft EA

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Proposed Capacity Enhancements at Charlotte Douglas International Airport

National Environmental Policy Act Environmental Assessment

AirTOp Simulation Report

April 2021

PREPARED FOR Charlotte Douglas International Airport

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1 Introduction

Charlotte Douglas International Airport (CLT or Airport) is the sixth busiest airport in the US in terms of aircraft operations and the tenth busiest in terms of passenger enplanements,¹ making it an integral part of the National Airspace System (NAS). CLT is the second busiest hub operation for American Airlines. In 2016, the airline connected approximately 58,000 passengers per day through CLT on a normal day; 67,000 passengers on a typical busy day, and even more during peak travel days.² Given this level of connecting passengers, American Airlines (AA) personnel have indicated that schedule reliability is critical to maintaining minimum connection times for passengers that range from 25 to 35 minutes.

The City of Charlotte (Sponsor) completed an Airport Capacity Enhancement Program (ACEP) and Master Plan Update in February 2016. The ACEP utilized a comprehensive approach to understand the demand for and capacity of runways, taxiways, aircraft gates, ramp, and passenger processing facilities. The ACEP identified a number of deficiencies that exist at CLT. These included insufficient runway capacity, gate capacity, and ramp space to accommodate the existing and future demand. The Sponsor is now undertaking an Environmental Assessment (EA) that analyzes proposed solutions for those deficiencies.

As part of the EA, a simulation modeling analysis has been conducted to simulate the existing and future airfield and airspace improvements at the Airport. The simulation was conducted using the Air Traffic Optimization (AirTOp) model, a rule-based, fast-time simulation tool. AirTOp computes aircraft travel times and delay statistics which are used as evaluation metrics to determine differences between various simulated alternatives.

The simulation modeling began with an analysis of CLT for the base year of 2016. The EA has a base year of 2016 because this was the latest calendar year with a full year of available data when the National Environmental Policy Act (NEPA) process began.

The simulation analysis involved the following steps and is described in the sections that follow:

- Develop design day flight schedules
- Define 2016 existing conditions and modeling assumptions
- Calibrate model to actual 2016 results
- Model 2019 Baseline experiments
- Model No Action experiments
- Model Airfield Alternatives experiments

1.1 Direction, Oversight, Review, and Agreement (DORA) Process

The EA utilized the DORA process to obtain the necessary operational input from stakeholders and the Federal Aviation Administration (FAA). The DORA Work Group was comprised of representatives from the FAA, CLT Airport, airlines, and consultants. The meetings provided FAA controller input on air traffic control operations and the viability of proposed alternatives, which were crucial components of analyzing and screening the airfield alternatives. The airlines, as users of the airport's infrastructure, were active in providing their operational perspectives, including linkages to network hub operations

¹ 2017 Airports Council International-North America Traffic Report

² Purpose and Need Working Paper, Charlotte Douglas International Airport, Environmental Impact Statement, prepared by VHB Engineering NC, P.C. in association with Parish and Partners, Inc. and TransSolutions, July 31, 2018.

and ramp control. FAA provided their perspective and expectations regarding data and simulation analysis, as well as unique knowledge about the efficacy of ways to enhance operational efficiency. Four meetings during the EA were conducted with the stakeholder group, which builds on prior DORA coordination conducted during the Environmental Impact Statement (EIS) and ACEP.

This process has ensured that the appropriate operational expertise and experience has informed the design, analysis and decision-making for the CLT EA effort.

2 Design Day Flight Schedules

The first step in building the simulation models was to select the design day flight schedule. The schedule for the calibration year of 2016 and future years of 2028 and 2033 were developed by VHB and InterVISTAS as part of the CLT EIS.³ Subsequent to the creation of those schedules, Runway 23 ceased being a primary arrival runway during South Flow operations. To ensure that the models accurately reflect airport operations without the use of Runway 23, a 2019 Baseline demand level was added to the simulation study.

The schedule for the Baseline year of 2019 was developed by Landrum & Brown using the Average Busy Weekday, Peak Month methodology. This methodology was used in the previous ACEP study. Weekends were excluded from the selection process due to the low number of operations compared to weekdays. The selected design day would also have to meet the following criteria:

- South flow runway configuration (all day)
- Visual Meteorological Conditions weather conditions (all day)
- No runway closures or other anomalies in the normal daily operation

Based on the FAA Aviation System Performance Metrics (ASPM) database, October was the peak month of operations for 2019. However, no suitable day in October met all of the selection criteria. May was the second busiest month for 2019. Applying the criteria above, May 30, 2019, with 1,628 daily operations was the nearest demand level to the average busy weekday for May (1,638 daily ops) so May 30, 2019 was chosen as the 2019 design day.

The operation levels of the four demand schedules are compared in Table 2-1.

Table 2-1, Total Daily Operations

YEAR	DAILY OPERATIONS
2016	1,563
2019	1,628
2028	1,860
2033	1,978

Source: Landrum & Brown analysis, 2021

The rolling hour arrival and departure demand for each schedule is shown on **Exhibit 2-1**. CLT has a typical hub airline schedule, with distinct arrival and departure banks throughout the day. The 2016 schedule exceeds 80 arrivals in five hours of the day and is at or above 80 departures in six hours of the day. The peak arrival period at the Airport occurs in the 10:00 a.m. hour. From 2016 to 2033, peak hour arrival demand increases from 88 to 104 operations. The peak departure period at the Airport occurs in the 09:00 a.m. hour. From 2016 to 2033, demand increases from 93 to 110 operations in the peak departure period.

³ *Forecast Technical Memorandum*, Charlotte Douglas International Airport Environmental Impact Statement, VHB in association with InterVISTAS, November 10, 2017



Exhibit 2-1, Rolling Hour Arrival and Departure Profiles



Table 2-2 and **Table 2-3** provides a summary of the aircraft fleet mix by flight type and FAA Airplane Design Group (ADG). The tables summarize the number of aircraft by group and as a percentage of total operations.

Flight Type	2016		2019		2028		2033	
	Number of Ops	% of Total Ops	Number of Ops	% of Total Ops	Number of Ops	% of Total Ops	Number of Ops	% of Total Ops
Passenger	1470	94%	1506	93%	1760	95%	1874	95%
General Aviation	81	5%	108	7%	84	5%	86	4%
Cargo	10	1%	14	1%	14	1%	16	1%
Military	2	0%	0	0%	2	0%	2	0%
Total	1563	100%	1628	100%	1860	100%	1978	100%

Table 2-2, Fleet Mix by Flight Type

Source: Landrum & Brown analysis, 2020

Table 2-3, Fleet Mix by Design Group

	2016		2019		2028		2033	
FAA ADG	Number	% of	Number	% of	Number	% of	Number	% of Total
	of Ops	Total Ops	of Ops	Total Ops	of Ops	Total Ops	of Ops	Ops
I	19	1%	16	1%	20	1%	21	1%
II	372	24%	474	29%	494	27%	495	25%
III	1139	73%	1102	68%	1309	70%	1421	72%
IV	14	1%	16	1%	16	1%	18	1%
V	19	1%	20	1%	21	1%	23	1%
Total	1563	100%	1628	100%	1860	100%	1978	100%

Source: Landrum & Brown analysis, 2020

2.1 Flight Dependability

A probability distribution is applied to flight times in the simulation models to mimic variation in flight arrival/departure times. Flights that arrive or depart early are indicated by negative values, while flights that arrive or depart late are indicated by positive values.

The distributions, shown in **Exhibit 2-2**, are based on data analyzed from Aerobahn.⁴ Arrivals tend to have more variability than departures and are more likely to be early.





Source: Aerobahn May 2016- Apr 2017, Landrum & Brown analysis, 2020

3 2016 Airport Operating Assumptions

The first objective of this simulation analysis was to develop an AirTOp simulation model that is an appropriate representation of the actual operations at CLT. Once it has been confirmed that the simulation model reflects existing operating conditions, the model can be adjusted using various control parameters and demand levels to evaluate changes in the operation. This chapter describes the assumptions that were used to develop and calibrate the AirTOp models.

3.1 Airfield and Aircraft Apron Layouts

CLT has three parallel runways oriented in the 18/36 direction and one crosswind runway oriented in the 5/23 direction. **Exhibit 3-1** depicts the airfield as it existed in 2016. The 2016 apron areas for the passenger airlines, cargo carriers (FedEx and UPS), general aviation, and military aircraft are shown on **Exhibit 3-2**. The passenger airlines park at Concourses A through E, which are located on the north side of the Airport between Runway 18C/36C and Runway 18L/36R. The passenger airline gating assignments are shown in **Table 3-1**. The table also summarizes the number of gates in each concourse. The count is based on the number of regional and narrowbody gates. For Multiple Apron Ramp System (MARS) gates, which accommodate one widebody or two narrowbody aircraft, only the narrowbody gates are counted to avoid double counting. The cargo facilities are located to the south of the passenger terminal and Runway 5/23. The general aviation and Air National Guard aprons are located to the east of Runway 18L/36R.

⁴ Aerobahn® tracks and reports aircraft ground movements to provide a comprehensive view of airport surface operations.

Exhibit 3-1, 2016 CLT Airfield



Source: ESRI ArcMap aerial imagery

Table 3-1, 2016 Airline Gating Assignment Assumptions

Concourse	Airline	Number of Gates
Α	American, Air Canada, JetBlue, Delta, Frontier, United, Southwest	13
В	American Mainline	16
С	American Mainline	18
D	American Mainline, Lufthansa	13
E	American Regional	44

Source: CLT airport and Landrum & Brown analysis, 2020
Exhibit 3-2, 2016 CLT Aircraft Parking Aprons



Source: ESRI ArcMap aerial imagery

3.2 Airfield Hold Pad Usage

CLT has one hold pad that is used to accommodate arrivals waiting for an available gate, remain overnight (RON) operations, towed aircraft, and departures waiting for a spot in the queue. This hold pad is located south of Concourse A and west of Concourse B as shown on **Exhibit 3-3**.

Exhibit 3-3, 2016 Airfield Hold Pad



Source: ESRI ArcMap aerial imagery

3.3 Runway Operating Configurations

Runway use at an airport is typically dictated by the origin/destination city, wind direction, and weather conditions. Runway use changes as demand for flights arriving from specific standard terminal arrival routes (STAR) or departing to standard instrument departure (SID) routes changes. The four primary (most often used) runway operating configurations at CLT were modeled for the EA:

- North Flow Visual Meteorological Conditions (VMC)
- North Flow Instrument Meteorological Conditions (IMC)
- South Flow VMC
- South Flow IMC

3.3.1 North Flow VMC and IMC Operating Configurations

The basic runway usage in a North Flow configuration (VMC and IMC) consists of arrivals on Runways 36L and 36R. Runway 36C is used in conjunction with Runways 36L and 36R to provide triple parallel approach capability during periods of high arrival demand. The primary departure runways are Runways 36C and 36R in both VMC and IMC. The allocation of departing aircraft to these runways is based on the destination of the flight. Runway 36C is used by aircraft departing to northbound and westbound destinations. Runway 36C is also used by international heavy aircraft heading east. Runway 36R is used by southbound and eastbound departures. Exhibit 3-4 depicts the North Flow runway usage. There is a single jet departure heading in North Flow (no fanning permitted). However, prop aircraft can turn immediately after becoming airborne.



Source: ESRI ArcMap aerial imagery; Landrum & Brown, 2020

3.3.2 South Flow VMC and IMC Operating Configurations

The basic runway usage in a South Flow VMC configuration consists of arrivals on Runways 23 and 18R, with Runway 18L used in lieu of Runway 23 during peak departure times⁵. In IMC, Runways 18L and 18R are used for arrivals; Runway 23 is used as a taxiway, not a runway in South Flow IMC. Runway 18C is used in conjunction with Runways 18L and 18R to provide triple parallel approach capability during periods of high arrival demand. The primary departure runways are Runways 18C and 18L in both VMC and IMC. The allocation of departing aircraft to these runways is based on the destination of the flight. Runway 18C is used by aircraft departing to northbound and westbound destinations. Runway 18C is also used by international heavy aircraft heading east. Runway 18L is used by southbound and eastbound departures. **Exhibit 3-5** depicts the South Flow runway usage.

Exhibit 3-5, 2016 South Flow VMC/IMC Runway Configuration



Source: ESRI ArcMap aerial imagery; Landrum & Brown, 2020

⁵ This was the standard arrival configuration in 2016. Since that time, Runway 23 is no longer a primary arrival runway.

3.4 Airfield Ground Speeds

For accurate simulation, the aircraft taxi speeds within the AirTOp model should replicate the actual taxi speeds at the Airport. **Exhibit 3-6** shows the average taxi speeds used in the model.

Exhibit 3-6, 2016 Airfield Ground Speed Assumptions



3.5 Airfield Taxi Flows

For accurate simulation, the aircraft movements within the AirTOp model should replicate the actual taxi flows at the Airport. The standard taxi routes are shown on **Exhibit 3-7.**

Exhibit 3-7, 2016 Taxi Routes



Source: Tower observations and ATCT feedback

3.6 Aircraft Separations

It is important to reflect the actual aircraft-to-aircraft separations in the AirTOp model because these separations have a large effect on the operating capacity of the Airport. The aircraft separation data, which is measured as the space between consecutive aircraft operations, is presented in terms of distance (nautical miles) for arrivals and in terms of time (seconds) for departures. **Table 3-2** presents the simulated minimum VMC and IMC in-trail separation distances for arrivals based on actual radar data. **Table 3-3** presents the simulated minimum VMC and IMC in-trail separation times for departures based on actual radar data from January 2013 to December 2013.

Aircraft	In-trail Separations (in nautical miles)						
Category	Upper Heavy	Lower Heavy	Upper Medium	Lower Medium	Small		
	(A332, B777)	(B763)	(A320, E190)	(AT72, CRJ9)	(GA Prop)		
Upper Heavy	3.3/3.8 ¹	4.3	5.3	5.3	7.3		
Lower Heavy	3.3/3.8 ¹	3.3/3.8 ¹	3.8	3.8	6.3		
Upper Medium	3.3/3.8 ¹	3.3/3.8 ¹	3.3/3.8 ¹	3.3/3.8 ¹	4.3		
Lower Medium	3.3/3.8 ¹	3.3/3.8 ¹	3.3/3.8 ¹	3.3/3.8 ¹	3.3/3.8 ¹		
Small	3.3/3.8 ¹	3.3/3.8 ¹	3.3/3.8 ¹	3.3/3.8 ¹	3.3/3.8 ¹		

Table 3-2, Simulated Arrival In-trail Separations

¹ VMC/IMC in-trail separations

Notes: 1. Arrival separations include a 0.3 nautical mile buffer. 2. Lead-to-trail arrival separation compression on final approach allows for minimum separation below 3.3/3.8 nautical miles.

Source: ACEP; Landrum & Brown analysis, 2020

Table 3-3,	, Simulated	Departure	In-trail Se	parations
------------	-------------	-----------	-------------	-----------

Aircraft	In-trail Separations (in seconds)					
Category	Upper Heavy	Lower Heavy	Upper Medium	Lower Medium	Small	
	(A332, B777)	(B763)	(A320, E190)	(AT72, CRJ9)	(GA Prop)	
Upper Heavy	90	120	120	120	120	
Lower Heavy	90	90	90	120	120	
Upper Medium	60/72 ¹	60/72 ¹	60/72 ¹	60/72 ¹	60/72 ¹	
Lower Medium	60/72 ¹	60/72 ¹	60/72 ¹	60/72 ¹	60/72 ¹	
Small	60/72 ¹	60/72 ¹	60/72 ¹	60/72 ¹	60/72 ¹	

¹ VMC/IMC in-trail separations

Source: ACEP; Landrum & Brown analysis, 2020

In addition to the above separations, the following in-trail separations were applied for CLT:

- Six nautical mile in-trail separations were applied at the arrival corner post fixes for transition from the center airspace to the terminal environment.
- During mixed arrival/departure operations:
 - Arrivals block departures 2.3 nautical miles from the runway threshold.
 - On the east runway, a minimum of 4.5 nautical miles arrival in-trail separation is maintained to ensure one departure between every arrival.
 - On the center runway, a minimum of 8.0 nautical miles arrival in-trail separation is maintained to allow for one departure and runway crossings between every arrival.

Vertical separation between aircraft on approaches to parallel runways is also important until the aircraft are established on the approach. Parallel approaches were assumed to be vertically separated by 1,000 feet when turning onto final approach.

3.7 Airspace Structure

The airspace route structure is a key part of the simulation model development. The CLT Metroplex terminal airspace was simulated in the AirTOp model, which represents an approximate 40-mile radius around the Airport. To create the simulation model's airspace structure, January 2015 to April 2017 Aerobahn data was analyzed and used to determine origin and destination city pair airspace fix assignments for input into the simulation flight schedule. May 2019 area navigation (RNAV) arrival and departure procedures were analyzed and used as the basis for constructing the simulation airspace.

3.7.1 Arrival Airspace

Table 3-4 provides a summary of the arrival routes and sample origin airports they serve.

Table 3-4, Sample Origins by Arrival Routing

Arrival Ro	ute Origin Direction	Origin Examples
PARQR	North	Midway and O'Hare (Chicago), Cleveland, Minneapolis, Seattle
CHSLY	East	Boston, Newark, New York City, Frankfurt, London Heathrow
MLLET	East	Coastal Carolina Regional, Ellis (Jacksonville NC), Florence SC
STOCR	South	Palm Beach, Southwest Florida, Fort Lauderdale
BANKR	South	Jacksonville, Miami
JONZE	West	Atlanta, Houston, Mexico City
FLIPZ	West	Denver, Dallas, Los Angeles, Phoenix, San Francisco
Note: C	Drigin examples listing is no	at all-inclusive.

Source: EIS and Landrum & Brown analysis, 2020

Exhibit 3-8 and **Exhibit 3-9** depict the arrival route structure for both North and South Flows. The exhibit shows the primary allocation of the arrival routes to an arrival runway. The routes that primarily feed Runway 18R/36L are shown in orange, Runway 18L/36R and Runway 23 routes are shown in blue, and the Runway 18C/36C routes are shown in green. While the primary route-runway allocations are depicted on the exhibit, arrivals were offloaded to a different runway than is shown as needed based on demand. For example, triple simultaneous approaches were simulated during various peak arrival pushes throughout the day. During these times, Runway 18C/36C served as the mixed-use offload runway.





Note: Arrivals can be offloaded to runways other than those shown on exhibit during busy periods. Source: FAA terminal procedures



Exhibit 3-9, 2016 South Flow Simulation Arrival Route Structure

Note: Arrivals can be offloaded to runways other than those shown on exhibit during busy periods. Source: FAA terminal procedures

3.7.2 Departure Airspace

Table 3-5 provides a summary of the departure routes and sample destination airports they serve.

Departure Route	Destination Direction	Destination Examples
JOJJO	North	Midway and O'Hare (Chicago), Portland, Seattle
WEAZL	North	Minneapolis, Cleveland, Detroit
KRITR	North	Buffalo, Pittsburgh, Toronto
KILNS	East	Baltimore, Dulles (Washington DC), Newark, Philadelphia
BARMY	East	Boston, Frankfurt, LaGuardia (New York City)
LILLS	East	Raleigh–Durham, Ellis (Jacksonville NC)
KWEEN	South	Myrtle Beach, Charleston
ICONS	South	Jacksonville, Miami
BEAVY	South	Cancun, Tallahassee
ESTRR	West	Austin, Dallas, Houston, Mexico City
BOBYZ	West	Denver, Dallas, Los Angeles, Phoenix, San Francisco

Table 3-5, Sample Destinations by Departure Routing

Note: Destination examples listing is not all-inclusive.

Source: EIS and Landrum & Brown analysis, 2020

Exhibit 3-10 and **Exhibit 3-11** depict the departure route structure for both North and South Flows. The exhibit shows the primary allocation of the departure routes to a departure runway. The routes that primarily use Runway 18L/36R are shown in blue, whereas the routes that primarily use Runway 18C/36C are shown in green. In addition to the routings shown, BEAVY, ICONS, and KWEEN departures were allowed to offload to Runway 36C in North Flow. In South Flow, KRITR departures were offloaded to Runway 18L during busy periods.



Exhibit 3-10, 2016 North Flow Simulation Departure Route Structure

Note: BEAVY, ICONS, and KWEEN departures can be offloaded to Runway 36C during busy periods. Source: FAA terminal procedures

Exhibit 3-11, 2016 South Flow Simulation Departure Route Structure



Note:KRITR departures can be offloaded to Runway 18L during busy periods.Source:FAA terminal procedures

3.7.3 Converging Runway Operation (CRO) with Arrival Departure Window (ADW)

Runway 5/23 intersects Runway 18L/36R and its flight paths intersect with Runway 18C/36C and Runway 18R/36L. As a result, operations on these runways must be coordinated when Runway 23 is being used for arrivals, as shown on **Exhibit 3-12**. This coordination involves:

- Arrivals on Runway 23 block departures on Runway 18C/36C and Runway 18L/36R when the arrival is 2.3 nautical miles or less from the Runway 23 threshold.
- Runway 18L departure cannot take off until Runway 23 arrival crosses the Runway 18L/36R intersection.
- Runway 18C cannot take off until Runway 23 arrival crosses Taxiway D.

Exhibit 3-12, Converging Runway Operation with ADW



Source: Landrum & Brown, 2020

4 Simulation Model Calibration

Calibration of a simulation model is an important step in any airside simulation analysis. The calibration process ensures that the model accurately reflects airport operations under different conditions. The ability of the model to simulate actual conditions is significant because the resulting statistics are used to assess operational performance and to determine the need for airside improvements and additional facilities. The AirTOp calibration is an update of the CLT EIS calibration, which analyzed the 2016 conditions using the SIMMOD simulation model.

Each simulation was run a minimum of ten iterations. Each of the iterations is intended to produce differing results. Probability distributions were input into the simulation model to produce random variations within the simulation so that no iteration is identical. The results of the calibration analysis presented in this chapter are based on the average of ten simulation iterations.

The following metrics were calibrated for CLT:

- Throughput rates
- Average total taxi times

4.1 Throughput Rates

A key metric in the calibration analysis is throughput rates. Throughput rates were calibrated to 2016-2017 FAA Aviation System Performance Metrics (ASPM) data or CLT's Aerobahn system data. The throughput rates were also compared to the EIS calibration effort to ensure consistency in the results.

The 90th percentile throughput was used as a measure of sustained, repeatable capacity in the calibration analysis. The maximum throughput was not used because it is not considered a reliable measure of sustained, repeatable capacity, based on FAA input and the DORA stakeholder group recommendations from the ACEP study and the first EA DORA meeting.

The simulated total operations throughput for the four calibration cases (North Flow VMC, North Flow IMC, South Flow VMC, and South Flow IMC) is compared to ASPM data and the EIS results in **Table 4-1**.

Casa	90 th Percentile Airport Throughput					
Case	ASPM	EIS	AirTOp			
North VMC	121	118	117			
North IMC	114	116	114			
South VMC	121	121	117			
South IMC	112	116	115			

Table 4-1, Calibration Total Operations Throughput Comparison

Sources: Capacity/Delay Analysis and Airfield Modeling Technical Memorandum, CLT EIS; ASPM data, 2016-2017; Landrum & Brown analysis, 2020

The simulated 90th percentile throughputs are within 10 percent of the ASPM rates and the EIS simulation results. The simulation schedule has less variation than actual operations over the 2016-2017 period. Lower variation leads to fewer instances of overlapping arrival and departure peaks, which results in a lower total operations peak for the simulated throughput versus the 2016-2017 actual data. The Airport is more stressed by demand in IMC as compared to VMC. This difference occurs because the separations required between aircraft are higher in IMC than in VMC. As a result, there are less pronounced peaks in IMC than in VMC.

The simulated arrival and departure throughputs are compared to the ASPM data and the EIS results for the maximum rates and the 90th percentile rates in **Table 4-2**. The simulated arrival and departure hourly throughputs match closely with ASPM and the EIS simulation results. The FAA's Capacity Airport Rates (called rates) are also shown; the arrival called rates are much higher than actual hourly counts, so they are not considered a reliable indication of actual throughput.

		Arrival and Departure Throughput						
Case	Type of Operation	ASPM Called Rate ¹	ASPM Max	ASPM 90 th	EIS Max²	AirTOp Max	AirTOp 90 th	
North VMC	Arrival	92	79	63	73	76	67	
	Departure	69	82	67	78	82	63	
North IMC	Arrival	75	76	64	73	72	64	
	Departure	65	79	62	68	78	59	
South	Arrival	92	78	63	77	77	68	
VMC	Departure	82	81	66	78	83	64	
South IMC	Arrival	75	77	64	74	77	66	
South INC	Departure	65	74	58	68	79	61	

Table 4-2, Calibration Arrival and Departure Throughput Comparison

¹ A variety of called rates were found in ASPM for each particular runway configuration; the most frequent called rate is shown in the table.

² The EIS did not include 90th percentile data for arrival and departure throughput.

Source: Capacity/Delay Analysis and Airfield Modeling Technical Memorandum, CLT EIS; ASPM data, 2016-2017; Landrum & Brown analysis, 2020

The hourly throughput rate for the main operation on each runway was compared to the actual runway throughput. The simulated runway throughputs are shown with the Aerobahn data and the EIS results for the 90th percentile rates in **Table 4-3**. The simulated runway throughputs match closely with Aerobahn and the EIS simulation results.

Table 4-3, Calibration Runway	y Throughput Comparison
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	Operation	Runway	Aerobahn – 90th	EIS - 90th	AirTOp – 90th
	Arrival	36L	35	32	34
North VMC	Departure	36C	38	37	39
	Departure	36R	29	28	27
	Arrival	36L	35	32	32
North IMC	Departure	36C	35	35	36
	Departure	36R	27	26	26
	Arrival	18R	33	33	33
South VMC	Departure	18C	32	31	32
	Departure	18L	38	35	37
	Arrival	18R	34	35	33
South IMC	Departure	18C	28	29	31
	Departure	18L	32	34	32

Source: Capacity/Delay Analysis and Airfield Modeling Technical Memorandum, CLT EIS; Aerobahn data, May 2016 for VMC, Jan-Aug 2016 for IMC; Landrum & Brown analysis, 2020

Simulated throughputs can also be compared to actual rates using a heat map. A heat map plots the number of hourly arrivals against the number of hourly departures. The frequency of occurrence of a particular arrival-departure rate in the data sample defines the color (heat) of the data point. This technique enables the visual differentiation of commonly occurring throughput rates from outlier throughput rates. **Exhibit 4-1** shows how heat maps work.



Exhibit 4-1, Heat Map Example



Exhibit 4-2 and **Exhibit 4-3** present the throughput rate heat map based on 2016-2017 ASPM data for the North Flow VMC and South Flow VMC operation respectively. In both flows, the simulated throughputs correlate well to the actual data.



Exhibit 4-2, Calibration North Flow VMC Throughput Heat Map – Actual Data



Exhibit 4-3, Calibration South Flow VMC Throughput Heat Map – Actual Data



Source: ASPM data, 2016-2017; Landrum & Brown analysis, 2020

Exhibit 4-4 and **Exhibit 4-5** present the throughput rate heat map based on 2016-2017 ASPM data for the North Flow VMC and South Flow IMC operation respectively. In both flows, the simulated throughputs correlate well to the actual data.



Exhibit 4-4, Calibration North Flow IMC Throughput Heat Map – Actual Data

Source: ASPM data, 2016-2017; Landrum & Brown analysis, 2020



Exhibit 4-5, Calibration South Flow IMC Throughput Heat Map – Actual Data

Source: ASPM data, 2016-2017; Landrum & Brown analysis, 2020

4.2 Aircraft Taxi Times

Aircraft ground taxi times are a key metric in the simulation model calibration process. The AirTOp simulated taxi times were calibrated to 2016 FAA ASPM data to ensure model accuracy. **Table 4-4** provides a comparison of the average taxi times for the 2016 ASPM data versus the North Flow and South Flow VMC simulated times. IMC taxi times were assumed to be the same as the VMC taxi times so they were not compared. It is important to note that the FAA database provides the taxi times for most of the major US carriers, however not all aircraft operations are accounted for (i.e., cargo, general aviation, non-major commercial carriers). The simulation average taxi times represent the averages for all airlines and flights which were simulated in 10 iterations. The primary goal of calibrating to actual taxi times is to achieve taxi in and out times which are representative of the actual average taxi times at the Airport.

Table 4-4, Calibration Taxi Time Comparison

Casa	Taxi Times (in minutes)			
Case	Arrival	Departure		
North Flow ASPM	11.0	20.3		
North Flow VMC AirTOp	11.9	20.2		
South Flow ASPM	12.4	19.5		
South Flow VMC AirTOp	11.6	17.6		

Source: ASPM data, 2016; Landrum & Brown analysis, 2020

4.3 Calibration Summary

The results of the calibration analysis for the North Flow VMC, South Flow VMC, North Flow IMC and South Flow IMC operations demonstrate that the models can successfully generate arrival and departure throughput rates and ground travel times which coincide well with actual operations. **Table 4-5** presents a summary of the final taxi time and delay metrics for the four calibrated simulation models. These results are based on the average of ten iterations of simulation runs.

Table 4-5,	Calibration	Results	Summary
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	Minutes per Operation						
Metric	North VMC	North IMC	South VMC	South IMC	All-Weather Annualization		
Runway Use ¹	44.8%	9.9%	38.8%	6.5%	100.0%		
Avg. Arrival Taxi Time	11.9	13.1	11.6	12.2	11.9		
Avg. Dep. Taxi Time	20.2	22.3	17.6	20.6	19.4		
Avg. Arrival Air Delay	6.1	7.5	5.1	5.6	5.8		
Avg. Arrival Delay	11.3	13.8	9.6	10.8	10.9		
Avg. Dep. Taxi Delay	7.0	9.1	6.8	9.5	7.3		
Avg. Dep. Delay	8.8	11.3	8.9	11.5	9.2		
Average Delay	10.1	12.5	9.2	11.2	10.1		

Based on ASPM configurations and ATC called rates in 2016.

Source: AirTOp simulations; ASPM data, 2016; Landrum & Brown analysis, 2020

5 2019 Baseline Operating Assumptions

Since the 2016 calibration, Runway 23 is no longer a primary arrival runway, therefore subsequent South Flow models were revised to reflect the new runway usage. To ensure that the models accurately reflect airport operations under the updated conditions, the 2019 Baseline simulation results were used to validate the models. North Flow models were not modeled for 2019 because runway usage remained the same as 2016.

The Baseline condition represents existing airside conditions (airfield, airspace, and terminal) in 2019 as shown on **Exhibit 5-1**. The primary differences between the 2016 calibrated condition and the 2019 condition are the addition of (1) the Concourse A Phase 1 Pier and (2) a deicing/hold pad to the north of the new pier. The 2019 Baseline condition was simulated with the 2019 flight schedule.

Exhibit 5-1, 2019 Baseline Airfield Layout



Source: 2020 Bing Maps imagery; Landrum & Brown, 2020

For purposes of the EA, the following 2019 Baseline modeling experiments were run:

- 2019 South Flow VMC
- 2019 South Flow IMC

5.1 Airfield and Aircraft Apron Layouts

The apron areas for the cargo carriers, general aviation, and military aircraft remain the same as in 2016. The 2019 Baseline includes the addition of the new Concourse A Phase I Pier as compared to the 2016 condition. In addition, airline usage of gates has changed since 2016. In 2019, American and Delta occupied the original Concourse A pier, while OALs moved to the Concourse A Phase I Extension Pier. The updated passenger airline gating assignments are shown in **Table 5-1**. The table also summarizes the number of gates in each concourse.

Concourse	Airline Assignments	Number of Gates
Α	American, Delta	13
A Phase I Pier	Other Airlines (OALs)	9
В	American Mainline	16
С	American Mainline	18
D	American Mainline, Lufthansa	13
E	American Regional	44

Source: CLT airport and Landrum & Brown analysis, 2020

5.2 Hold Pad Usage

As with the 2016 condition, airfield deicing/hold pads were used to accommodate arrivals waiting for an available gate, RON operations, towed aircraft, and departures waiting for a spot in the queue. In the Baseline condition, the new deicing/hold pad located at the Runway 18C end can be used in addition to the existing hold pad between Concourses B and C, as shown on **Exhibit 5-2**.

Exhibit 5-2, 2019 Baseline Deicing/Hold Pads



Source: 2020 Bing Maps imagery; Landrum & Brown, 2020

5.3 Runway Operating Configurations

In South Flow, Runway 23 is no longer used for arrivals in the 2019 Baseline; Runway 5/23 is used as a taxiway instead. The basic runway usage in a South Flow configuration therefore consists of arrivals on Runways 18L and 18R, Runway 18C is used in conjunction with Runways 18L and 18R to provide triple parallel approach capability during periods of high arrival demand. The primary departure runways are Runways 18C and 18L in both VMC and IMC. The allocation of departing aircraft to these runways is based on the destination of the flight. Runway 18C is used by aircraft departing to northbound and westbound destinations. Runway 18C is also used by international heavy aircraft heading east. Runway 18L is used by southbound and eastbound departures. **Exhibit 5-3** depicts the South Flow runway usage.



Exhibit 5-3, 2019 Baseline South Flow VMC/IMC Runway Configuration

Source: 2020 Bing Maps imagery; Landrum & Brown, 2020

5.4 Airfield Ground Speeds

The overall ground speed assumptions remain the same as in 2016. **Exhibit 5-4** shows the 2019 Baseline speeds with the Concourse A pier expansion and deicing/hold pad included.





Source: ACEP, EIS, and Landrum & Brown analysis, 2020

5.5 Airfield Taxi Flows

Exhibit 5-5 shows the South Flow taxi routes with the Baseline improvements. Runway 23 is used as a taxiway.

Exhibit 5-5, 2019 Baseline Taxi Routes



Source: Tower observations and ATCT feedback

5.6 Airspace Assumptions

The 2019 Baseline conditions were modeled with the same aircraft separation and airspace structure assumptions as were used for the 2016 modeling and calibration effort.

6 2019 Baseline Modeling Results

The results of the 2019 Baseline simulation models are presented in this chapter. The following metrics were validated for the South VMC and IMC models:

- Throughput rates
- Average total taxi times

6.1 Throughput Rates

A key metric in the calibration analysis is throughput rates. Throughput rates were calibrated to 2019 FAA ASPM data or CLT's Aerobahn system data. The simulated total operations throughput is compared to ASPM data in **Table 6-1**. The simulated 90th percentile throughputs are within 10 percent of the ASPM rates.

,	1 01	•
Case	90 th Percentile Airport Th	roughput
	ASPM	AirTOp
South VMC	117	118
South IMC	111	116

Table 6-1, 2019 Baseline Total Operations Throughput Comparison

Sources: ASPM data, 2019; Landrum & Brown analysis, 2020

The simulated arrival and departure throughputs are compared to the ASPM data for the maximum rates and the 90th percentile rates in **Table 6-2.** The simulated arrival and departure hourly throughputs match closely with ASPM data. The FAA's Capacity Airport Rates (called rates) are also shown; the arrival called rates are much higher than actual hourly counts, so they are not considered a reliable indication of actual throughput. The called rates also heavily prioritize arrivals over departures, with the arrival hourly called rate being much higher than the departure rate. However, in actual operations, arrivals and departures are more balanced, with the peak departure rates slightly higher than arrival rates. The simulation takes a similar balanced approach to optimize delays.

Since the separation requirements between aircraft are higher in IMC than in VMC, the throughput is generally lower in IMC that it is in VMC. However, some IMC rates are slightly higher than VMC rates. The 2019 demand level does not constantly stress the airport during VMC as most operations are completed within the hour. During IMC, demand often spills over to the next hour, causing a backup that increases the throughput rate.

Arrival and Departure Throughput										
Case	Type of Operation	ATC Called Rate ¹	ASPM Max	ASPM 90 th	AirTOp Max	AirTOp 90 th				
South VMC	Arrival	87	73	60	68	62				
	Departure	69	77	63	74	64				
South IMC	Arrival	80	71	60	71	63				
	Departure	69	69	57	72	59				

Table 6-2, 2019 Baseline Arrival and Departure Throughput Comparison

A variety of called rates were found in ASPM for each runway configuration; the most frequent called rate is shown in the table.

Source: ASPM data, 2019; Landrum & Brown analysis, 2020

The hourly throughput rate for the main operation on each runway was compared to the actual runway throughput determined from Aerobahn data. The simulated runway throughputs are shown with the Aerobahn data for the 90th percentile rates in **Table 6-3**. The simulated runway throughputs match closely with the observed data.

 Table 6-3, 2019 Baseline Runway Throughput Comparison

Case	Operation	Runway	Aerobahn – 90th	AirTOp – 90th
South VMC	Arrival	18R	34	34
	Departure	18C	34	36
	Departure	18L	30	30
South IMC	Arrival	18R	32	33
	Departure	18C	32	33
	Departure	18L	27	29

Source: Aerobahn data, January-April 2019; Landrum & Brown analysis, 2020

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Simulated throughputs can also be compared to actual rates using a heat map. **Exhibit 6-1** and **Exhibit 6-2** present the throughput rate heat map based on 2019 ASPM data for the South Flow VMC and South Flow IMC operation respectively. In both flows, the simulated throughputs correlate well to the actual data.



Exhibit 6-1, 2019 Baseline South Flow VMC Throughput Heat Map – Actual Data







Source: ASPM data, 2019; Landrum & Brown analysis, 2020

6.2 Aircraft Taxi Times

Aircraft ground taxi times are a key metric in the simulation model calibration process. The AirTOp simulated taxi times were calibrated to 2019 FAA ASPM data to validate model accuracy. **Table 6-4** provides a comparison of the 2019 ASPM data versus the simulated average taxi times. The comparison is only made for the VMC because the IMC and VMC taxi times were assumed to be the same. It is important to note that the FAA database provides the taxi times for most of the major US carriers, but not all aircraft operations are accounted for (i.e., cargo, general aviation, non-major commercial carriers).

Table 6-4, 2019 Baseline Taxi Time Comparison

Casa	Taxi Times (in minutes)				
Case	Arrival	Departure			
South Flow ASPM	13.1	19.6			
South Flow VMC AirTOp	12.6	17.5			

Source: ASPM data, 2019; Landrum & Brown analysis, 2020

6.3 Baseline Summary

The results of the validation analysis for the South Flow VMC and South Flow IMC operations demonstrate that the models can successfully produce arrival and departure throughput rates and ground travel times which coincide well with actual operations.

7 No Action Operating Assumptions

With the 2016 and 2019 simulation models calibrated to reflect airport conditions, the models can be adjusted using various control parameters and demand levels to evaluate future changes in the operation. The No Action experiment reflects the existing airside system along with improvements that are expected to be in place by 2028, as shown on **Exhibit 7-1**. These include:

- Concourse A Phase II Pier
- North End Around Taxiway (EAT) on the Runway 18C end
- Dual taxilanes for Concourse A
- Taxiway N removal
- West hold pad between Runways 18C/36C and 18R/36L
- Taxiway S removal
- South crossfield taxiway and deicing pad

The No Action cases were simulated with the 2028 and 2033 flight schedules.



Exhibit 7-1, 2028/2033 Future No Action Airfield Layout



For purposes of the EA, the following No Action modeling experiments were run:

- 2028 North Flow VMC
- 2028 North Flow IMC
- 2028 South Flow VMC
- 2028 South Flow IMC

- 2033 North Flow VMC
- 2033 North Flow IMC
- 2033 South Flow VMC
- 2033 South Flow IMC

7.1 Airfield and Aircraft Apron Layouts

The apron areas for the cargo carriers, general aviation, and military aircraft remain the same as in 2016 and 2019. The No Action conditions include the addition of Concourse A Phase II Pier as compared to the 2019 condition. The updated passenger airline gating assignments are shown in **Table 7-1**. The table also summarizes the number of gates in each concourse.

Concourse	No Action Airline Assignments	Number of Gates
Α	American	9
A Phase I Pier	Other Airlines (OALs)	9
A Phase II Pier	Other Airlines (OALs)	10
В	American Mainline	16
С	American Mainline	18
D	American Mainline, Lufthansa	13
E	American Regional	44

Source: CLT airport and Landrum & Brown analysis, 2020

7.2 Hold Pad Usage

Airfield deicing/hold pads were used to accommodate arrivals waiting for an available gate, RON operations, and towed aircraft. In the No Action condition, the South Deicing Pad and West Hold Pad can be used in addition to the existing hold pad between Concourses B and C (see **Exhibit 7-2**).





Source: CLT airport and Landrum & Brown, 2020

7.3 Runway Operating Configurations

For North Flow, the No Action experiments were modeled with the same runway operating configurations as the 2016 Calibration modeling effort. For South Flow, the No Action experiments were modeled with the same runway operating configurations as the 2019 Baseline modeling effort.

7.4 Airfield Ground Speeds

The overall ground speed assumptions remain the same as in 2016 and 2019. **Exhibit 7-3**, *No Action Airfield Ground Speed Assumptions*, shows the 2028 and 2033 No Action speeds with the No Action additions, such as the Concourse A pier and the North EAT, included.



Exhibit 7-3, No Action Airfield Ground Speed Assumptions

7.5 Airfield Taxi Flows

Exhibit 7-4 shows the taxi routes in the No Action with additional projects implemented. Both North Flow and South Flow reflect the use of the new North EAT and the new dual taxilanes along Concourse A. In addition, in South Flow, Runway 23 is not used for arrivals as it was in 2016; instead Runway 5/23 is used as a taxiway.





Source: Tower observations and ATCT feedback

7.6 Airspace Assumptions

Based on discussion with the FAA during the DORA process,⁶ the No Action and alternative simulations assumed a final approach in-trail separation of 2.5 nautical miles due to average runway occupancy time of less than 50 seconds. This separation allows arrivals to fully utilize runway capacity at higher demand levels.

With the implementation of the NASA Airspace Technology Demonstration 2 (ATD-2) system, a predecessor to the FAA Terminal Flight Data Manager (TFDM), the miles-in-trail (MIT) constraints that would have otherwise been added for northern destinations from CLT are no longer necessary. Prior to ATD-2, it was normal practice for MIT restrictions to be implemented, even during VMC, due to overhead enroute congestion. With ATD-2, flights going to the north are assigned a takeoff time prior to pushback from the gate to meter the departures into the airspace. Further improved enroute flows are anticipated with the Atlantic Coast Reroute Project.

⁶ DORA #3 follow up meeting with FAA, July 8, 2020

In addition, wake turbulence separations were updated according to Consolidated Wake Turbulence (CWT) Separation Standards issued in September 2019. **Table 7-2** lists the different aircraft types in each new category. **Table 7-3** presents the simulated minimum VMC and IMC in-trail separation distances for arrivals. **Table 7-3** presents the simulated minimum VMC and IMC in-trail separation times for departures.

Table 7-2, CWT Categories

Α	B	С	D		E	F		0	6	H	
Super	Upper Heavy	Lower Heavy	Non-Pai Heav	rwise vy	B757	Upper	Large	Lower Large		Upper Small	Lower Small
A388	A332	A306	A124	DC85	B752	A318	C130	AT43	E170	ASTR	BE10
	A333	A30B	A339	DC86	B753	A319	C30J	AT72	E45X	B190	BE20
	A343	A310	A342	DC87		A320	CVLT	CL60	E75L	BE40	BE58
	A345	B762	A3ST	E3CF		A321	DC93	CRJ1	E75S	B350	BE99
	A346	B763	A400	E3TF		B712	DC95	CRJ2	F16	C560	C208
	A359	B764	A50	E6		B721	DH8D	CRJ7	F18H	C56X	C210
	B742	DC10	AN22	E767		B722	E190	CRJ9	F18S	C680	C25A
	B744	K35R	B1	IL62		B732	GL5T	CRJX	F900	C750	C25B
	B748	MD11	B2	IL76		B733	GLEX	DC91	FA7X	CL30	C402
	B772		B52	IL86		B734	GLF5	DH8A	GLF2	E120	C441
	B773		B703	IL96		B735	GLF6	DH8B	GLF3	F2TH	C525
	B77L		B741	K35E		B736	MD82	DH8C	GLF4	FA50	C550
	B77W		B743	KE3		B737	MD83	E135	SB20	GALX	P180
	B788		B74D	L101		B738	MD87	E145	SF34	H25B	PAY2
	B789		B74R	MYA4		B739	MD88			LJ31	PA31
	C5		B74S	R135			MD90			LJ35	PC12
	C5M		B78X	T144						LJ45	SR22
			BLCF	T160						LJ55	SW3
			BSCA	TU95						LJ60	
			C135	VMT						SH36	

Source: JO 7110.126A - Consolidated Wake Turbulence (CWT) Separation Standards. Effective Date: September 28, 2019

Table 7-3, CWT Arrival In-trail Separations

ln-tı	rail				Tra	iling Airc	raft			
Separations		•	P	<u> </u>	D	E	E	G	u	
miles)						-	•	G		
	A	2.5/3.8 ¹	4.8	6.3	6.3	7.3	7.3	7.3	7.3	8.3
t,	В	2.5/3.8 ¹	3.3	4.3	4.3	5.3	5.3	5.3	5.3	6.3
Cra	С	2.5/3.8 ¹	2.5/3.8 ¹	2.5/3.8 ¹	2.5/3.8 ¹	3.8	3.8	3.8	5.3	6.3
Vird	D	2.5/3.8 ¹	3.3	4.3	4.3	5.3	5.3	5.3	6.3	6.3
9	E	2.5/3.8 ¹	4.3							
i.	F	2.5/3.8 ¹	4.3							
eac	G	2.5/3.8 ¹								
Ľ	Н	2.5/3.8 ¹								
	1	2.5/3.8 ¹								

VMC/IMC in-trail separations

1

Note:

Arrival separations include a 0.3 nautical mile buffer

Source: JO 7110.126A - Consolidated Wake Turbulence (CWT) Separation Standards. Effective Date: September 28, 2019. Landrum & Brown analysis with FAA feedback, 2020

In-trail					Trai	iling Airo	raft			
Separa (secon	itions ids)	Α	В	С	D	E	F	G	н	I.
	Α	60/72 ¹	180	180	180	180	180	180	180	180
¥.	В	60/72 ¹	120	120	120	120	120	120	120	120
cra	С	60/72 ¹	60/72 ¹	60/72 ¹	60/72 ¹	120	120	120	120	120
\ir	D	60/72 ¹	120	120	120	120	120	120	120	120
6	E	60/72 ¹	120							
lin	F	60/72 ¹								
eac	G	60/72 ¹								
Ľ	Н	60/72 ¹								
		60/72 ¹								

Table 7-4, CWT Departure In-trail Separations

VMC/IMC in-trail separations

Source: JO 7110.126A - Consolidated Wake Turbulence (CWT) Separation Standards. Effective Date: September 28, 2019. Landrum & Brown analysis with FAA feedback, 2020

Table 7-5 summarizes the existing and forecasted fleet mix sorted by the new wake classes.

CWT Category	2016		20)19	2	028	2033	
	Number of Ops	% of Total Ops	Number of Ops	% of Total Ops	Number of Ops	% of Total Ops	Number of Ops	% of Total Ops
Α	0	0%	0	0%	0	0%	0	0%
В	19	1%	20	1%	21	1%	23	1%
С	10	1%	12	1%	14	1%	16	1%
D	0	0%	0	0%	0	0%	0	0%
E	2	0%	4	0%	0	0%	0	0%
F	770	49%	683	42%	779	42%	865	44%
G	708	45%	843	52%	991	53%	1017	51%
Н	40	3%	55	3%	40	2%	42	2%
I	14	1%	11	1%	15	1%	15	1%
Total	1563	100%	1628	100%	1860	100%	1978	100%

Source: Landrum & Brown analysis, 2020

8 No Action Modeling Results

The results of the No Action simulation models are presented in this chapter. Throughput, taxi times, and delay data are presented for the 2028 (1,860 daily operations) and the 2033 (1,978 daily operations) demand levels. Each of the simulation modeling experiments was run a minimum of ten iterations to incorporate random variation in the modeling in order to produce statistically significant results.

To summarize the results for each demand level, annualized averages were calculated for each of the simulation metrics. The annualized data was calculated by averaging the results of the four flow and weather configurations, weighted by the percent of time each configuration was observed. FAA ASPM runway usage/weather data from 2012 to 2019 were analyzed to determine the frequency of each configuration, as shown in **Exhibit 8-1**. The data show a clear trend in the increase of North Flow operations and decrease of South Flow operations over this time period. Based on conversations with local Air Traffic, North Flow is favored over South Flow due to factors such as North Flow having more

departure queue space. An average of 2012 to 2019 configuration shares would likely undercount North Flow percentages at future demand levels, therefore the 2028 and 2033 simulation results were weighted solely on the 2019 shares.





Source: ASPM data, 2012-2019

8.1 Throughput Rates

In order to evaluate the No Action airfield's ability to manage the increase in demand, rolling hour throughput rates were calculated from the simulations. As recommended by the DORA stakeholder group, the 90th percentile throughput is used in this analysis rather than the maximum throughput. The 90th percentile methodology presents an achievable runway throughput rate, while the maximum hourly rate may not be sustainable⁷ on a recurring basis.

Exhibit 8-2 shows the 90th percentile hourly throughput rate for arrivals, departures, and overall airport operations. The 2016 calibration throughput rates are included for reference. The 2016 rates are annualized based on the shares of 2016 runway configurations, while the 2028 and 2033 rates are annualized based on the 2019 runway configurations. At the higher No Action demand levels, airfield improvements such as the addition of the North EAT and the compression of arrival separations to 2.5nm allow for the increase in throughput as compared to the 2016 Calibration.

⁷ Although the focus of the analysis was on the 90th percentile sustained throughput rate, the maximum 15-minute simulation throughput was verified with and matches the Airport Capacity Profile modeled rates for CLT.



Exhibit 8-2, No Action Weighted Aircraft Throughput

Source: Landrum & Brown analysis, 2020

Table 8-1 presents the 90th percentile hourly throughput rates for each of the four weather and flow configurations. In addition to the overall airport, arrival, and departure rates, the throughput rates for the main operation on each runway is listed. The departure rate on Runway 18L/36R is lower than Runway 18C/36C because Runway 18L/36R is a mixed-use runway.

90th Percentile	2	028 Future	e No Actior	า	2033 Future No Action			
Simulated	North	North	South	South	North	North	South	South
Throughput	VMC	IMC	VMC	IMC	VMC	IMC	VMC	IMC
Airport	134	128	132	128	139	131	137	132
Arrival	73	70	70	69	75	72	72	71
Departure	72	65	73	67	71	67	73	68
18R/36L Arrival	41	34	40	35	42	35	41	36
18C/36C Departure	44	42	44	40	45	43	45	42
18L/36R Departure	30	27	31	29	30	27	31	28

Table 8-1, No Action Aircraft Throughput by Flow

Source: Landrum & Brown analysis, 2020

8.2 Aircraft Taxi Times and Delay

To assess the impact of the increased operations on the performance of the No Action airfield, average taxi times and delay were generated from the simulation. **Exhibit 8-3** depicts the average aircraft taxi times including delays for arrivals, departures and overall airport operations. Taxi times increased as compared to the 2016 Calibration due to increased delay and the longer taxi distances when aircraft use the North EAT.



Exhibit 8-3, No Action Weighted Average Taxi Times



Exhibit 8-4 shows the average aircraft delays for arrivals, departures and overall airport operations. Arrival delays include air, taxi, and gate wait delays. Departure delays include taxi and gate holding delays. Delays increased when compared to the 2016 Calibration due to constraints in runway capacity, taxiway and ramp congestion, as well as gate shortages. One major bottleneck is located near the tip of Concourse C, where the flow of aircraft traffic on the taxilanes and Taxiway M is severely constricted due to the single taxilane access to Concourse E.

Exhibit 8-4, No Action Weighted Average Delay



Source: Landrum & Brown analysis, 2020

Exhibit 8-5 shows the total aircraft times including delays for arrivals, departures and overall airport operations. Arrival total times include air delays, taxi times, taxi delays, and gate wait delays. Departure total times include gate holding delays, taxi times, and taxi delays. The total time provides a more well-rounded measure of airport performance than taxi times and delay could separately.



Exhibit 8-5, No Action Total Time Including Delay

Source: Landrum & Brown analysis, 2020

Exhibit 8-6 presents the delay that can be attributed to the runway versus non-runway delays. Runway related delays include arrival air delays and departure queue delays. Non-runway delays include taxi and gate delays. Arrivals and departures both experience high amounts of delay largely due to the constraint of the runway system. Taxiway and ramp congestion as well as gate shortage generate additional delays. The average runway delay of 7.5 at the 2028 demand level and 9.4 minutes at the 2033 demand level exceeds the threshold for the acceptable level of runway delay (seven minutes).



Exhibit 8-6, No Action Runway vs Non-Runway Delay

Source: Landrum & Brown analysis, 2020

9 Airfield Alternatives Operating Assumptions

Three alternatives were developed and evaluated to meet the purpose and need identified in the EA process, with Alternative 1 serving as the Proposed Action. The Proposed Action assumes the construction of a new 10,000 feet runway (designated as Runway 01/19 for the purposes of the EA) that is located 1,200 feet to the west of existing Runway 18C/36C. Under current FAA regulations, this separation allows for simultaneous triple independent approaches in all weather conditions on Runways 18R/36L, 18C/36C, and 18L/36R. Alternative 2 is identical to Alternative 1, except the new runway is located 100 feet closer to Runway 18C/36C. This creates a 3,200 feet separation between Runways 18R/36L and 01/19. Alternative 2 was not simulated as results were assumed to be very similar to Alternative 1. Alternative 3 includes a new 8,900 feet runway located 900 feet west of Runway 18C/36C and 3,400 feet spacing between Runways 01/19 and 18R/36L will allow for simultaneous triple independent approaches in all weather conditions for FAA Order 7110.65, the 3,400 feet spacing between Runways 01/19 and 18R/36L, 01/19, and 18L/36R. **Exhibit 9-1** depicts the main differences between the alternatives.



Exhibit 9-1, Alternatives Overview

Source: Landrum & Brown, 2020

For purposes of the EA, each of the following modeling experiments were run for Alternatives 1 and 3:

- 2028 North Flow VMC
- 2028 North Flow IMC
- 2028 South Flow VMC
- 2028 South Flow IMC

- 2033 North Flow VMC
- 2033 North Flow IMC
- 2033 South Flow VMC
- 2033 South Flow IMC
9.1 Airfield and Aircraft Apron Layouts

The alternatives' airfields and apron areas contain numerous improvements to support future demand levels. These include full North and South EATs, additional crossfield taxiways, extensions of Concourses B and C, and complete dual taxilanes around the terminals. This infrastructure, highlighted in **Exhibit 9-2** and **Exhibit 9-3** complements the new runway by allowing for efficient taxi flows between gates and runways and removing bottlenecks around the ramp area. Alternative 3 includes the same infrastructure improvements as Alternative 1 but has a shorter runway and does not have a full-length Taxiway V. The runway is shorter in Alternative 3 because it would be used primarily as an arrival runway so does not require the 10,000-foot length. Taxiway V cannot extend the full length of the runway due to the location of the Runway 18C/36C glideslopes.





Source: CLT airport and Landrum & Brown, 2020



Exhibit 9-3, Alternative 3 Airfield Layout

Gating assignments assumptions, presented in **Table 9-1**, were updated to accommodate future demand. All OALs (except for Lufthansa) were assumed to operate out of the two new Concourse A piers, while the original Concourse A would exclusively serve American Mainline. Concourses B and C would continue to be used by American Mainline and accommodate some American Regional. Concourse D would remain as the international concourse, housing American and Lufthansa. Concourse E would also retain its current use serving American Regional.

	Table 9-1, Alternatives	Airline Gating	Assignment A	ssumptions
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Concourse	Airline Assignments	Number of Gates
Α	American Mainline	9
A Phase I Pier	Other Airlines (OALs)	9
A Phase II Pier	Other Airlines (OALs)	10
В	American Mainline, American Regional	35
С	American Mainline, American Regional	32
D	American Mainline, Lufthansa	6
E	American Regional	37

Source: CLT Terminal Area Plan Forecasts, 2020; Landrum & Brown analysis, 2020

Source: CLT airport and Landrum & Brown, 2020

9.2 Runway Operating Configurations

The addition of the fourth runway allows for greater flexibility in runway operating configurations. For the purposes of this study, one main set of runway configuration was assumed and simulated for each alternative. Other runway configurations and procedures can be developed based on the needs of future airport operations.

In Alternative 1, the new runway does not have sufficient spacing between it and either of its two adjacent runways to allow for triple simultaneous independent straight-in approaches, so it is intended to be used primarily by departures. Therefore, Runways 18R/36L, 18C/36C, and 18L/36R would be used for arrivals to provide simultaneous triple independent approaches capability. Runways 01/19 and 18L/36R would be used for departures. During off-peak periods when arrival demand is sparse, Runway 18C/36C could be used for departures.

In Alternative 3, the new runway has sufficient spacing between it and Runways 18R/36L and 18L/36R to allow for triple simultaneous independent straight-in approaches, so it intended to be used primarily by arrivals. Therefore, Runways 18R/36L, 01/19, and 18L/36R would be used for arrivals to provide simultaneous triple independent approaches capability. Runways 18C/36C and 18L/36R would be used for departures.

The runway usage for each Alternative is depicted on Exhibit 9-4 and Exhibit 9-5.

Exhibit 9-4, Alternative 1 VMC/IMC Runway Configuration

North Flow







South Flow



Exhibit 9-5, Alternative 3 VMC/IMC Runway Configuration

North Flow

South Flow





9.3 Airfield Ground Speeds

The overall ground speed assumptions are consistent with those in the No Action. New infrastructure, such as the full EATs, is subject to the speed limits listed on **Exhibit 9-6** and **Exhibit 9-7**.



Exhibit 9-6, Alternative 1 Airfield Ground Speed Assumptions

Source:	ACEP, EIS, and Landrum & Brown analysis, 20	020
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Exhibit 9-7, Alternative 3 Airfield Ground Speed Assumptions



Source: ACEP, EIS, and Landrum & Brown analysis, 2020

High Speed Exits	32 knots
Outer Perimeter Taxiways	20 knots
Runway Crossings	18 knots
Taxiways	15 knots
Ramp Area Taxiways	12 knots
Ramp Area Taxilanes	10 knots

High Speed Exits	32 knots
Outer Perimeter Taxiways	20 knots
Runway Crossings	18 knots
Taxiways	15 knots
Ramp Área Taxiways	12 knots
Ramp Area Taxilanes	10 knots

9.4 Airfield Taxi Flows

As depicted in **Exhibit 9-8** and **Exhibit 9-9**, both alternatives take advantage of the new crossfield taxiways to move traffic between the east and west sides of the airfield without interfering with ramp area movements. Traffic on the dual taxilanes abutting the ramp area would be unidirectional to avoid head-on conflicts. In Alternative 1, Runway 01/19 departures would cross Runway 18C/36C to access the departure queue on Taxiway V. Two locations are used in both flows to allow for two simultaneous crossings of Runway 18C/36C between each pair of arrivals. The locations were selected to avoid the high energy zone in the middle third of the runway and the glide slope critical areas. The departures would not use the EAT to reach Runway 01/19 to avoid taxiing under approaching aircraft, which is not allowed unrestricted. In Alternative 3, Runway 01/19 arrivals would exit east for a shorter taxi when there are no Runway 18C/36C departures. Otherwise, they exit west and taxi around one of the EATs to avoid interrupting the departure stream.





Source: Landrum & Brown analysis and ATCT feedback, 2020



Exhibit 9-9, Alternative 3 Taxi Routes

Source: Landrum & Brown analysis and ATCT feedback, 2020

9.5 Airspace Assumptions

Exhibit 9-10 and **Exhibit 9-11** show the arrival fix assignments for each arrival runway. Arrival traffic can be swapped between runways to balance runway loads. Alternative 3 was assumed to have the same airspace assumptions, with Runway 18C/36C replaced by Runway 01/19.



Exhibit 9-10, Alternative 1 North Flow Arrival Route Structure

Note: Arrivals can be offloaded to other runways during busy periods Source: FAA terminal procedures; Landrum & Brown analysis

Exhibit 9-11, Alternative 1 South Flow Arrival Route Structure



Note: Arrivals can be offloaded to other runways during busy periods Source: FAA terminal procedures; Landrum & Brown analysis

Exhibit 9-12 and **Exhibit 9-13** present the primary fix allocation for each departure runway. Departures to the north (JOJJO, WEAZL, KRITR) and south (BEAVY, ICONS, KWEEN) fixes can be switched between runways to balance the runway queues during departure pushes. Alternative 3 was assumed to have the same fix assignments, with Runway 01/19 replaced by Runway 18C/36C.





Note: Departures to north and south fixes can be swapped between runways to balance the airfield Source: FAA terminal procedures; Landrum & Brown analysis, 2020

Exhibit 9-13, Alternative 1 South Flow Departure Route Structure



Note:Departures to north and south fixes can be swapped between runways to balance the airfieldSource:FAA terminal procedures; Landrum & Brown analysis, 2020

10 Airfield Alternatives Modeling Results

To provide a comparison against the No Action simulation results, the same metrics of throughput, taxi times, and delay were generated for the Alternative 1 and Alternative 3 simulation models. Alternative 2 was not modeled as it was expected to produce very similar results to Alternative 1. The same annualization percentages used to generate the No Action results were used for the alternatives.

10.1 Throughput Rates

The 90th percentile hourly throughput rates are displayed in **Exhibit 10-1**. The left chart presents the arrival rates, the middle chart the departure rates, and the right chart the overall airport rates. Each chart shows the No Action, Alternative 1, and Alternative 3 throughput rates for both the 2028 and 2033 demand levels. Alternatives 1 and 3 produce very similar throughputs and both outperform the No Action. This is the expected result as the alternatives add a runway and therefore allow the two center runways to operate as dedicated arrival/departure runways.



Exhibit 10-1, Throughput Rates from the No Action and Alternatives Simulations

Source: Landrum & Brown analysis, 2021

The 90th percentile throughput numbers presented do not necessarily represent total airport capacity because the modeled throughput rates are also a function of the flight schedule demand. While the additional runway and updated operating procedures allow for higher hourly rates, the schedule profile does not push the airport to capacity for extended periods at a time. Higher throughput may be achievable with a higher demand level or different demand profiles.

Table 10-1 and **Table 10-2** presents the 90th percentile hourly throughput by weather and flow configurations. The overall airport, arrival, and departure rates, and the throughput rates for the main operation on each runway is listed. Alternatives 1 and 3 produce similar throughputs on each runway. It is important to note that Runway 01/19 and 18C/36C swap arrival and departure operations between the alternatives. Alternative 1 Runway 18C/36C has slightly lower arrival throughput than Alternative 3 Runway 01/19 due to departures crossing Runway 18C/36C in Alternative 1.

90th Percentile	2028 Alternative 1			2033 Alternative 1				
Simulated Throughput	North VMC	North IMC	South VMC	South IMC	North VMC	North IMC	South VMC	South IMC
Airport	145	139	146	137	153	144	153	142
Arrival	79	78	79	76	83	79	82	77
Departure	81	74	80	74	84	75	83	76
18R/36L Arrival	36	33	37	35	38	34	39	35
01/19 Departure	41	37	40	36	42	38	42	38
18C/36C Arrival	31	31	31	28	33	32	33	29
18L/36R Departure	44	40	44	40	44	40	45	41

Table 10-1, Alternative 1 Aircraft Throughput by Flow

Source: Landrum & Brown analysis, 2021

Table 10-2	, Alternative 3	Aircraft	Throughput	by	Flow
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90th Percentile	2028 Alternative 3			2033 Alternative 3				
Simulated Throughput	North VMC	North IMC	South VMC	South IMC	North VMC	North IMC	South VMC	South IMC
Airport	149	140	147	138	156	144	154	143
Arrival	80	77	80	77	83	79	82	80
Departure	82	74	81	72	85	74	84	73
18R/36L Arrival	35	32	38	34	37	33	39	34
01/19 Arrival	35	30	32	30	37	31	34	31
18C/36C Departure	42	37	41	37	44	38	43	37
18L/36R Departure	44	39	44	38	45	39	45	39

Source: Landrum & Brown analysis, 2021

10.2 Aircraft Taxi Times and Delay

The average arrival, departure, and overall taxi times are presented in **Exhibit 10-2**. The No Action, Alternative 1, and Alternative 3 numbers are shown for the 2028 and 2033 demand levels. The taxi times capture delays experienced by aircraft during taxi, including time spent waiting at runway crossings and in the queue for takeoff. The alternatives have substantially lower taxi times than the No Action primarily due to the improved airfield geometry and the resulting reduced congestion around the ramp area. Alternative 1 has lower average arrival taxi times than Alternative 3 because arrivals land on Runway 18C/36C and have a short taxi in to the terminal area. Alternative 3 arrivals use the new runway and must taxi around the EAT. This is reversed for departure taxi times with Alternative 3 departures using Runway 18C/36C and Alternative 1 departures having to cross 18C/36C to depart on the new runway.



Exhibit 10-2, No Action and Alternatives Weighted Average Taxi Times

Source: Landrum & Brown analysis, 2021

The average arrival, departure, and overall aircraft delays are shown in **Exhibit 10-3**. Both arrival and departure delays are slightly higher in Alternative 1 than Alternative 3 due to Runway 01/19 departures needing to cross Runway 18C/36C to reach the departure queue on Taxiway V. The departures experience delay at the runway crossing, and arrivals experience air delay due to increased arrival separations on Runway 18C/36C.

Exhibit 10-3, NO Action and Alternatives weighted Average Delay	Exhibit 10-3,	No Action a	nd Alternatives	Weighted	Average Delay
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Source: Landrum & Brown analysis, 2021

To provide a holistic measure of the alternatives, both taxi time and delay must be considered. **Exhibit 10-4** captures the total delay that aircraft experience by adding arrival air delay and departure gate holding delay to arrival and departure taxi times respectively. Both alternatives benefit from the additional runway, improved taxiway and ramp layout, and concourse extensions. These improvements result in lower air and ground delays than the No Action experiment. This difference is especially noticeable at the 2033 demand level, with the alternatives able to handle the increased traffic demand much more effectively than the No Action (note the steeper slope of the No Action lines compared to the alternatives lines). The overall airport performance for Alternatives 1 and 3 is very similar. The difference in arrivals and departures between Alternative 1 and Alternative 3 is due to the usage of Runway 18C/36C and 01/19. In Alternative 1, arrivals benefit from a short taxi in from Runway 18C/36C and departures must cross Runway 18C/36C to reach the new runway. In Alternative 3, departures use Runway 18C/36C, while arrivals use the new runway and must taxi around one of the EATs to reach the ramp area in periods of high demand.





Source: Landrum & Brown analysis, 2021

Exhibit 10-5 presents the delay associated with the runway compared to non-runway delay. Runwayrelated delays include arrival air delays and departure queue delays. Other delays include taxi and gate delays. Alternatives 1 and 3 achieve lower delay in both categories compared to No Action, while performing very similarly to each other. The alternatives runway delays remain below the seven-minute threshold for acceptable delays.





Source: Landrum & Brown analysis, 2021

11 Conclusions

The EA simulation modeling analysis simulated two proposed airfield alternatives which provide the additional runway, taxiway, ramp and gate infrastructure necessary to accommodate the forecasted increase in aviation traffic at reasonable delay levels. The simulation modeling analysis was vetted through the official FAA DORA process which includes participation from FAA Office of Airports, Air Traffic Control staff from the Tower, TRACON and Traffic Management Units. In addition, representatives from American Airlines and other airlines, City of Charlotte Aviation Department, and Landrum & Brown participated in four working group meetings to discuss the simulation analysis methodology, approach, results and refinements. Based on the simulation modeling analysis conducted by L&B, all three alternatives would provide the required capacity and infrastructure to be able to accommodate the 2033 demand level of 1,978 daily operations while maintaining average runway delays of less than seven minutes per aircraft operation.

Proposed Capacity Enhancements at Charlotte Douglas International Airport

National Environmental Policy Act Environmental Assessment

Alternatives Analysis

April 2021

PREPARED FOR Charlotte Douglas International Airport

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1 Introduction

This appendix discusses the development and evaluation of runway alternatives for the Charlotte Douglas International Airport (CLT) Environmental Assessment (EA) for the Capacity Enhancement Projects. This appendix only describes the airfield alternatives that were developed in response to the upcoming changes to FAA rules regarding parallel runway separation. Each of the alternatives includes a new runway which is referred to as Runway 01/19 for purposes of the analysis in this EA. If the new runway is implemented in the future, the proper nomenclature will be determined at that time.

2 Runway Separation

The separation provided between parallel runways is the primary factor that determines the air traffic procedures that must be followed, which in turn determines the capacity of the runways. The current Federal Aviation Administration (FAA) runway separation requirements that are relevant to the CLT analysis are shown in **Table 2-1**.

TABLE 2-1, LATERAL RUNWAY SEPARATION REQUIREMENTS

Type of Operation	Lateral Runway Separation (in feet)
Simultaneous VFR Operations – Standard	700 feet
Simultaneous VFR Operations – Recommended for ADG V and VI Runways	1,200 feet
Simultaneous IFR Approaches and Departures	2,500 feet ¹
Simultaneous IFR Departures	2,500 feet ¹
Dual Simultaneous Independent IFR Approaches	3,600 feet ²
Triple Simultaneous Independent IFR Approaches	3,900 feet ²

¹ When thresholds are not staggered.

² Assumes straight-in approaches.

Note: VFR = Visual Flight Rules; IFR = Instrument Flight Rules; ADG = Airplane Design Group

Source: FAA Order 7110.65Y, Air Traffic Control

The FAA notified CLT in April of 2020 of an upcoming modification to the lateral runway separation requirements for the dual and triple simultaneous independent approaches shown in the table. A comparison of the current and expected lateral runway separation requirements is shown in **Table 2-2**.

TABLE 2-2, CURRENT AND EXPECTED RUNWAY SEPARATION REQUIREMENTS

Type of Approach	Current Runway Separation Requirement	Expected Runway Separation Requirement
Dual Simultaneous Independent	3,600 feet	3,200 feet
Triple Simultaneous Independent	3,900 feet	3,400 feet

Note: Assumes straight-in approaches.

Source: FAA Order 7110.65Y, Air Traffic Control; FAA Headquarters office

This rule change is relevant at CLT because the new runway location and intended runway use in the Proposed Action Alternative were chosen based on the current runway separation requirements in FAA Order 7110.65, *Air Traffic Control*. As shown on **Exhibit 2-1**, the Proposed Action includes a new "midfield" runway located on the west side of the airfield between Runways 18R/36L and 18C/36C, which are separated by 4,300 feet. Based on the current FAA separation requirements, it is not possible to meet the separation requirement for simultaneous Visual Flight Rules (VFR) operations between Runways 01/19 and 18C/36C (700 to 1,200 feet) while also meeting the 3,900-foot separation requirement for triple approaches between Runway 01/19 and 18R/36L. Therefore, the new runway in the Proposed Action alternative was sited so that it provides 1,200 feet of separation to Runway 18C/36C (the recommended separation for ADG V and VI aircraft), leaving 3,100 feet between it and Runway 18R/36L. Because Runway 01/19 does not have the necessary separation between it and the other runways to allow for triple simultaneous independent straight-in approaches, the new runway in the

Proposed Action Alternative is intended primarily for departure use, with Runway 18C/36C intended primarily for arrival use.¹



EXHIBIT 2-1, PROPOSED ACTION RUNWAYS

Source: Landrum & Brown, 2020

The expected reduction in separation requirements for triple simultaneous independent straight-in approaches, results in two possible alternative locations for the new runway in the midfield. The first is placement of Runway 01/19 so that it provides 3,400 of separation to Runway 18R/36L and 900 feet of separation to Runway 18C/36C (see **Exhibit 2-2**). The 3,400-foot separation to Runway 18R/36L would allow triple simultaneous independent straight-in approaches to Runways 18R/36L, 01/19, and 18L/36R. Another possible location for Runway 01/19 is to place Runway 01/19 with 3,200 of separation to Runway 18R/36L and 1,100 feet of separation to Runway 18C/36C (see **Exhibit 2-3**). This option would not allow triple simultaneous independent straight-in approaches to Runways 18R/36R but would provide operational flexibility² and position CLT to take advantage of any potential future reductions in runway separation requirements.³ Both of these runway separation options meet standards for the separation between Runway 01/19 and Runway 18R/36L but do not provide the recommended separation of 1,200 feet between Runway 01/19 and Runway 18C/36C. The 3,200-foot and 3,400-foot runway separations will be evaluated in the alternatives analysis.

¹ Although Runway 01/19 is primarily intended for departure use and Runway 18C/36C is primarily intended for arrival use, no restrictions on runway use are proposed or assumed. It is important that air traffic controllers have the flexibility to use these two runways for both arrivals and departures to maximize capacity and operational flexibility. For example, during off-peak periods, air traffic controllers may choose to land on Runways 18R/36L and 18L/36R while departing Runways 01/19 and 18C/36C. Air traffic controllers could also choose to land on Runway 01/19 and depart Runway 18C/36C during visual weather conditions.

² The 3,200-foot separation between the new runway and Runway 18R/36L would allow these runways to be used by arrivals, with departures on the two eastern most runways, during off-peak periods when triple approaches are not required. The operational benefit of this runway use configuration is the segregation of arrival and departure traffic.

³ Because dual simultaneous independent approaches would be permitted to Runways 18R/36L and Runway 01/19 if the runways were 3,200 feet apart and because the separation between Runway 01/19 and Runway 18L/36R far exceeds the requirement of 3,400 feet for triple simultaneous independent approaches, it may be possible to obtain a waiver from FAA to operate triple simultaneous independent approaches at CLT in the future. Such an operation would require further study and is not assumed for this EA.

EXHIBIT 2-2, POTENTIAL SEPARATION SCENARIO 1



Notes: Diagram is not to scale. The length of the new runway is shown at 10,000 feet but may vary depending on the use of the runway.

Source: Landrum & Brown analysis, 2021

EXHIBIT 2-3, POTENTIAL SEPARATION SCENARIO 2





Notes: Diagram is not to scale. The length of the new runway is shown at 10,000 feet but may vary depending on the use of the runway.

Source: Landrum & Brown analysis, 2021

3 Runway Length Requirements

This section describes the takeoff and landing runway length requirements for CLT.

3.1 Runway Length Methodology

Landing and takeoff requirements were calculated following the recommended guidance in FAA Advisory Circular (AC) 150/5325-4B, *Runway Length Requirements for Airport Design*. As such, the aircraft manufacturers' airport planning manuals from Airbus, Boeing, and Gulfstream were utilized in conjunction with the 2033 forecast fleet mix to calculate runway length requirements. Runway length requirements are a function of the following factors:

- Aircraft Fleet
- Density Altitude
- Runway Contamination (landings only)
- Flap Settings (landings only)

3.1.1 Aircraft Fleet

The CLT 2033 fleet mix was reviewed to determine the most critical aircraft for runway length requirements. Thirteen aircraft were selected for the analysis. All of the analyzed aircraft meet the critical aircraft threshold of maintaining at least 500 operations annually in the 2033 forecast. Landing runway length requirements for these aircraft were assessed at maximum landing weight (MLW). Takeoff requirements were calculated for the furthest destination for each aircraft, assuming 100 percent payload. Each aircraft used in this analysis is depicted in **Table 3-1**.

3.1.2 Density Altitude

Density altitude is pressure altitude corrected for non-standard temperature. It affects an aircraft's performance including how fast it can accelerate, how quickly it can obtain lift, and how fast it can climb. As an airport's elevation and/or temperature increase, air density decreases, which results in decreased aircraft performance and longer runway length requirements.⁴

Airfield elevation is the first component to density altitude. It is used as an input factor on the landing and takeoff charts in the aircraft manufacturers' airport planning manuals to determine accurate takeoff and landing requirements. The elevation at CLT is 747.9 feet above Mean Sea Level (MSL).⁵

⁴ https://www.aopa.org/training-and-safety/active-pilots/safety-and-technique/weather/density-altitude#WIDA

⁵ FAA Airport Data and Information Portal (ADIP) 2020

Aircraft	Operator	Critical Destination (distance in NM from CLT)	2033 Annual Operations
Airbus A300-600F	FedEx, UPS	MEM (444)	4092
Airbus A321	American	SFO (1,995)	96,503
Airbus A321NEO	American	KEF (2,711)	21,142
Airbus A330-200	American	GRU (4,018)	3,410
Boeing B717-200	Delta	MSP (808)	4,092
Boeing B737-800	Delta, Southwest	PDX (1,983)	6,138
Boeing B737MAX8	American, Southwest	PDX (1,983)	37,169
Boeing B737MAX9	United	SFO (1,995)	2,046
Boeing B787-900	American	FCO (4,182)	3,069
Bombardier CRJ900	American, Delta	n/a ¹	133,672
Embraer 145	American	n/a ¹	1,364
Gulfstream G500/600	General Aviation	n/a ¹	682
McDonnel Douglas DC10	FedEx	MEM (444)	1,364

TABLE 3-1, 2033 AIRCRAFT FLEET FOR RUNWAY LENGTH ANALYSIS

¹ Aircraft not assessed for takeoffs. Source: 2033 design day flight schedule

The second component to density altitude is temperature. The effect of temperature on density altitude is greater with takeoffs than landings. As a result, the FAA requires temperature adjustments for takeoffs, but not landings, according to FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*. The aircraft manufacturers' manuals contain charts to calculate takeoff runway length requirements based on temperature. Takeoff length requirements may be calculated based on a "standard day" (defined as 59 degrees Fahrenheit) or a "hot day." The hot day charts in the aircraft manufacturers' manuals vary the conditions of the hot day depending on the aircraft type. The determination of which temperature chart to use depends upon the average or typical weather conditions for a particular region or airport. FAA guidance prescribes the use of an airport's mean-max temperature for use in runway length calculations. The mean-max temperature is defined as the average daily maximum temperature of the hottest month. The mean daily maximum temperature at CLT is approximately 87 degrees Fahrenheit,⁶ making the hot day charts most appropriate for use in the CLT takeoff analysis.

3.1.3 Runway Contamination

Landing length requirements should be calculated for wet (contaminated) runways when following FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*. Contaminated runway conditions require longer runways for landing than dry conditions, due to the additional distance needed to decelerate on wet pavement. For those aircraft where the aircraft performance manuals do not specifically show a wet landing length curve, the dry landing length was increased by 15% as specified in the runway length AC. Takeoff runway length requirements do not factor in runway contamination per FAA guidance.

3.1.4 Flap Settings

Flaps are used on landings to produce a slower stall speed (so the pilot can land slower) and more drag (which allows the pilot to fly at a steeper descent angle to the runway). Maximum flap settings allow a pilot to maximize the lift and drag that the aircraft wings produce. All landing analysis was conducted using the highest landing flap settings available. Flap settings are not used in determining takeoff requirements.

3.2 Takeoff Runway Length Requirements

The *Runway Length Analysis: Proposed Runway 1-19 Technical Memorandum*, April 15, 2019, found that 10,000 feet of runway length is required at CLT to serve departures by the critical aircraft. This analysis was based on

⁶ National Centers for Environmental Information, 1981-2010 Station Normals of Temperature, Precipitation, and Heating and Cooling Degree Days.

performance engineering data from the airlines, which found that the Boeing 787-9 is the critical aircraft for runway length. This aircraft would require 10,000 feet of runway when departing in north flow.

As a result of critical aircraft runway length requirement, at least one departure runway at CLT should be 10,000 feet long. Runway 18C/36C is 10,000 feet long and currently serves as the primary departure runway. If this runway will continue to be used as a departure runway it meets the 10,000-foot need. For alternatives where Runway 18C/36C is intended primarily for arrival use and the new runway will become the primary departure runway, the new runway should be 10,000 feet long.

Not every departure runway at CLT needs to be 10,000 feet long. Runway 18L/36R is the secondary departure runway and is 8,676 feet long. The ability of this runway to serve the forecast fleet was assessed using a payload/range analysis (see **Table 3-2**) to determine if it needs to be extended. This analysis assumed 100% payload to the furthest destination for 10 aircraft in the 2033 fleet. The analysis determined that 3 of the 10 aircraft analyzed are unable to takeoff with maximum (100%) payload from Runway 18L/36R:

- A330-300 international passenger aircraft to GRU (4,018 nautical miles)
- B787-900 international passenger aircraft to FCO (4,182 nautical miles)
- B737-900 domestic passenger aircraft to SEA (1,980 nautical miles)

All of the other analyzed aircraft were found to be able to depart Runway 18L/36R with maximum payloads to the furthest destination identified for each aircraft type. The aircraft that require more than 8,676 feet for takeoff at 100% payload are noted in the table.

Aircraft	Critical Destination	CLT to Critical Destination (NM)	Payload to Critical Destination (lbs.)	% Payload to Critical Destination
A330-200*	Brazil (GRU)	4,018	90,000	90%
MD-DC10	Memphis (MEM)	444	152,964	100%
B787-900*	Rome (FCO)	4,182	148,000	95%
B737MAX8	Portland (PDX)	1,983	52,040	100%
A321	San Francisco (SFO)	1,995	56,000	100%
A300-600F	Memphis (MEM)	444	102,852	100%
B737-800	Portland (PDX)	1,983	47,000	100%
A321NEO	Keflavik (KEF)	2,711	56,200	100%
B717-200	Minneapolis-St Paul (MSP)	808	32,000	100%
B737MAX9	San Francisco (SFO)	1,995	156,500	100%
B737-900*	Seattle (SEA)	1,980	43,720	96%

TABLE 3-2, 2033 RUNWAY 18L/36R PAYLOAD-RANGE ANALYSIS

Note: * = Aircraft that require more than 8,676 feet of runway for takeoff at 100% payload.

Source: Aircraft manufacturer's airport planning manuals; Landrum & Brown analysis, 2020

If any of the three aircraft have full payloads, they must use Runway 18C/36C to depart instead of Runway 18L/36R. If the aircraft are headed eastbound, the departure from Runway 18C/36C results in an airspace crossing, which means aircraft waiting to depart on Runway 18L/36R must hold until the eastbound departure from Runway 18C/36C is clear. This negatively affects the capability of the runways. As a result, the 2033 design day schedule was reviewed to determine how many takeoffs per hour would require use of Runway 18C/36C (see **Table 3-3**). This analysis found that there would be at most two aircraft in any hour that cannot depart from Runway 18L/36R. This level of activity is not sufficient to justify an extension to Runway 18L/36R in any of the alternatives. As a result, none of the CLT EA alternatives will include an extension to Runway 18L/36R.

Aircraft	Destination	Daily Departures	Hours of Operation
	Frankfurt (FRA)	1	16:00
A220 200	Paris (CDG)	1	18:00
A330-200	Brazil (GRU)	1	20:00
	Barcelona (BCN)	1	20:00
B787-900	Rome (FCO)	1	18:00
B737-900	Seattle (SEA)	1	17:00

TABLE 3-3, 2033 DEPARTURES THAT CANNOT TAKEOFF FROM RUNWAY 18L/36R AT FULL PAYLOAD

Source: 2033 design day flight schedule; Landrum & Brown analysis, 2020

3.3 Arrival Runway Length Requirements

Given the FAA's expected rule change for runway separations, it may be possible for CLT's new runway to be a primary arrival runway in some of the EA alternatives. As a result, arrival runway length requirements were determined using the procedures outlined in FAA Advisory Circular (AC) 150/5325-4B, *Runway Length Requirements for Airport Design*. The results of these calculations can differ from the more detailed performance engineering analysis that aircraft operators and airlines are capable of performing. As a result, the airlines at CLT were consulted to validate the runway length conclusions.

The landing length requirements are depicted on **Exhibit 3-1**. The requirements shown for most of the aircraft reflect the results of the aircraft manufacturers' charts. American Airlines provided requirements for the B878-900, B737-800, A321, and B737MAX8; the requirements provided by American are shown instead of the chart results for these aircraft. The B787-900, B737-800, and Gulfstream 500/600 require the most landing length at 7,300 feet. These aircraft combined are forecast to make up 9,889 annual operations in 2033. Therefore, any alternative that considers arrival use for the new runway will include a 7,300-foot long runway, unless there are operational reasons that require a longer length.



EXHIBIT 3-1, 2033 LANDING RUNWAY LENGTH REQUIREMENTS

Notes: Source: Landing lengths based on wet (contaminated) runway conditions at MLW. Aircraft manufacturer's airport planning manuals; Landrum & Brown analysis, 2020

4 Taxiway Geometry

Taxiway geometry requirements at an airport are dictated by the critical aircraft as specified in FAA AC 150/5000-17, *Critical Aircraft and Regular Use Determination*. CLT's critical aircraft is the Airbus 350-900.⁷ It is the largest aircraft that is forecast to have at least 500 annual operations at CLT in 2033. The A350-900 is classified by FAA as an ADG V and Taxiway Design Group (TDG) 5 aircraft. All of the alternatives should be designed to meet ADG V and TDG 5 standards.

The taxiway geometry should be designed to protect for Category (CAT) II/III approaches in the event CLT decides to provide CAT II/III instrumentation on the new runway. In addition, it is preferable that a full-length parallel taxiway be provided on both sides of Runway 01/19 (between Runways 01/19 and 18R/36L and between Runways 01/19 and 18C/36C) in order to maximize operational flexibility and operational performance.

The key taxiway dimension for the CLT alternatives is the lateral spacing between the new runway and its parallel taxiways. The required spacing can vary based on a number of factors. **Table 4-1** provides the various lateral spacing requirements that apply for Runway 01/19. In order to meet TDG 5 and ADG V standards while protecting for CAT II/III approaches, the minimum separation between the new runway and its parallel taxiways should be 500 feet. Another consideration for runway-taxiway separation is the location of the glideslope antenna and the glideslope critical area. In order to be able to taxi past a glideslope antenna, 560 feet of lateral separation must be provided between the runway and the parallel taxiway. In order to be able to taxi unrestricted around a glideslope critical area, 642.5 feet of lateral separation must be provided between the runway and the parallel taxiway. These spacing requirements will be applied in the alternatives.

Criteria	Runway-Taxiway Lateral Separation Requirement (in feet)
ADG V with Visibility $>= \frac{1}{2}$ mile	400
TDG 5 (Minimum) ¹	427
TDG 5 (Recommended) ¹	450
ADG V with Visibility < 1/2 mile	500
Allow Taxi Past Glideslope Antenna	560
Protect for Glideslope Critical Area	642.5

TABLE 4-1, RUNWAY TO TAXIWAY LATERAL SEPARATION REQUIREMENTS

Separation requirement for reverse turns from a high-speed exit.

Source: FAA AC 150/5300-13A, Airport Design

5 Runway Exit Geometry

The type of runway exits and the location and number of exits on a runway depend on many factors including the separation distance between the runway and its associated parallel taxiways, the length of the runway, any displacement of the arrival threshold, and the types of aircraft using the runway. The time it takes an aircraft to decelerate to a slow enough speed to exit the runway varies depending on the size and performance characteristics of the aircraft and condition of the runway. If exits are not placed at the point(s) where the majority of aircraft using the runway reach their exit speed, the aircraft must continue down the runway at a relatively low rate of speed until it reaches the next available exit taxiway.

Runways with adequate and properly spaced runway exits allow capacity to be optimized by minimizing the runway occupancy times (ROT) of arriving aircraft and reducing the spacing required between sequential landing aircraft. The ROT is the length of time required for an arriving aircraft to proceed from over the runway threshold

⁷ The A350-900 is the critical aircraft based on its wingspan and approach speed. The critical aircraft for runway length is the B787-9 based on its landing and takeoff performance characteristics. Per FAA Advisory Circular 150/5000-17, *Critical Aircraft and Regular Use Determination*, Section 3.1, airports can have "multiple critical aircraft determinations."

to a point clear of the runway. An average ROT of 50 seconds or less is considered high efficiency.⁸ The number, type, and location of runway exits influences the ROT for each runway.

A runway exit analysis was conducted for CLT to identify the best placement of runway exits on Runway 01/19 in the alternatives. The analysis was completed for the 2028 and 2033 fleet mixes. The new Version 3 release of the FAA's Runway Exit Design Interactive Model (REDIM) was used in this analysis. This new version of REDIM uses real aircraft landing data from 30 major U.S. airports to determine typical landing patterns by aircraft type based on runway length. As a result, the ROT results from REDIM V3 are influenced by factors outside of aircraft performance such as the availability of properly placed exits and terminal/parking locations at the analyzed airports. Because this model is new, additional study will be needed to determine the most appropriate number and location of runway exits for the new runway prior to its construction.

5.1 Assumptions

REDIM uses a mix of airport specific fixed and variable inputs to perform its analysis. The main inputs include the following:

- Fleet Mix
- Airport Temperature
- Airport Elevation
- Surface Conditions

Table 5-1 summarizes the 2028 and 2033 forecast fleet mix for CLT.

TABLE 5-1, REDIM AIRCRAFT FLEET MIX

Fleet Mix	2028 % of Fleet	2033 % of Fleet
319 (A319)	14.6%	14.0%
320 (A320)	2.1%	1.7%
321 (A321)	15.2%	14.3%
32N (A320neo)	0.0%	0.3%
332 (A330-200)	0.5%	0.5%
333 (A330-300)	0.0%	0.0%
359 (A350-900)	0.1%	0.1%
A321 Neo	2.9%	3.1%
717 (B717-200)	0.6%	0.6%
733 (B737-300)	0.0%	0.0%
738 (B737-800 Passenger)	0.9%	1.0%
739 (B737-900 Passenger)	0.0%	0.3%
73G (B737-700 Passenger)	0.6%	0.7%
752 (B757-200 Passenger)	0.0%	0.0%
Boeing 787-8	0.0%	0.1%
Boeing 787-9	0.5%	0.5%
7M7 (B737-Max 7 Passenger)	0.1%	0.1%
7M8 (B737-Max 8 Passenger)	3.6%	5.5%
7M9 (B737-Max 9 Passenger)	0.2%	0.3%
A300	0.6%	0.6%
Beech 350 Super King	0.1%	0.1%
Beech 200 Super King	0.4%	0.4%
Beechcraft Baron	0.1%	0.1%
Beech 90 King Air	0.1%	0.1%
Lockheed C-130	0.1%	0.1%
Cessna 525A	0.1%	0.1%

⁸ An average 50-second ROT on a runway allows air traffic controllers to authorize 2.5-nautical mile separation between aircraft on final approach within 10 nautical miles of the landing runway. FAA Order 7110.65, Air Traffic Control.

Fleet Mix	2028 % of Fleet	2033 % of Fleet
Cessna 525B	0.1%	0.1%
Cessna T303 Crussader	0.1%	0.1%
Cessna 550	0.2%	0.2%
Cessna Citation V	0.3%	0.3%
Cessna Citation Excel	0.4%	0.4%
Cessna Citation X	0.2%	0.2%
Bombardier Challenger 300	0.2%	0.2%
Bombardier Challenger 350	0.1%	0.1%
Bombardier Challenger 600	0.1%	0.1%
CR2 (CRJ-200)	4.6%	3.7%
CR7 (CRJ-700)	17.9%	17.3%
CR9 (CRJ-900)	21.7%	19.8%
CR7 (CRJ-700)	0.2%	0.3%
CRJ (CRJ)	0.0%	0.0%
Airbus 220-100	0.0%	1.0%
McDonnell Douglas DC-10	0.1%	0.2%
DH3 (DHC-8-300)	0.0%	0.0%
DH8 (DHC-8)	0.0%	0.0%
Embraer Phenom 300	0.4%	0.4%
E70 (E-170)	0.5%	0.5%
E75 (E-175)	5.5%	7.0%
E7W (E-175 Enhanced Winglets)	0.9%	0.9%
E90 (E-190)	0.8%	0.9%
EM2 (EMB-120 Brasilia)	0.2%	0.2%
ER4 (ERJ-145)	0.2%	0.2%
Dassault Falcon 2000	0.4%	0.4%
Dassault Falcon 900	0.1%	0.1%
DASSAULT Falcon 50	0.1%	0.1%
FRJ (328Jet)	0.1%	0.1%
Gulfstream G100	0.1%	0.1%
Gulfstream G280	0.1%	0.1%
Gulfstream G200	0.1%	0.1%
Bombardier Global Express	0.2%	0.2%
Gulfstream 5	0.1%	0.1%
Gulfstream 6	0.1%	0.1%
Hawker 800	0.1%	0.1%
Learjet 45	0.2%	0.2%
Learjet 60	0.1%	0.1%
M88 (MD-88)	0.0%	0.0%
M90 (MD-90)	0.2%	0.0%
Cirrus SR22	0.1%	0.1%
Socata TBM-800	0.1%	0.1%
Socata TBM-900	0.1%	0.1%

Source: 2028 and 2033 design day flight schedules.

Table 5-2 presents the airport specific assumptions that affect the REDIM output. Higher airport elevation results in higher ground speeds, leading to longer landing distances. Similarly, higher airport temperature leads to lower air density and decreased aircraft performance, resulting in increased ROT. Surface conditions affect the landing performance of aircraft. A wet runway results in increased rolling distances and higher ROT times than dry runway conditions.

TABLE 5-2, AIRPORT SPECIFIC INPUTS

Input	CLT
Airport Elevation	747.9 feet above sea level ¹
Airport Temperature	87°F ²
Surface Conditions	90% Dry, 10% Wet ³
¹ FAA Airport Data and Information Pol	rtal (ADIP) 2020

² National Centers for Environmental Information, 1981-2010 Station Normals of Temperature, Precipitation, and Heating and Cooling Degree Days 3

National Centers for Environmental Information, precipitation data from 1/1/2009 to 12/31/2019

5.2 **Runway Exit Analysis Results**

REDIM was used to determine the optimal location and number of exits for three runway lengths:

- 10,000 feet: Based on the runway length analysis presented in Section 1.2, Runway Length Analysis, 10,000 feet is the most appropriate length for a departure runway.
- 8,900 feet: The new 10,000-foot long runway in the Proposed Action alternative includes a 1,100-foot long displaced threshold on the Runway 19 end, resulting in 8,900 feet of available landing length. It was assumed that any alternative with a 10,000-foot long runway would have a similar displaced threshold.
- 7,300 feet: Based on the runway length analysis presented in Section 1.2, Runway Length Analysis, 7,300 feet is the most appropriate length for an arrival runway.

Table 5-3 and Table 5-4 present the results of the REDIM analysis at each of the demand levels for a 10,000-foot runway, with four versus five exits. The ROT for both scenarios is greater than the desired 50 seconds. The higher ROT occurs because the aircraft will use the end-around taxiways (EATs) and so have no incentive to exit the runway quickly.

TABLE 5-3, REDIM RESULTS FOR 10,000-FOOT LONG RUNWAY WITH FOUR EXITS

Evit	Exit Distance	Exit Analo	Exit L	Jsage
EXIL	from Threshold	Exit Angle	2028	2033
1	5,800	30°	40%	39%
2	6,600	30°	35%	35%
3	7,600	90°	21%	21%
4	10,000	90°	4%	5%
	Average ROT		54 seconds	54 seconds

Note: Percentages may not sum to 100% due to rounding. Source: **REDIM V3 analysis**

TABLE 5-4, REDIM RESULTS FOR 10,000-FOOT LONG RUNWAY WITH FIVE EXITS

Evit	Exit Distance	Exit Angle	Exit L	Jsage
EXIL	from Threshold	Exit Angle	2028	2033
1	5,500	30°	25%	25%
2	6,200	30°	34%	33%
3	7,000	30°	26%	26%
4	7,900	90°	13%	13%
5	10,000	90°	3%	3%
	Average ROT		53 seconds	53 seconds

Percentages may not sum to 100% due to rounding. Note: Source: **REDIM V3 analysis**

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Table 5-5 presents the results of the REDIM analysis at each of the demand levels for an 8,900-foot long runway. This 8,900-foot length represents the 1,100-foot long displaced threshold on 10,000-foot long Runway 19, which would be used in south flow. As with the 10,000-foot length, the ROT is higher than 50 seconds. This higher ROT occurs because aircraft in south flow are traveling away from the terminal area when they land so pilots have no incentive to exit the runway early.

Evit	Exit Distance	Exit Analo	Exit L	Jsage
EXIL	from Threshold		2028	2033
1	5,700	30°	37%	37%
2	6,500	30°	38%	37%
3	7,200	90°	20%	22%
4	8,900	90°	5%	4%
	Average ROT		52 seconds	52 seconds

TABLE 5-5, REDIM RESULTS FOR 8,900-FOOT LONG RUNWAY

Note: Percentages may not sum to 100% due to rounding. Source: REDIM V3 analysis

Table 5-6 presents the REDIM results for a 7,300-foot long runway. ROT is below 50 seconds due to the shorter length of the runway.

TABLE 5-6, REDIM RESULTS FOR 7,300-FOOT LONG RUNWAY

Exit	Exit Distance from Threshold	Exit Angle	Exit Usage	
			2028	2033
1	4,900	30°	51%	50%
2	5,700	30°	37%	38%
3	7,300	90°	12%	12%
Average ROT			47 seconds	48 seconds

Source: REDIM V3 analysis

This exit location information for the various runway lengths will be used to determine the appropriate placement of exits in the alternatives. The actual locations of the exits may differ slightly due to the location of thresholds, existing exits, and glideslopes.

6 Development of Alternatives

Based on the upcoming changes in FAA runway separation requirements and the runway length analysis, three alternatives with new runways in the midfield were developed. The alternatives are summarized in **Exhibit 6-1**. The three alternatives are shown in more detail on **Exhibit 6-2** through **Exhibit 6-4**. This section discusses typical or primary runway use when discussing the alternatives. It is important to note that no new restrictions on runway use are proposed or assumed. The proposed new runway will be usable by arrivals and departures.



EXHIBIT 6-1, MIDFIELD RUNWAY ALTERNATIVES SUMMARY

¹ Proposed Action

Source: Landrum & Brown analysis, 2020

6.1 Alternative 1 (Proposed Action)

Alternative 1 is the Proposed Action. It includes a 10,000-foot long midfield runway with 3,100 feet of separation to Runway 18R/36L and 1,200 feet of separation to Runway 18C/36C. The new runway does not have sufficient spacing between it and either of its two adjacent runways to allow for triple simultaneous independent straight-in approaches, so it is intended to be used primarily by departures. As a result of this intended use, the new runway is 10,000 feet long in this alternative. Runways 18R/36L, 18C/36C, and 18L/36R are anticipated to be used for arrivals, providing triple simultaneous independent approach capability. Runways 01/19 and 18L/36R would be used for departures.

Runway 01/19 is intended for departure use so it is not necessary to optimize ROT in this alternative. As a result, two high-speed exits are provided in north flow and one is provided in south flow. The locations of the exits differ from that shown in Section 5, *Runway Exit Geometry*, due to the location of other taxiways and navigational aids.

Alternative 1 includes the construction of a partial north EAT (NEAT), and a full south EAT (SEAT). The alternative also includes the construction of a west parallel taxiway and the extension of Taxiway V (the taxiway between the new runway and Runway 18C/36C) to the Runway 01 threshold. There is 1,200 feet of separation between Runways 01/19 and 18C/36C, so Taxiway V has sufficient spacing to both runways to allow unrestricted taxiing during all weather conditions.

EXHIBIT 6-2, ALTERNATIVE 1



Source: Landrum & Brown, 2020

EXHIBIT 6-3, ALTERNATIVE 2



Source: Landrum & Brown, 2020

EXHIBIT 6-4, ALTERNATIVE 3



Source: Landrum & Brown, 2020

6.2 Alternative 2

As in the Proposed Action, Alternative 2 includes a 10,000-foot long midfield runway. The runway is shifted 100 feet to the east in this alternative to provide 3,200 feet of separation to Runway 18R/36L and 1,100 feet of separation to Runway 18C/36C. The new runway does not have sufficient spacing between it and either of its two adjacent runways to allow for triple simultaneous independent straight-in approaches so is intended to be used primarily by departures. As a result of this intended use, the new runway is 10,000 feet long in this alternative. Runways 18R/36L, 18C/36C, and 18L/36R are anticipated to be used for arrivals, providing triple simultaneous independent approach capability. Runways 01/19 and 18L/36R would be used for departures. This runway use is the same as in Alternative 1.

As discussed in Section 2, *Runway Separation*, the 3,200-foot separation between the new runway and Runway 18R/36L would provide operational flexibility to air traffic controllers because dual simultaneous independent approaches would be permitted to Runways 18R/36L and 01/19. The controllers could opt to run arrivals to these two runways while using Runways 18C/36C and 18L/36R for departures in non-peak arrival periods. This would segregate arriving and departing traffic, possibly providing operational benefits. The 3,200-foot separation would also position CLT to take advantage of any potential future reductions in runway separation requirements.⁹

Runway 01/19 is intended for departure use, however, due to its potential use as an arrival runway during offpeak times, it is important to optimize ROT to the extent possible in this alternative. As a result, three high-speed exits are provided in north flow and two are provided in south flow. The locations of the exits differ from that shown in Section 5, *Runway Exit Geometry*, due to the location of other taxiways and navigational aids.

Alternative 2 includes the construction of a partial NEAT and a full SEAT. The alternative also includes the construction of a west parallel taxiway and the extension of Taxiway V (the taxiway between the new runway and Runway 18C/36C) to the SEAT in order to allow arrivals on Runway 01/19 to access the SEAT. There is 1,100 feet of separation between Runways 01/19 and 18C/36C, which falls short of the recommended separation between closely spaced parallel runways for ADG V aircraft. As a result of having 1,100 feet of separation between the location of the Runway 36C glideslope, ADG V aircraft cannot taxi on Taxiway V when visibility is less than a half mile.¹⁰

6.3 Alternative 3

Alternative 3 includes a new midfield runway with 3,400 feet of separation to Runway 18R/36L and 900 feet of separation to Runway 18C/36C. The new runway has sufficient spacing between it and Runways 18R/36L and 18L/36R to allow for triple simultaneous independent straight-in approaches. As a result, it is intended to be used primarily by arrivals along with Runways 18R/36L and 18L/36R. Runways 18C/36C and 18L/36R would be used for departures.

Alternative 3 includes the construction of a partial NEAT, and a full SEAT. The 900-foot separation between the proposed runway and Runway 18C/36C allows for a center taxiway with 450 feet separation to both runways, which results in restricted use. ADG V aircraft cannot use this taxiway when visibility is less than a ½ mile. The 900-foot spacing also results in another restriction. The location of the Runway 18C and 36C glideslopes and associated critical areas combined with the 900-foot spacing means Taxiway V cannot extend the full length of Runway 01/19 and cannot connect to the EATs (a minimum of 560 feet of spacing is required between the runways to allow aircraft to taxi past the Runway 18C and 36C glideslope antennas).

⁹ Because dual simultaneous independent approaches would be permitted to Runways 18R/36L and Runway 01/19 if the runways were 3,200 feet apart and because the separation between Runway 01/19 and Runway 18L/36R far exceeds the requirement of 3,400 feet for triple simultaneous independent approaches, it may be possible to obtain a waiver from FAA to operate triple simultaneous independent approaches at CLT in the future. This would require further study and consultation with FAA.

¹⁰ A separation of 642.5 feet is required between Runway 36C and Taxiway V on the southern portion of Taxiway V to allow unrestricted taxing past the Runway 36C glideslope critical area. With 1,100 feet of separation between Runways 18C/36C and 01/19, that leaves 457.5 feet of separation between Taxiway V and Runway 01/19, which is not sufficient to allow ADG V aircraft to taxi when visibility is less than a half mile.

It is important that aircraft have the ability to exit Runway 01/19 to both the east and the west. Aircraft exiting to the west can use the EATs to reach the terminal area, avoiding runway crossings. In addition, ADG V aircraft, which cannot use Taxiway V when visibility is less than a half mile, need to be able to exit to the west. According to the runway exit analysis, two high-speed exits are required in order to achieve runway occupancy times of less than 50 seconds. If the two glideslopes for Runway 01/19 were placed on the west side of Runway 01/19 (most typical location), their critical areas would conflict with the optimal location of the runway exits. Because the parallel taxiway to the east of Runway 01/19 has restricted use due to the separation between the proposed runway and Runway 18C/36C, the glideslopes were placed on the west side of Runway 01/19. This placement of the glideslopes allows two high-speed exits to be placed on the west side of the runway in both directions.

The ability to exit to the east Runway 01/19 is needed because it provides a shorter path to the terminal. If the new runway were 7,300 feet long, Taxiway V could only extend from Taxiway E3 to Taxiway V4 due to the location of the Runways 18C, 19, 01, and 36 glideslopes as well as the location of Runway 36C high-speed exits. This distance is 3,500 feet which is not sufficient to allow most aircraft in the CLT fleet to exit to the east. In order for the center taxiway to be long enough to provide the capability for all arrivals to exit east, the runway needs to be longer. A length of 8,900 feet provides 7,303 feet of usable runway length for south flow arrivals exiting east and 7,418 feet of usable runway length for north flow arrivals exiting east. Thus, Runway 01/19 is 8,900 feet long in Alternative 3. It has one high-speed exit in both directions to the east of Runway 01/19.

The location of the runway and exit taxiways requires that a portion of Taxiway N, a portion of the newly constructed Taxiway V, and Taxiway E8 (a high-speed exit for Runway 36C) be removed. The removal of a Runway 36C high-speed taxiway is not expected to cause an increase in ROT for Runway 36C.

7 Alternatives Comparison

There are several key differentiators between the three alternatives: (1) EAT holding requirements, (2) runway use and runway crossings, (3) Taxiway V capability, (4) navigational aid placement, and (5) the ability to provide future flexibility. The alternatives were screened with regards to these factors to identify any fatal flaws.

The alternatives will all result in differing costs, implementation time frames, and operational performance. These factors will be assessed as part of the EA alternatives analysis to determine which ones should be carried forward for detailed environmental analysis.

7.1 End Around Taxiway (EAT) Holding

An EAT is a taxiway that crosses the extended centerline of a runway, on which aircraft do not require clearance from air traffic control (ATC) to cross. EATs can improve efficiency and reduce runway crossings. All three alternatives have full EATs around Runways 19 and 18C on the north end and around Runways 01 and 36C on the south end. These EATs were designed based on the following guidance in FAA AC 150/5300-13A, *Airport Design*:

- The centerline of an EAT must be at least 1,500 feet from the stop end of the runway for a minimum of 500 feet on each side of the extended runway centerline.
- The minimum dimensions are typically increased in order to prevent aircraft tails from being a penetration to the 40:1 departure surface or any other relevant surfaces.
- EATs can be placed at a lower elevation than the stop end of the runway to reduce the distance between the runway end and the EAT that is perpendicular to the extended runway centerline.
- It is not currently possible for aircraft to taxi unrestricted on the EAT in the approach surface of an incoming arrival.

7.1.1 South EAT Holding Requirements

The perpendicular portion of the SEAT is located 2,600 feet from the stop end of Runways 01 and 36C in all three alternatives. This distance allows unrestricted flow on the EATs under departing aircraft because all tail heights for the CLT fleet can clear the 40:1 departure surface.

7.1.2 North EAT Holding Requirements

On the north end of Alternatives 1 and 2, the perpendicular portion of the NEAT is located 1,500 feet from the stop end of Runway 19 and 18C. The 1,500-foot distance is the maximum distance that can be achieved without relocating the railroad to the north of the runways. This distance requires that ADG IV and V aircraft hold for ATC clearance before taxiing around the NEAT because the ADG IV and V aircraft tail heights cannot clear the 40:1 departure surface. This restriction is not expected to be significant because there are no commercial ADG IV aircraft forecast for 2028 and 2033 and less than two percent of operations are expected to be ADG V. Air traffic controllers have indicated that they would most likely land ADG V aircraft on one of the other runways to avoid the issue of holding on the NEAT.¹¹ For Alternative 3, the perpendicular portion of the NEAT is located 2,578 feet from the stop end of Runways 19 and 18C. This distance does not require any holding on the EAT under departing aircraft.

7.2 Runway Use and Runway Crossings

When operating on closely spaced runways such as proposed Runway 01/19 and existing Runway 18C/36C, departures typically occur on the "inboard" runway (runway closest to the terminal) and arrivals occur on the outboard runway (runway furthest from the terminal). Alternative 3 would be able to be operated this way but Alternatives 1 and 2 would not. In the case of Alternatives 1 and 2, there is insufficient separation between Runway 01/19 (the outboard runway) and Runway 18R/36L to allow triple simultaneous IFR approaches on Runways 01/19, 18R/36L, and 18L/36R. As a result, in these alternatives, arrivals would typically use the inboard runway (Runway 18C/36C) and departures would typically use the outboard runway (Runway 01/19).¹² An example of both runway use situations is shown on **Exhibit 6-5**.

EXHIBIT 6-5, RUNWAY USE EXAMPLES



Source: Landrum & Brown analysis, 2020

These differences in runway use would result in different EAT usage and runway crossings assumptions, as described in the subsections that follow.

7.2.1 Alternatives 1 and 2

Primary taxi flows for Alternative 1 are shown on **Exhibit 6-6**. The taxi flows for Alternative 2 would be the same as Alternative 1 so they are not shown on an exhibit. In Alternatives 1 and 2, all North Flow arrivals on Runway 36L and 01 would exit to the east and use the NEAT to reach the terminal. Similarly, in South Flow, arrivals on

¹¹ Direction, Oversight, Review, and Agree (DORA) Meeting #4, January 27, 2021

¹² No restrictions on runway use are proposed or assumed for the new runway. Additionally, no runway use restrictions are proposed for the existing runways.
18R and 19 would exit to the east and use the SEAT to access the terminal. No arrivals would be required to cross a runway to reach the terminal area in these alternatives.

Departing aircraft bound for Runway 01 in North Flow or Runway 19 in South Flow would cross Runway 18C/36C at two locations to reach the departure queue. These departing aircraft were assumed to cross Runway 18C/36C instead of using the EATs for several reasons:

- FAA air traffic officials indicated they would rather cross Runway 18C/36C than taxi on the EATs due to the amount of time it would take for aircraft to taxi through the approach surface.¹³
- Participants at the Safety Assessment Workshop (October 16, 2020) identified a hazard with a high potential risk related to holding on the EATs for the approach surface of Runway 18C/36C.
- Large gaps in the arrival stream (eight to nine nautical miles) would be required in order to allow aircraft on the EATs to taxi through the approach surfaces of Runway 18C/36C. These gaps would result in reduced capacity on Runway 18/36C. If the gaps are not provided, taxiing aircraft would have long ground delays while waiting for a natural gap in the arrival sequence. Crossing the runway was found to take less time and result in a more efficient operation than taxiing on the EATs.

Based on these factors, crossing the runway was identified as preferable over taxiing through the approach surfaces on the EATs.

There would be more runway crossings with Alternatives 1 and 2 versus Alternative 3 because all Runway 01/19 departures would be required to cross a runway to reach their departure queue in Alternatives 1 and 2. Runway 01/19 departures would have to cross an arrival runway (Runway 18C/36C) to access the Runway 01/19 departure queue. This type of operation creates a more complex situation for air traffic controllers to manage than when arrivals are on the outboard runway and departures are on the inboard runway. In general, it is more complicated to cross an arrival runway than a departure runway for two reasons:

- Arrivals restrict the runway from use by crossing aircraft for a longer period of time than departures. Arrivals that are less than two miles out "own" the runway until they land and pass the runway crossing point, whereas departures only "own" the runway from the point of takeoff clearance until they pass the runway crossing point.
- Crossing an arrival runway provides less flexibility to manage the flow of aircraft on the ground. Arrivals cannot be told to hold in the air for a runway crossing. If separation cannot be assured between arrivals due to a slow runway crossing or other reason, the controller must send the arriving aircraft around for a missed approach to avoid an operational error. On the other hand, departures on the ground can be told to hold for runway crossings, providing flexibility to reduce taxiway congestion.

¹³ Feedback received at DORA Meeting #2 (June 11, 2020).



EXHIBIT 6-6, ALTERNATIVE 1 PRIMARY TAXI FLOWS - NORTH FLOW/SOUTH FLOW

Note: Alternative 2 would have identical taxi flows to Alternative 1. Source: Landrum & Brown, 2020

7.2.2 Alternative 3

Primary taxi flows for Alternative 3 are shown on **Exhibit 6-7**. All arrivals on Runways 36L would use the NEAT and all Runway 18R arrivals would use the SEAT. Runway 01/19 arrivals could exit to the east or west. Runway 01 arrivals exiting to the west would use the NEAT and Runway 19 arrivals that exit west would use the SEAT. Runway 01/19 arrivals that exit west would use the SEAT. Runway 01/19 arrivals that exit east would have to cross Runway 18C/36C to reach the terminal area. It was assumed that the Runway 01/19 arrivals would use the EATs during peak periods of activity to reduce the capacity impacts of runway crossings. Exiting to the east (with the associated runway crossing) was assumed to occur in off-peak periods, resulting in fewer runway crossings than Alternatives 1 and 2. Runway 18C/36C would be primarily used by departing aircraft so the Runway 01/19 arrivals that do cross Runway 18C/36C would be crossing a departure runway. Crossing a departure runway is less complex for air traffic controllers to manage than crossings an arrival runway.

7.3 Taxiway V Capability

When constructing a new runway, the supporting taxiway structure is critical. The ability to provide sufficient taxiway capacity and meet all applicable FAA standards to the extent possible is imperative to ensuring that runway capacity can be maximized and in enabling aircraft to transition to/from the terminal area with minimal delay and restrictions. Providing a taxiway between two parallel runways is one key factor in providing sufficient taxiway geometry to support a new runway. A parallel taxiway between two runways provides an alternative location for aircraft to queue for departure that is outside of the terminal area and allows aircraft a place to hold while waiting to cross a runway. FAA recommends 1,200 feet of separation between two parallel runways to allow for proper taxiway geometry.¹⁴

¹⁴ FAA AC 150/5300-13A, Airport Design

All of the CLT alternatives meet all applicable FAA requirements for taxiway design and provide a full parallel taxiway to the west of Runway 01/19. They differ in the capability of the taxiway between Runways 01/19 and 18C/36C. Alternative 1 is the only alternative that provides a full parallel taxiway between the runways, meets FAA recommendations, and is capable of accommodating ADG V aircraft in all weather conditions.

Alternative 2 provides a full parallel taxiway between the runways but ADG V aircraft cannot taxi on it when visibility is less than a half mile because the separation between Runways 18C/36C and 01/19 is 1,100 feet. ADG V aircraft would have to exit Runway 01/19 to the west during these low visibility conditions, resulting in a longer taxi times and less flexibility for air traffic controllers. This restriction is not expected to be significant because less than two percent of operations are expected to be ADG V and the referenced low visibility conditions occur less than one percent of the time.

Alternative 3 has 900 feet of separation between Runways 01/19 and 18C/36C. Similar to Alternative 2, this separation does not allow ADG V aircraft to taxi on Taxiway V when visibility is less than a half mile. ADG V aircraft would have to exit Runway 01/19 to the west during these low visibility conditions, resulting in a longer taxi times and less flexibility for air traffic controllers. As with Alternative 2, this restriction is not expected to be significant. In addition, a full taxiway cannot be provided between Runways 01/19 and 18C/36C due to the location of the Runway 18C/36C glideslopes. The lack of a full length taxiway means that the EAT would not be accessible to aircraft that exit Runway 01/19 to the east. It also means there would be less flexibility for controllers because there would be less space for aircraft to queue for departure and fewer places for aircraft to hold while waiting to cross Runway 18C/36C.



EXHIBIT 6-7, ALTERNATIVE 3 PRIMARY TAXI FLOWS - NORTH FLOW/SOUTH FLOW

Source: Landrum & Brown, 2020

7.4 Navigational Aid Placement

Glideslopes are located on the sides of runways near the runway ends. They have critical areas that need to be kept free of aircraft when the glideslope is in use. As a result, glideslope placement must be carefully considered so that there are no implications to taxiing aircraft.

For Alternatives 1 and 2, the Runway 01/19 glideslopes were placed on the west side of the runway. There is sufficient separation between the runway and the west parallel taxiway to allow aircraft to taxi unrestricted adjacent to the glideslope critical area. The glideslope and its critical area do not cause restrictions on taxiing aircraft.

Alternative 3 would require that the Runway 01/19 glideslopes be placed between Runways 01/19 and 18C/36C in order to allow for high-speed exits on the west side of the runway. This placement results in the Runway 01 glideslope being co-located with the Runway 36C glideslope. While it is possible to co-locate the glideslopes, there may be issues with the glideslopes and the terminal instrument procedures (TERPS) surfaces – this requires further study. If this glideslope siting is ultimately not possible, the glideslope would have to be placed on the west side of the runway. If the Runway 01 glideslope is located on the west side of the runway, the second high-speed exits in both directions would be in the glideslope critical area which may not be permitted due to signal reflectivity issues. Not having the second high-speed exit in both directions could increase runway occupancy times and ultimately reduce the capacity of the runway.

7.5 Future Flexibility

Alternative 2 provides 3,200 feet of separation between Runways 01/19 and 18C/36C, which meets the minimum requirement for dual simultaneous independent approaches under the FAA's upcoming rule change. The separation between Runways 01/19 and 18L/36R in this alternative is 6,100 feet, which is far in excess of the 3,400 feet of separation that will be needed for triple simultaneous independent approaches under the new FAA requirements. The capability to run duals to Runways 18R/36L and 01/19 combined with the excess separation between Runways 01/19 and 18L/36R may make it possible to get approval to run triples to Runway 01/19 in the future. If so, Alternative 2 would be operated with arrivals on Runways 18R/36L, 01/19, and 18L/36R. With regards to the set of closely spaced parallel runways (01/19 and 18C/36C), arrivals would occur on the outboard runway, with departures on the inboard runway. This is a more typical runway use which would result in fewer runway crossings and reduce crossings of an arrival runway. As a result, Alternative 2 could provide future flexibility that may not be available with Alternative 1. It is important to note that this runway use has not been approved and is not assumed as part of this EA. The ability to run triples with 3,200 feet of separation would require future study and consultation with the FAA.

The future flexibility concept is not necessary with Alternative 3 because its 3,400-foot separation takes advantage of the upcoming FAA rule change for triple approaches. No additional flexibility would be needed.

7.6 Conclusions

The results of the alternatives screening are summarized in **Table 7-1**. Alternative 1 would have a fully capable taxiway system with no aircraft size restrictions and the glideslope siting is standard. However, this alternative would have more runway crossings than Alternative 3, would require crossings of an arrival runway, would require holding by ADG IV and V aircraft on the NEAT, and would not provide future flexibility with regards to triple approaches to the new runway.

Alternative	Pro/Con	EAT Holding	Runway Crossings	Taxiway V Capability	Navigational Aid Placement	Future Flexibility
1 ¹	Con	ADG IV and V aircraft required to hold on NEAT;	Rwy 01/19 departures cross inboard arrival runway	n/a	n/a	No
	Pro	no holding on SEAT	n/a	Full length, unrestricted Taxiway V	Standard placement	n/a
2	Con	ADG IV and V aircraft required to hold on NEAT;	Rwy 01/19 departures cross inboard arrival runway	ADG V cannot use Taxiway V when visibility is less than a half mile	n/a	Yes
	Pro	no holding on SEAT		Full length Taxiway V	Standard placement	n/a
3	Con	n/a	n/a	Partial Taxiway V; ADG V cannot use Taxiway V when visibility is less than a half mile	Requires 18C/19 and 36C/01 glideslopes to be co-located which may have TERPS issues	n/a
	Pro	No holding on NEAT or SEAT	some Rwy 01/19 arrivals cross inboard departure runway	n/a	n/a	n/a

TABLE 7-1, ALTERNATIVES SCREENING SUMMARY

Note: ¹ Proposed Action

Source: Landrum & Brown analysis, 2021

Alternative 2 would provide a full length Taxiway V, the glideslope siting is standard, and it would provide future flexibility with regards to triple approaches to the new runway. However, this alternative would have an aircraft size restriction on Taxiway V, more runway crossings than Alternative 3, require crossings of an arrival runway, and require holding by ADG IV and V aircraft on the NEAT.

Alternative 3 would not require holding for arriving aircraft on the EATs, would have the least complex runway use, and would have fewer runway crossings than Alternatives 1 and 2. However, it would have the least amount of capability on Taxiway V and would require co-location of glideslopes.

Each of these alternatives has its pros and cons but no fatal flaws. It is therefore recommended that all three alternatives be carried forward into the EA for airfield simulation analysis to determine the best performing alternative from an operational perspective.