

# APPENDIX B

## AVIATION ACTIVITY FORECASTS

---

### B.1 PURPOSE

The purpose of this appendix is to determine if the City of Chicago's (City) Aviation Forecasts appropriately represent the level of aircraft activity likely to occur at O'Hare International Airport (O'Hare or the airport) during the forecast period. Consideration is given to whether the forecast conditions are reasonable given historical data and the outlook for the future.

---

### B.2 INTRODUCTION AND BACKGROUND

The Chicago Department of Aviation (CDA) submitted, to the Federal Aviation Administration (FAA) and the FAA Third Party Consultant, documentation with its annual activity and design day forecasts for enplanements and operations including passenger airlines, cargo airlines, general aviation, and military. This documentation can be found at the end of this chapter in **Attachment B-2**. The FAA and its Third Party Consultant, herein referred to as the FAA Third Party Consultant, reviewed the materials provided by the CDA on annual enplanement and operations forecast for the period ending 2030.

The CDA utilized the FAA's Terminal Area Forecast (TAF) for the annual enplanement forecast and historical schedule data, along with future fleet orders, for the annual operations forecast. Each year the FAA prepares a TAF, and the forecasts are based on industry standard analyses of Federal Fiscal Year trends in airline service and represent the FAA's official outlook for airports in the National Plan of Integrated Airport Systems (NPIAS). When this Environmental Assessment (EA) was started in 2019, the most current FAA forecast available at the time was the 2018 TAF, published in early 2019. The TAF projects operations and enplanements for fiscal years ending on September 30. The following years were selected for analysis: 2023 (peak construction year) and 2030 (Build Out).

Work on the EA process commenced in 2019. Due to extensive special purpose law analysis, the proposed construction schedule for the Proposed Action was shifted by two years. The original forecast period utilized to assess the environmental effects of the Proposed Action was 2019-30 with specific design days analyzed for the Interim Condition in 2023, representing a peak construction year, and 2030 reflecting Build Out. As a result of the revised timetable, the forecast year representing peak construction conditions analyzed in the Interim year shifts from 2023 to 2025, and Build Out shifts from 2030 to 2032. The FAA re-examined the differences in passenger operations, passenger fleet mix, and total aircraft operations from 2023 and 2030 to 2025 and 2032. The analysis in **Attachment B-1** demonstrates that differences in fleet mix and operations are not material and that there would not be significant changes to the forecast if the analysis years are shifted.

For the analysis required, these fiscal year activity levels were adjusted to full calendar years (CY). The CDA forecasts are presented in **Table B-1**.

**TABLE B-1**  
**CHICAGO DEPARTMENT OF AVIATION ACTIVITY FORECASTS**

	<b>2018</b>	<b>2023</b>	<b>2030</b>	<b>CAGR: 2018-2030</b>
Enplanements (Mns)	41.6	47.4	53.6	2.1%
<b>Operations</b>				
Passenger	877,461	918,075	973,592	0.9%
Cargo	24,739	28,433	34,283	2.8%
General Aviation	5,770	5,906	5,906	0.2%
Military	75	75	75	0.0%
Total Operations	908,045	952,489	1,013,856	0.9%
Notes: Compound annual growth rate (CAGR); millions (Mns) Sources: Chicago Department of Aviation Terminal Area Plan and Air Traffic Actions Environmental Assessment Annual Activity Forecast; January 24, 2020				

Additionally, the COVID-19 pandemic occurred between the time of the CDA's development of the activity forecast and the completion of this document. As a result, the FAA Third Party Consultant analyzed the impact COVID-19 might have on O'Hare's activity levels. The analysis found that COVID-19 had an immediate and significant impact on O'Hare's passenger traffic and operations, but that O'Hare would return to growth and achieve previously forecasted traffic levels for 2030 by 2032. This is consistent with the change in the EA construction schedule; therefore, the CDA forecasts remain appropriate for environmental purposes. A summary of this analysis can be found in **Appendix N**.

### **B.3 SCOPE OF WORK**

The FAA requested that its Third Party Consultant complete a comprehensive review of the CDA's forecasts to determine if the annual enplanement and operation levels and assumptions were appropriate and if the CDA's Design Day Flight Schedules were reasonable and appropriate for environmental modeling purposes for this EA. A key element in the review of the forecasts was whether the facilities in the Proposed Action would induce demand. The analysis included (1) a review of passenger traffic trends at O'Hare, Chicago, and the United States (U.S.) aviation industry, (2) trends in aircraft operations and fleet mix, and (3) peak month average day activity in design day flight schedules. The FAA Third Party Consultant needed to determine whether a new forecast for the EA—other than prepared by the CDA—was required.

### **B.4 METHODOLOGY**

To validate the use of the CDA's forecasted activity levels in the EA, the FAA's Third Party Consultant independently assessed three factors:

1. The CDA's methodology and results,
2. The underlying trends in the relevant aviation market, and,
3. The likelihood that the Proposed Action would result in induced demand.



## B.5 PASSENGER TRAFFIC ANALYSIS

The CDA utilized the FAA's 2018 TAF enplanement (passenger) forecast for O'Hare for use in the EA.<sup>1</sup> The TAF is prepared by reviewing recent industry trends and expectations of future airline service and schedule data to inform near-term forecasts, and through statistical analysis of the relationship between historical demand and local and national economic conditions to inform longer-term forecasts. Per the FAA, the TAF assumes a demand-driven forecast for aviation services based on local and national economic conditions and conditions within the aviation industry and is developed independent of the ability of the airport and air traffic control system to provide the capacity required to meet demand.

To make the TAF useful for the EA analysis, three adjustments or assumptions were made by the CDA. Notably, the CDA:

1. Converted the TAF's enplanement projections from Federal Fiscal Years ending September 30 to Calendar Years ending December 31. The CDA utilized U.S. Department of Transportation T-100 data from the time period between December 2017 and November 2018 to make this conversion.
2. Assumed that O'Hare's Origin and Destination (O&D) and connecting passenger split remains stable throughout the forecast period. This assumption is also made by the FAA in creating the TAF.
3. Adjusted the TAF to account for non-revenue passengers, which in 2018 represented 3.2 percent of O'Hare's passengers. (The TAF only includes revenue passengers.) To reflect all the activity at O'Hare, non-revenue passengers—such as airline staff travelers—were added to the TAF based on U.S. Department of Transportation T-100 data.

The TAF and the CDA's forecast of enplanements are shown in **Attachment B-2** and in **Table B-2**.

**TABLE B-2**  
**CHICAGO DEPARTMENT OF AVIATION ENPLANEMENT FORECASTS**

Year	TAF (Fiscal Years)	TAF (Calendar Years)
2007	36,742,947	36,217,744
2008	34,630,139	33,786,366
2009	31,235,776	31,412,704
2010	31,947,531	31,917,226
2011	31,825,619	31,932,654
2012	32,256,202	32,185,877
2013	31,973,296	32,342,340
2014	33,457,901	34,021,847
2015	35,726,566	36,130,416
2016	37,351,189	37,554,536
2017	38,169,220	38,568,476
2018	39,775,365	40,309,141
2019	41,922,662	42,184,491

<sup>1</sup> [https://www.faa.gov/data\\_research/aviation/taf/](https://www.faa.gov/data_research/aviation/taf/)

Year	TAF (Fiscal Years)	TAF (Calendar Years)
2020	42,975,959	43,211,552
2021	43,923,714	44,144,993
2022	44,813,884	45,027,930
2023	45,674,957	45,878,026
2024	46,491,870	46,694,565
2025	47,307,278	47,509,690
2026	48,121,550	48,331,092
2027	48,964,505	49,183,402
2028	49,845,092	50,072,333
2029	50,759,245	50,993,653
2030	51,702,230	51,941,815
CAGR (2007-18)	0.7%	1.0%
CAGR (2018-30)	2.2%	2.1%
Sources: Chicago Department of Aviation Terminal Area Plan and Air Traffic Actions Environmental Assessment Annual Activity Forecast; January 24, 2020; Federal Aviation Administration 2018 Terminal Area Forecast		

### B.5.1 Review of the CDA Analysis Completed in Support of Utilizing the 2018 TAF

The CDA prepared two analyses to assess the reasonableness of using the 2018 TAF for O'Hare for the annual enplanement forecast. These analyses are:

1. Regression analyses of O'Hare's total enplanements, using both local and national economic and demographic data as independent variables, and forecasting enplanements in future years using the generally accepted sources of economic forecasts and the historical relationship between those variables and enplanements.
2. Review of O'Hare's historical share of U.S. Revenue Enplaned Passengers, generating a forecast of enplaned passengers at O'Hare should its share of the U.S. total remain at 4.5 percent over the forecast period.

Both analyses' growth rates were in line with the 2018 TAF Compound Annual Growth Rate (CAGR) of 2.1 percent from 2018 to 2030.

#### B.5.1.1 CDA Regression Analysis

The CDA conducted a regression analysis that examined the relationship between historical total passengers and local and national economic and demographic data. The CDA used single variable regression analysis to analyze the relationships between passenger volumes and the economic and demographic data. The economic and demographic variables included earnings, employment, gross regional product, population, personal income, and personal income per capita for the Chicago Combined Statistical Area and the U.S. This analysis was used to forecast enplaned passenger volumes over the forecast period from 2019 through 2030.

The CDA presented to the FAA the coefficient of determination, commonly referred to as the r-squared value, and the CAGR associated with each regression. The R-Squared Values all indicated that the independent socio-economic variables explained approximately 90 percent or more of the variation in the dependent aviation activity variable and as such were acceptable on econometric and statistical bases.

The forecasted growth rates using regression analysis generated similar results to the TAF growth rate of 2.1 percent. This led the CDA to conclude that the 2018 TAF growth rates were appropriate to use for the enplaned passenger forecast.

### B.5.1.2 CDA Market Share Analysis

The second method that the CDA used to assess the reasonableness of the TAF was to conduct a market share analysis of O'Hare's revenue enplaned passengers compared to the United States. This analysis used the FAA's national forecast for U.S. revenue enplaned passengers and the 2018 TAF for O'Hare. Based on O'Hare's historic share of the U.S. revenue enplaned passengers (4.5 percent), the CDA forecasted O'Hare's enplaned passenger volumes through 2030. This method produced a 2.1 percent growth rate for O'Hare, same as for the TAF.

### B.5.1.3 Conclusion of the CDA's Analysis and Further Information Required by FAA

Overall, both the regression analysis and the market share analysis produced results that support the utilization of the TAF's enplaned passenger forecast for O'Hare. The CDA's annual forecast for enplaned passengers is shown in **Table B-3**. With a CAGR of 2.1 percent through 2030, O'Hare's enplaned passengers are forecast to increase from 41.6 million in 2018 to 53.6 million in 2030.

**TABLE B-3**  
**CHICAGO DEPARTMENT OF AVIATION ENPLANEMENT FORECASTS**

Year	Total Enplaned Passengers
2018	41,623,010
2019	43,560,290
2020	44,620,281
2021	45,583,343
2022	46,494,099
2023	47,370,842
2024	48,212,837
2025	49,053,364
2026	49,900,388
2027	50,779,408
2028	51,696,340
2029	52,646,798
2030	53,625,042
CAGR (2018-30)	2.1%
Sources: Chicago Department of Aviation Terminal Area Plan and Air Traffic Actions Environmental Assessment Annual Activity Forecast; January 24, 2020	

To further validate the appropriateness of the TAF, the FAA and its Third Party Consultant requested information on O'Hare's historic response to the easing of constraints, either by easing schedule limits or through increased gate availability. The Proposed Action would increase linear gate frontage by 14.2 percent. If the airport were currently constrained and unable to accommodate new carriers and/or

additional service, there would be pent-up demand. This pent-up demand could be relieved when the new facilities become available. This pent-up demand is also known as latent demand. If that were the case, the airport could experience growth due to "induced demand."

In response to the FAA's request, the CDA report assessed the concept of induced demand. The CDA analyzed the current utilization of gates at O'Hare by reviewing the current flight schedule and finding that the current gates at O'Hare are not utilized as intensively as they could be. In essence, the CDA found that existing gates could accommodate more flights per day or larger aircraft, in alignment with normal airline practices to not schedule more than 8 to 10 turns per gate per daily.<sup>2,3,4</sup> Therefore, the CDA concluded that with no pent-up demand at present, there is no likelihood of induced demand in the future. The FAA's Third Party Consultant conducted an independent analysis that examined actual trends with easing of capacity constraints and reached the same conclusion regarding historic factors. The independent analysis is presented in the following section.

### **B.5.2 FAA Third Party Consultant Analysis of Historical Data to Understand Whether O'Hare Exhibits Indicators of Induced Demand**

Because O'Hare has been subject to activity limitations in the past, this analysis assesses whether there is evidence that pent-up demand growth occurred after the capacity limitations were eased or if facility constraints resulted in curbing of traffic growth.

The FAA's Third Party Consultant analyzed a series of factors that required deeper analysis. Specific emphasis was placed on examining O'Hare's carriers' seat capacity responses after relief from capacity constraints either through new runway capacity (and subsequent easing of FAA schedule limits) or the addition of gates. This has occurred three times in O'Hare's recent past.

1. In 2004, the FAA enforced a previously voluntary restriction on the number of aircraft operations that O'Hare could accommodate. This was done in response to excessive delays caused by insufficient runway capacity. This schedule limit was lifted in 2008 after new Runway 9L/27R opened and the capacity of the airfield increased.
2. The second easing of facility capacity constraints resulted from remedies required by the U.S. Departments of Justice and Transportation to approve the merger of American Airlines and US Airways in December 2013. This merger resulted in American Airlines ("American") making gates available to other airlines.
3. The third occurrence was in 2018, when five new gates opened for American in the Concourse L-Stinger.

To complete this analysis, the FAA's Third Party Consultant reviewed the following criteria:

- Passenger development in comparison to other large U.S. airports,
- Outbound passenger development in relation to local economic and demographic development,
- Inbound passenger development in comparison to other large U.S. airports,
- Non-stop international seat capacity in comparison to other large U.S. airports,
- Low-cost and ultra-low-cost carrier seat capacity and market share versus the U.S. average,
- The impact of gate reallocation at O'Hare following airline mergers: American/US Airways, Delta Air Lines/Northwest Airlines, and United Airlines ("United")/Continental Airlines,

<sup>2</sup> See ACRP Report 163, Guidebook for Preparing and Using Airport Design Day Flight Schedules, page 60

<sup>3</sup> As noted in Attachment B-1, the results of TAAM modeling of activity levels in 2023 and 2030 did not trigger delays under a no-action scenario and all flights could be gated.

<sup>4</sup> See Attachment B-2 for all gate schedules for No Action and Proposed Action conditions analyzed.

- Origin & Destination (O-D) versus Connecting Passenger trends at O'Hare on American and United Airlines,
- The impact of the removal of FAA orders Limiting Scheduled Operations at O'Hare<sup>5</sup> in 2008<sup>6</sup> following the opening of Runway 9L/27R,<sup>7</sup>
- The impact of airline schedule rebanking<sup>8</sup> versus de-peaking on passenger traffic,
- The impact of Global Alliances on airline seat capacity and traffic at O'Hare, and
- The impact of the new L-stinger gates on traffic and seat capacity at O'Hare.

Evidence of pent-up demand is defined as a broad-based increase in activity unleashed by facilities being made available that would result in a sustained change in activity at O'Hare. There were increases in year-to-year growth related to international carrier activity in 2014 and Ultra Low Cost Carrier activity in 2015. However, the multi-year growth rate from 2007 to 2018 indicated no change in activity trends. Over this period, O'Hare experienced slower growth than other Large Hubs and the industry. Therefore, no evidence exists of pent-up demand at O'Hare.

#### **B.5.2.1 Does passenger growth at O'Hare suggest a level of induced demand due to the easing of schedule limits or gate transfers due to carrier consolidation?**

**Table B-4** presents a comparison of O'Hare's enplaned passenger history for the 2007–18 period to that of all Large Hubs and the U.S. industry. Total enplaned passengers at O'Hare increased at a CAGR of 0.7 percent for the 11-year period. This rate is less than half of other Large Hub airports. For O'Hare, this marks a period when the new Runway 9L/27R opened and in 2008 slot restrictions were lifted by the FAA. Despite the newly available runway capacity, the period started with a steep decline due to a weak economy during the Great Recession of 2008 and 2009. This was followed by a four-year period of stagnation, where O'Hare's enplaned passengers remained 12 percent below its 2007 level and lagged the growth experienced in the broader airline industry. For the six-year period following the removal of slots at O'Hare, there was no evidence of pent-up demand being stimulated by the removal of slots. As discussed earlier, a series of econometric regressions conducted by the CDA's consultants that compared the growth in passenger traffic to both the Chicago and national economy found that the economy explained more than 90 percent of O'Hare's passenger traffic growth trends.

From 2013 to 2018, O'Hare outgrew other large hubs and the airline industry as shown in **Table B-4**. In 2014, gates historically used by the hub carriers were made available to Low Cost Carriers (LCCs) as a result of major carrier consolidation. Initially, O'Hare's growth accelerated. However, compared to large hubs and the industry, O'Hare's annual growth rate was only faster in 2014 and 2015 then lagged behind annual growth rates for the industry and large hubs in 2016.

<sup>5</sup> FAA Orders limiting scheduling at O'Hare were adopted on January 21, 2004, April 21, 2004, and August 18, 2004.

<sup>6</sup> The High Density Rule (or "Slot" rule) is a federal regulation established in 1969 (14 CFR Section 93.123) to manage congestion at five high-density airports: Ronald Reagan Washington National Airport, New York City's John F. Kennedy International, LaGuardia, Newark Liberty International airports, and Chicago's O'Hare International Airport (ORD). A slot is an Instrument Flight Rules (IFR) reservation for an arrival or a departure. A "slot pair" is equivalent to a round trip flight. O'Hare was subject to slot controls until 1999, when the slot control system was phased out through 2004. Schedule limits were reimposed for a temporary period while additional runways were built as a part of the O'Hare Modernization Plan, but have been removed since 2008. O'Hare remains a Worldwide Airport Slot Guidelines (WASG) Level II airport for schedule facilitation under FAA Schedule Orders.

<sup>7</sup> Due to significant delays following the phasing out of the High Density Rule in 2002, the FAA imposed schedule limits on O'Hare starting in 2004. The schedule limits expired when new Runway 9L/27R opened in 2008.

<sup>8</sup> Re-banking a hub means that a carrier intends to move its schedule back to a defined connecting bank hub in which large numbers of flights arrive during a short time period, remain on the ground for approximately an hour, then depart in large numbers during a short time period. The benefit of the defined connecting bank hub is that it maximizes revenue by providing connections between a large number of origin and destination points in a short period of time, but it is expensive to operate because it requires large amounts of space, equipment, and employees while planes are on the ground during a bank that stands empty or idle between banks.

Finally, despite the addition of five gates in Spring of 2018, O'Hare's growth in 2018 was lower than that of Large Hubs and the industry as a whole. Hence, analysis of total growth at O'Hare compared to other large hubs and the aggregate airline industry indicates growth rates broadly consistent with the economy and industry trends. Comparable growth at O'Hare and the industry does not support that new runway capacity or additional gates at O'Hare resulted in the release of pent-up demand.

**TABLE B-4**  
**TOTAL ENPLANEMENTS AT O'HARE, LARGE HUB AIRPORTS, AND THE U.S. INDUSTRY (MILLIONS, CY 2007-18)**

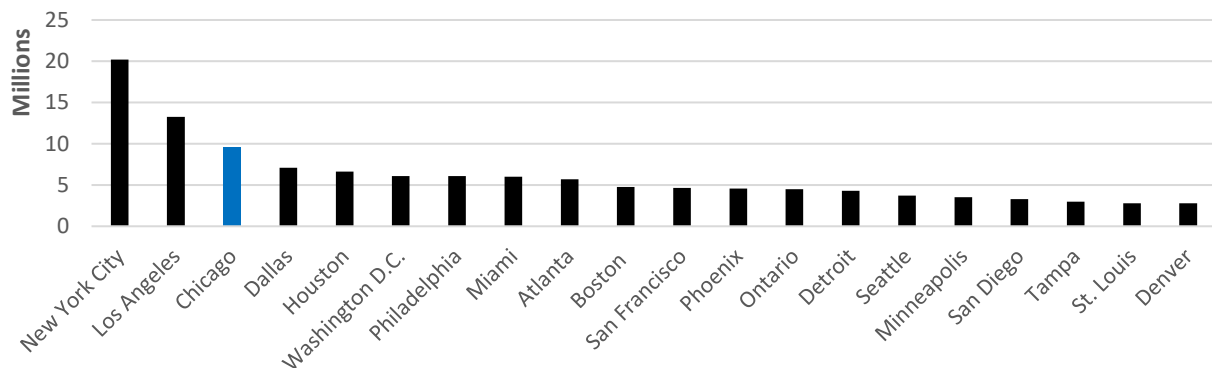
Year	Enplanements			Percent Change		
	O'Hare	Large Hub Airports	U.S. Airline Industry	O'Hare	Large Hub Airports	U.S. Airline Industry
2007	36.7	529.9	769.8			
2008	33.8	515.0	741.8	-7.9%	-2.8%	-3.6%
2009	31.3	495.0	702.9	-7.5%	-3.9%	-5.3%
2010	32.3	507.7	717.8	3.4%	2.6%	2.1%
2011	32.1	519.0	729.9	-0.7%	2.2%	1.7%
2012	32.2	526.5	734.8	0.3%	1.5%	0.7%
2013	32.3	534.7	741.6	0.4%	1.6%	0.9%
2014	33.6	551.6	762.0	4.1%	3.2%	2.8%
2015	36.2	581.2	799.0	7.6%	5.4%	4.9%
2016	37.4	601.1	827.6	3.3%	3.4%	3.6%
2017	38.4	617.5	855.6	2.8%	2.7%	3.4%
2018	39.7	640.9	896.1	3.4%	3.8%	4.7%
<b>CAGR</b>						
2007-18	0.7%	1.7%	1.4%			
2013-18	4.2%	3.7%	3.9%			

Sources: US DOT T-100 Database, Large Hub Based on 2017 Enplanement Data from the FAA

**B.5.2.2 Is O'Hare's passenger traffic generation consistent with the Chicago Metropolitan Statistical Area's (MSA) population and income, or does it appear to be constrained due to a lack of facility capacity?**

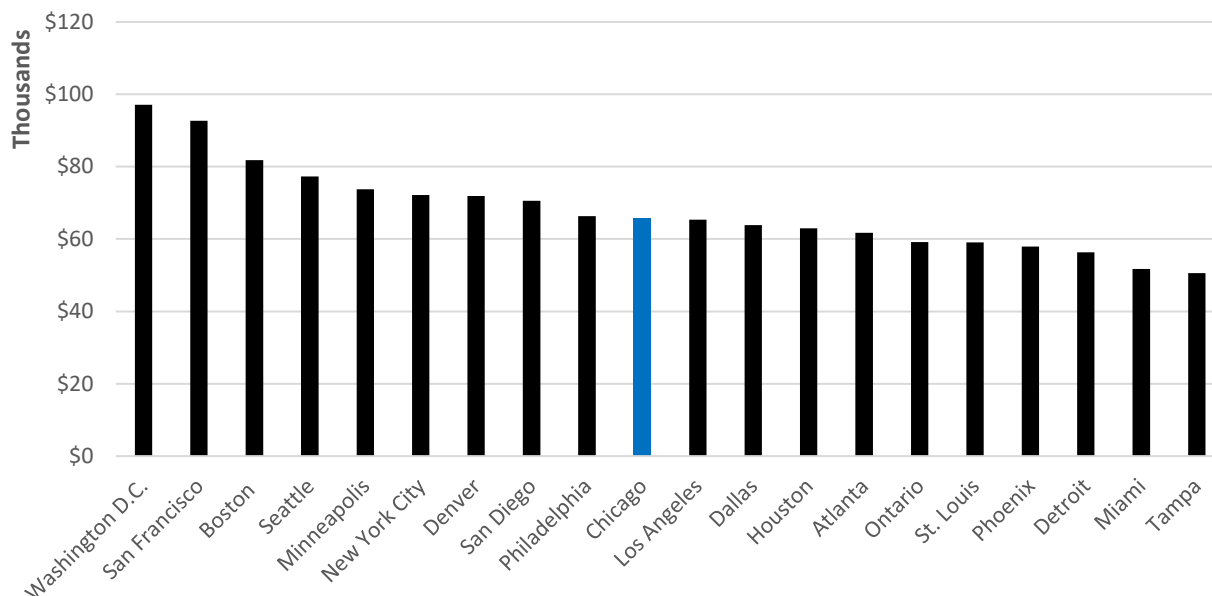
An airport's market area's ability to generate passenger traffic is directly related to its socioeconomic profile and its level of service. **Figures B-1** and **B-2** present the essence of Chicago's ability to generate traffic. First, Chicago is the third largest MSA in the U.S. based on population, following New York and Los Angeles. Chicago's rank based on Median Household Income, which is often shown as the primary determinant of passenger generation per capita, is tenth, following other more affluent markets such as Washington D.C., San Francisco, Boston, and Seattle.

**FIGURE B-1**  
**TOP 20 LARGEST U.S. MARKETS BASED ON POPULATION (CY 2017, MILLIONS)**



Source: American Community Survey; Note: Uses CY 2017 demographic data because it was the latest available at the time of the report

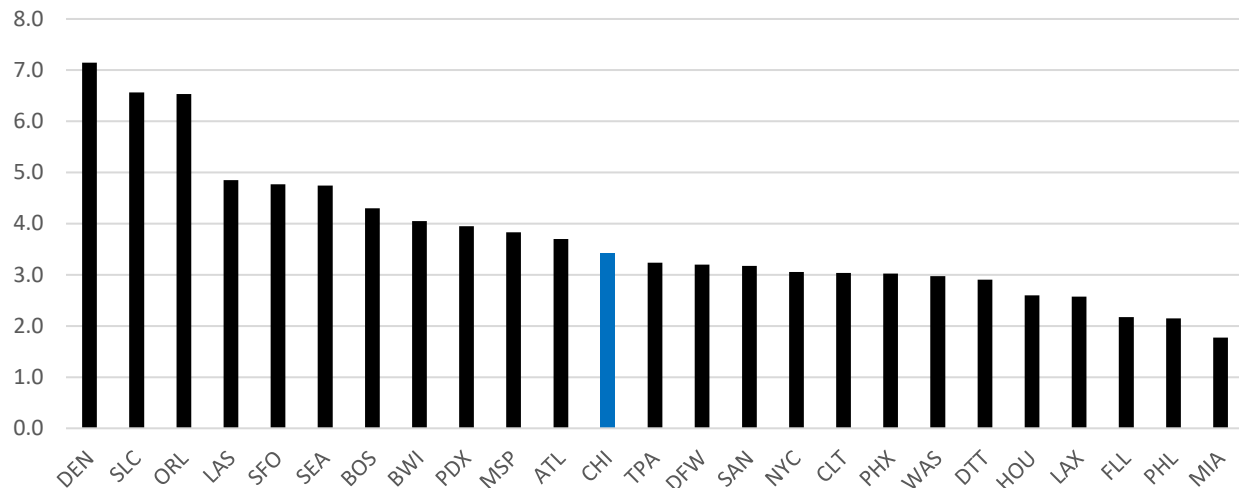
**FIGURE B-2**  
**TOP 20 LARGEST U.S. MARKETS MEDIAN HOUSEHOLD INCOME (CY 2017, THOUSANDS)**



Source: American Community Survey Note: Uses CY 2017 demographic data because it was the latest available at the time of the report

As shown in **Figure B-3**, Chicago's passenger origination per capita ranks 12th, following most of the markets with higher income and two markets with high levels of service relative to its population: the leisure destinations of Orlando and Las Vegas. Originating O&D trips per capita is an industry-wide benchmark to demonstrate the economy's propensity to generate trips. Chicago's ranking of 12th is consistent with its ranking of tenth in terms of Median Household Income as opposed to its Population ranking of third.

**FIGURE B-3**  
**RANKING OF LARGE HUB MARKETS ORIGINATING O&D TRIPS PER CAPITA (CY 2018)**

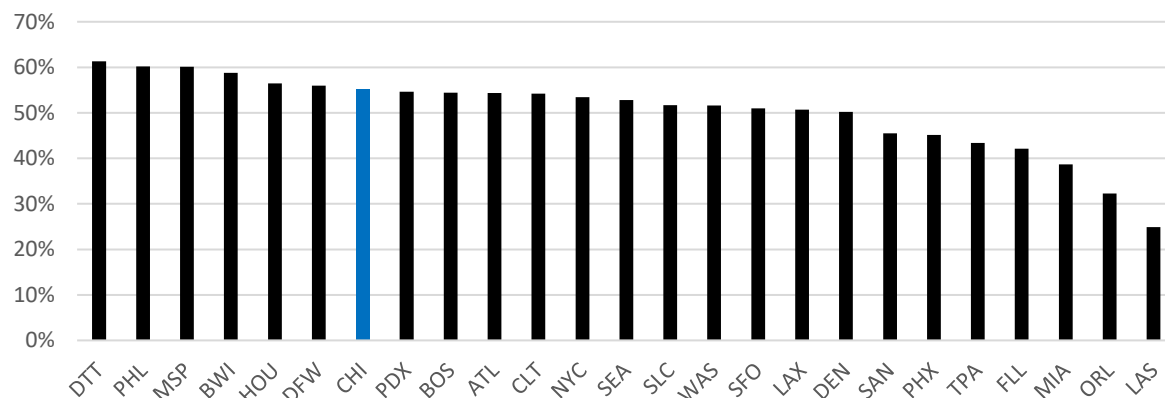


Sources: US DOT O&D Survey, Sabre Marketing Information Data Tapes (MIDT), and American Community Survey

#### B.5.2.3 How does Chicago perform vis-à-vis other major cities in attracting visitors?

A ratio of 50 percent originating and 50 percent visiting reflects a balanced market. Chicago originates 55 percent of its traffic, as seen in **Figure B-4**, and attracts 45 percent of its traffic. This results in the seventh-highest originating market among U.S. Large Hub markets. While indicating a lower relative visitor rate, it is in line with the other mega-hubs of Dallas and Atlanta. In comparison, Chicago contrasts sharply with Orlando and Las Vegas, both well-known predominantly visitor markets with originating shares of 32 percent and 25 percent respectively.

**FIGURE B-4**  
**LARGE HUB MARKETS ORIGINATING SHARE OF O&D (CY 2018)**

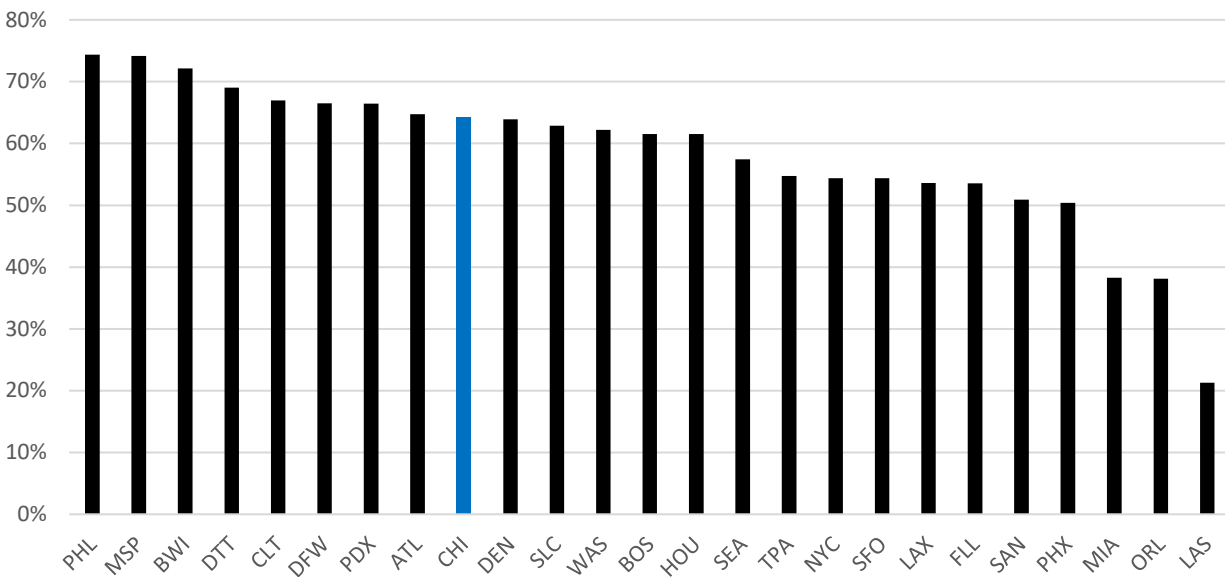


Sources: US DOT O&D Survey, Sabre MIDT



**Figure B-5** depicts the large hub markets origination share of international traffic, which offers partial explanation for the imbalance in originating travel versus incoming travel. Internationally, Chicago is almost two-thirds originating, ranking it ninth among the U.S. Large Hub markets for originations. This level of international origination remains consistent with other large markets that generate more traffic than they attract and where the supply of airline services is not constrained. Rather, it is consistent with the trend in the U.S. industry caused by the strength of the U.S. economy and the resultant strength in the U.S. dollar.

**FIGURE B-5  
LARGE HUB MARKETS SHARE OF INTERNATIONAL ORIGINATING O&D (CY 2018)**

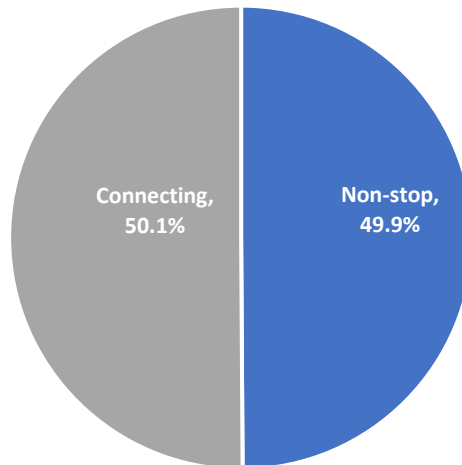


Source: Sabre MIDT

**B.5.2.4 Is O'Hare underserved internationally? What share of international O&D passengers travel on a non-stop international flight from O'Hare versus taking a connecting flight, and how does this compare to other major cities?**

A key metric of the adequacy of air travel is the share of passengers that can reach their destination on a non-stop flight versus making a connection at another gateway. **Figure B-6** demonstrates that approximately half of O'Hare's international O&D traffic travels non-stop.

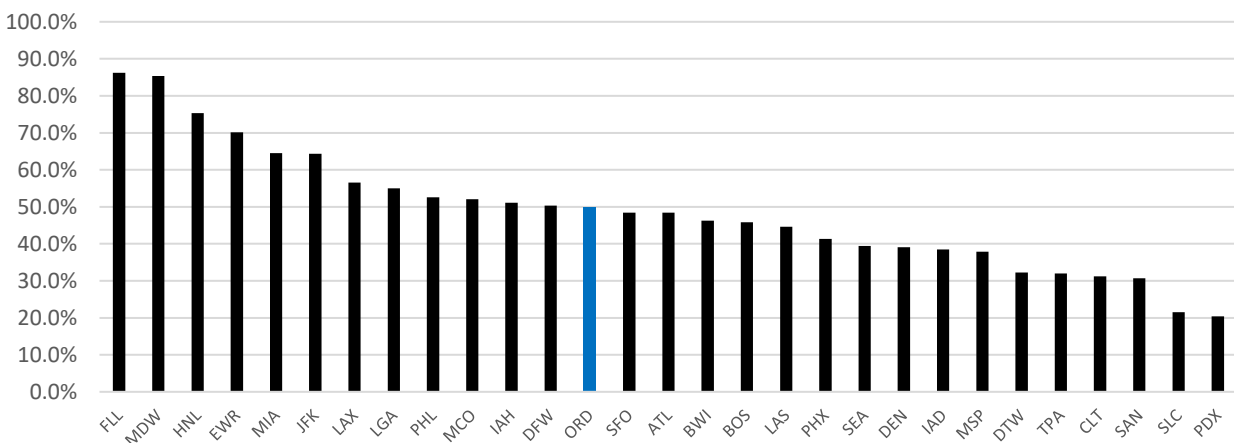
**FIGURE B-6**  
**O'HARE INTERNATIONAL O&D SHARE, FLYING NON-STOP VS. CONNECTING (CY 2018)**



Source: Sabre MIDT

This metric is compared to the largest markets in **Figure B-7**. O'Hare's non-stop share is low compared to other major airports. Fort Lauderdale and Miami rank first and third respectively, but this reflects their dominance in the Caribbean and Central American markets, and in the case of Miami, its dominance in South America. Chicago's lower ranking is largely driven by its Midwestern location. Coastal cities have an advantage as international gateways across the Atlantic and Pacific. Chicago's Midwest location results in a geographic disadvantage to major international markets.

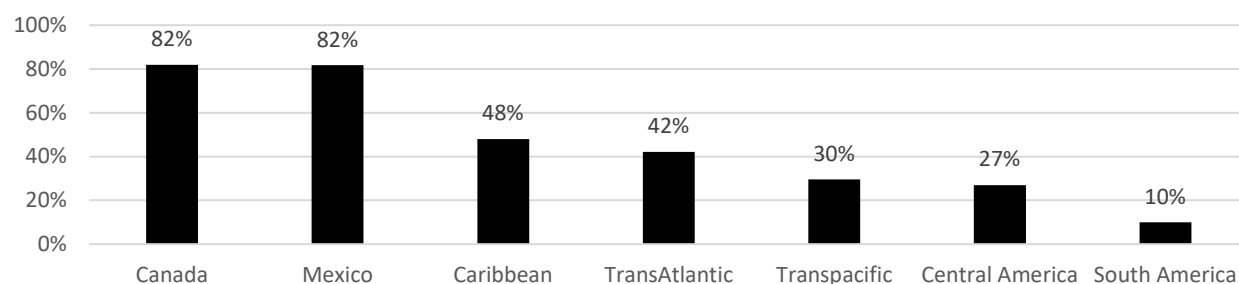
**FIGURE B-7**  
**LARGE HUB MARKETS INTERNATIONAL O&D SHARE, FLYING NON-STOP (CY 2018)**



Source: Sabre MIDT (excludes MDW, LGA, and DCA), U.S. contiguous states only

The relative ranking by world area in **Figure B-8** supports the theory that the geographic location of Chicago plays a role in the Chicago traveler's ability to travel non-stop. Chicago is a significant gateway to Canada and Mexico, and air service at O'Hare reflects that. As **Figure B-8** indicates, 82 percent of passengers are able to fly non-stop to these markets from O'Hare. Of passengers traveling between O'Hare and the Caribbean, 48 percent fly non-stop. Similarly, 42 percent of passengers on transatlantic journeys use non-stop flights from O'Hare. Passengers to other regions are far more likely to require a connecting itinerary.

**FIGURE B-8**  
**O'HARE'S INTERNATIONAL O&D SHARE, FLYING NON-STOP BY SEGMENT (CY 2018)**



O'Hare's Rank in U.S. Large Hub Markets						
Canada	Mexico	Caribbean	Transatlantic	Transpacific	Central America	South America
3	8	13	9	7	11	12

Source: Sabre MIDT (excludes MDW, LGA, and DCA), U.S. contiguous states only

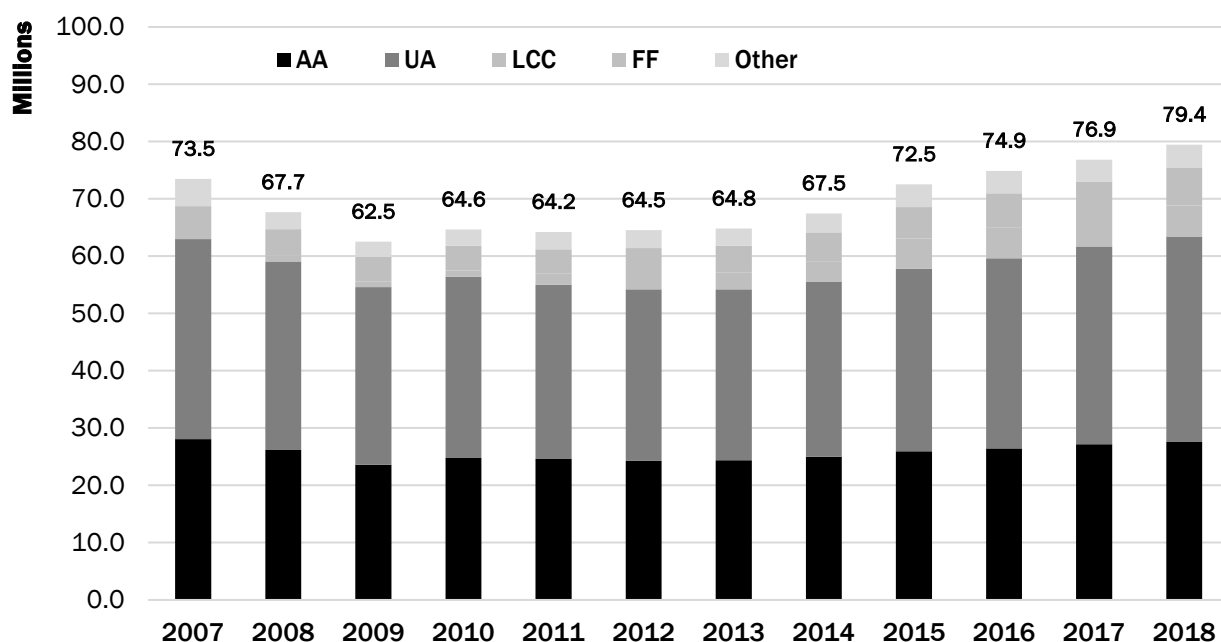
#### **B.5.2.5 Did the gate reallocations at O'Hare stemming from mergers stimulate passenger increases by LCCs<sup>9</sup>/Ultra Low Cost Carriers (ULCCs)?<sup>10</sup>**

Over the last decade at O'Hare, passenger traffic has grown at a CAGR of 1.6 percent, reaching 79.4 million passengers in 2018. During this period, after undergoing mergers (United/Continental in 2010 and American/US Airways in 2013) which caused the consolidated carriers to release gates, both American and United experienced declines in market share. Beginning in 2011, LCCs have gradually been capturing a larger share of the O'Hare market, as seen in **Figure B-9**.

<sup>9</sup> Low Cost Carriers are airlines that try to maintain lower operating costs. Examples of an LCC are Southwest and JetBlue.

<sup>10</sup> Ultra Low Cost Carriers are airlines that try to maintain lower operating costs and offer a no-frills travel experience. Examples of ULCCs are Spirit, Allegiant, and Frontier.

**FIGURE B-9**  
**O'HARE'S HISTORICAL PASSENGER TRAFFIC (CY 2007-18)**

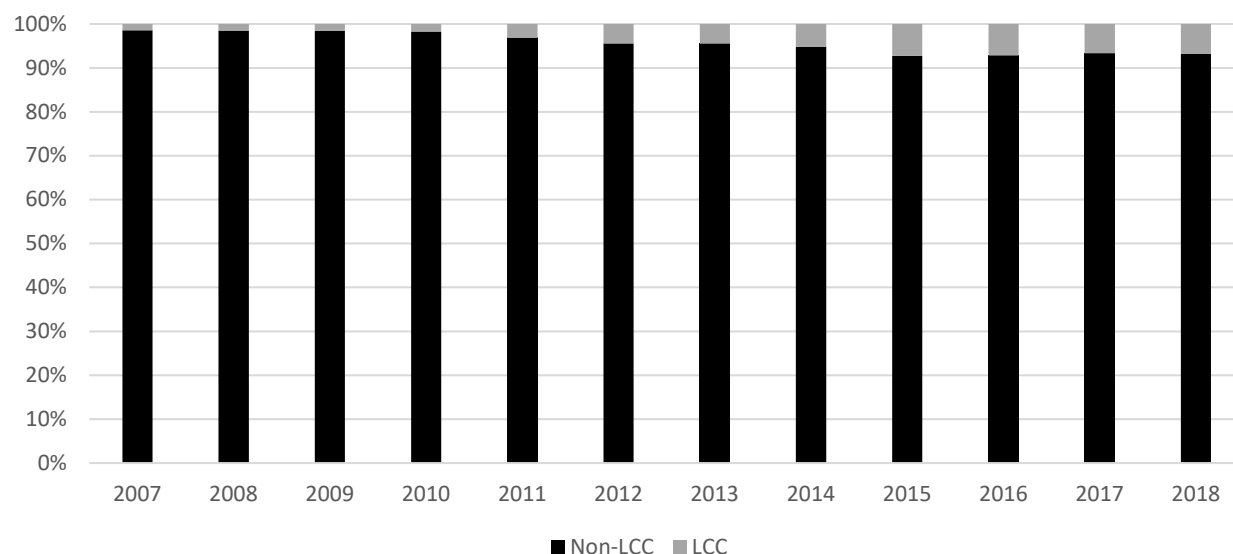


Carrier Share	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
AA	38.2%	38.7%	37.8%	38.3%	38.4%	37.6%	37.6%	37.1%	35.8%	35.3%	35.4%	34.7%
UA	47.5%	48.6%	49.6%	48.9%	47.2%	46.5%	46.0%	45.2%	43.9%	44.3%	44.9%	45.2%
LCC	1.4%	1.5%	1.6%	1.7%	3.1%	4.4%	4.5%	5.2%	7.2%	7.2%	6.7%	6.8%
Foreign Flag (FF)	6.3%	6.9%	6.8%	6.7%	6.6%	6.7%	7.3%	7.6%	7.6%	7.9%	8.1%	8.3%
Other	6.5%	4.3%	4.2%	4.4%	4.7%	4.8%	4.6%	4.9%	5.4%	5.2%	4.9%	5.0%

Source: USDOT T-100

In 2018, LCC passengers accounted for 6.8 percent of O'Hare's traffic, up from 1.5 percent in 2008, as seen in **Figure B-10**. Despite growing five percentage points, the LCC passenger share at O'Hare continues to lag behind the industry average of 14.9 percent. Over the last decade, seven new LCC airlines, most of which were international operators, began serving O'Hare. Much of the LCC disparity experienced at O'Hare can be attributed to Southwest Airlines (Southwest) operations out of Chicago Midway International Airport (Midway).

**FIGURE B-10**  
**HISTORICAL SHARE OF LCC PASSENGERS AT O'HARE (CY 2007-18)**

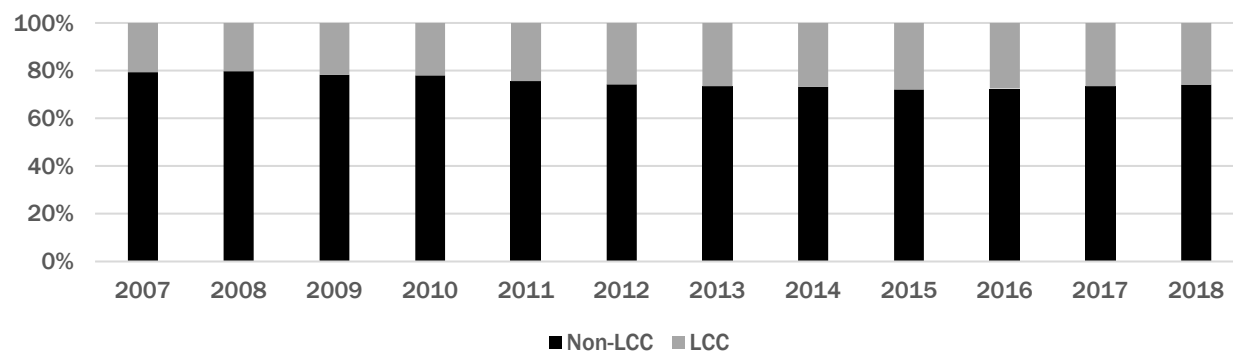


U.S. LCC Share of the Industry (Excluding Southwest)												
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Share	10.9%	11.7%	12.3%	12.9%	14.1%	14.2%	13.8%	13.1%	11.9%	13.2%	14.0%	14.9%

Source: USDOT T-100

As seen in **Figure B-11**, when O'Hare passengers are combined with Midway's, and Southwest is included in the analysis, Chicago's share of LCCs is only slightly lower than the industry-wide LCC share (25.8 percent versus 30.5 percent), highlighting the significant presence Southwest has not only at Chicago but also industry-wide. This also indicates that the Chicago market is in line with the industry and not underrepresented by LCCs.

**FIGURE B-11**  
**CHICAGO (ORD/MDW) HISTORICAL SHARE OF LCC PASSENGERS (CY 2007-18)**

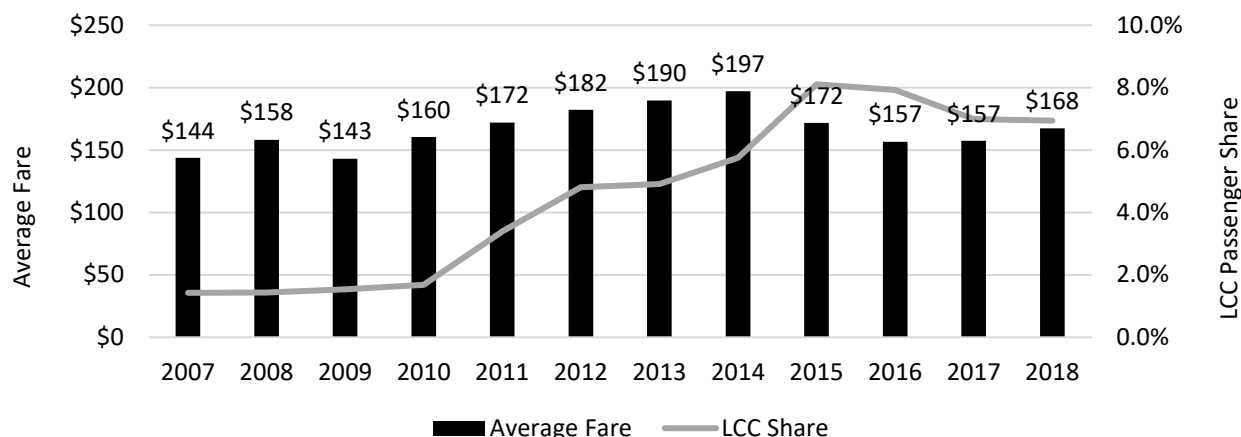


U.S. Industry LCC Share												
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Share	23.6%	24.8%	25.9%	26.6%	28.0%	28.1%	27.9%	28.2%	28.2%	29.3%	30.1%	30.5%

Source: USDOT T-100

As LCCs significantly increase their presence at an airport previously dominated by legacy carriers, the airlines typically enter a competitive price war, in which both airlines drop fares on shared routes to drive the other carrier out and capture a larger market share. This trend occurred at O'Hare beginning in 2015 as the LCC carriers increased their share of domestic passengers. During this time, and in the subsequent two years, the average domestic fare at the airport dropped by 15 percent, from \$197 in 2014 to \$168 in 2018 (as seen in **Figure B-12**).

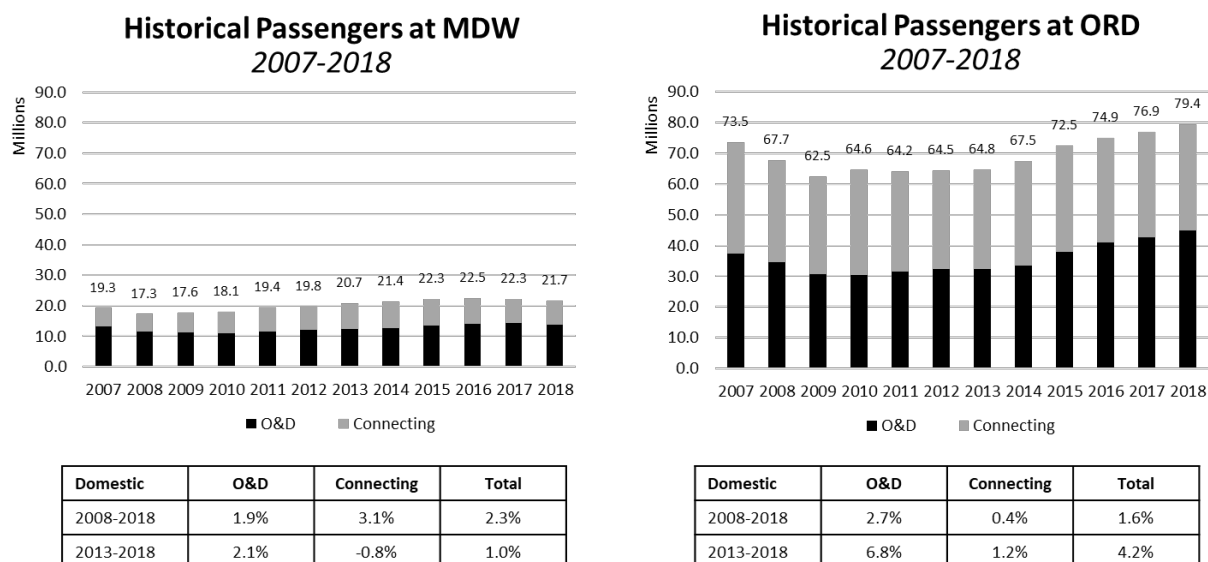
**FIGURE B-12**  
**AVERAGE DOMESTIC FARE AND LCC DOMESTIC SHARE AT O'HARE (CY 2007-18)**



Sources: USDOT O&D Survey and Sabre MIDT

With Southwest's operations at Midway accounting for more than 80 percent of domestic LCC passengers in Chicago, Midway weathered the great recession better than O'Hare, as seen in **Figure B-13**, despite having significantly lower annual passengers. However, the emergence of LCC's at O'Hare resulted in its passenger traffic growth outpacing growth at Midway, with an average annual growth rate of 4.2 percent over the last five years, compared to Midway's CAGR of 1.0 percent over the same time.

**FIGURE B-13**  
**HISTORICAL PASSENGERS AT MIDWAY AND O'HARE**



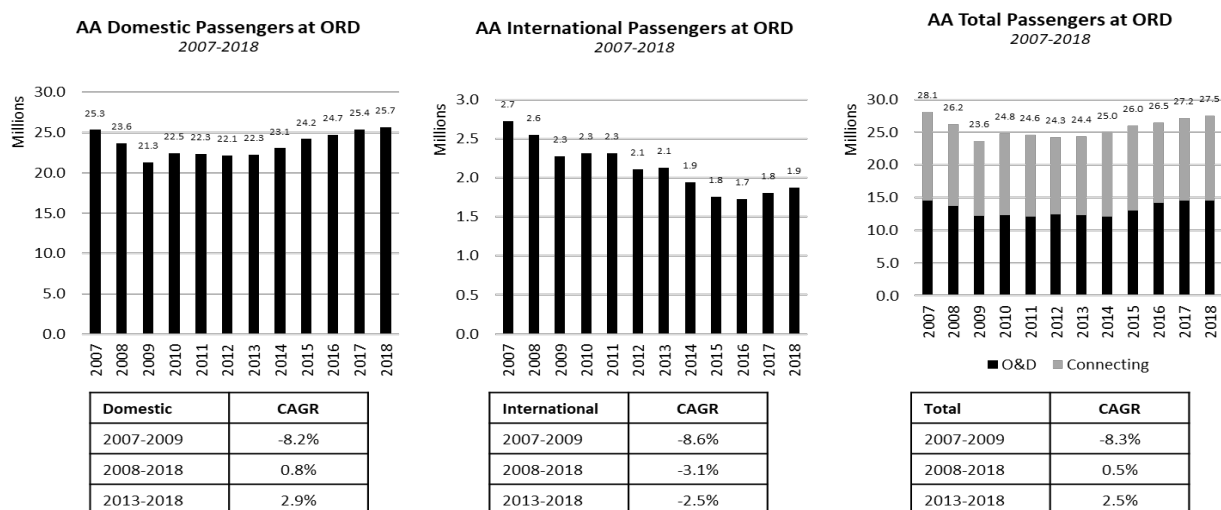
Sources: USDOT O&D Survey, Sabre MIDT, and USDOT T-100

As discussed throughout this section, it was determined after analyzing the historic activity for LCCs at O'Hare, Midway, and nationwide that the gate reallocation at O'Hare which occurred due to the airline mergers did not appear to stimulate low-cost carrier demand above what was experienced industry-wide. LCC's share at O'Hare is actually below the industry average.

#### **B.5.2.6 Have facility constraints hampered O'Hare's role as a dual connecting hub for American Airlines and United Airlines?**

Figures B-14 and B-15 present American's and United's passengers by year for the 2007–18 period, depicting O&D/Connecting trends as well as Domestic vs. International detail. Focusing first on the 10-year period, both carriers are growing at less than one percent annually. As already shown, the hub carriers share of O'Hare's traffic declined from 85.7 percent in 2007 to 79.9 percent in 2018. American's growth has been the slower of the two, with actual declines in international travel. For the most recent five-year period, American has shrunk internationally (by 2.5 percent) annually while growing domestically by 2.9 percent.

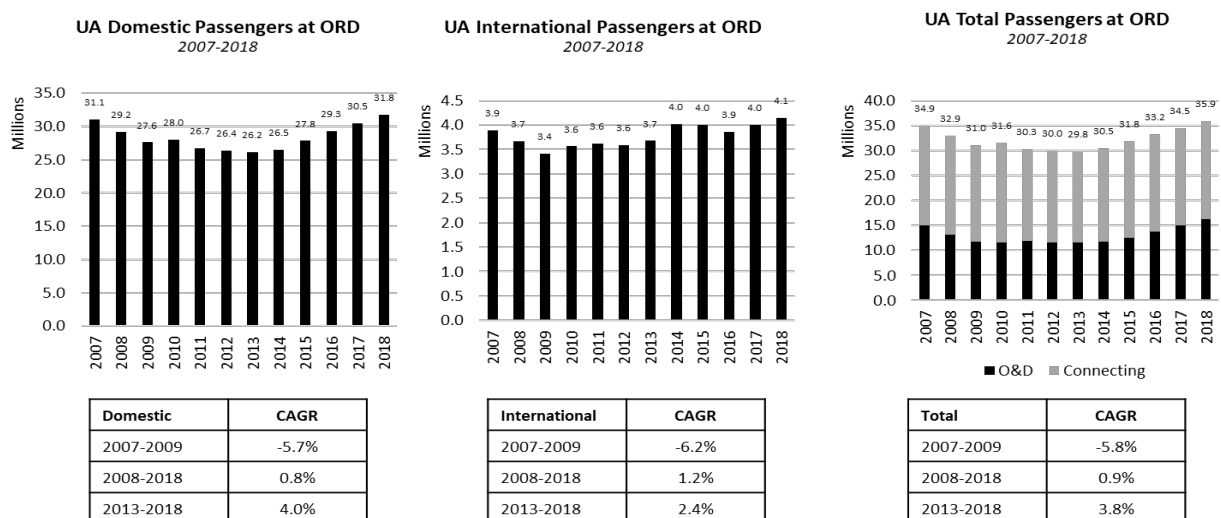
**FIGURE B-14**  
**AMERICAN PASSENGERS AT O'HARE (CY 2007-18)**



Sources: USDOT O&D Survey, Sabre MIDT, and USDOT T-100

Compared to American, United had higher growth from 2013–2018, growing internationally and domestically for a combined annual rate of 3.8 percent. In addition, while American has been shrinking O'Hare's role as connecting hub (**Figure B-17**), United relies more on connecting traffic; 55 percent of United's O'Hare traffic is connecting, while American's connecting traffic in 2018 accounted for 47 percent of its onboard traffic. The number of connections made on United has increased by almost one million passengers since 2013, yet the high-growth segment for both carriers is in domestic traffic.

**FIGURE B-15**  
**UNITED PASSENGERS AT O'HARE (CY 2007-18)**



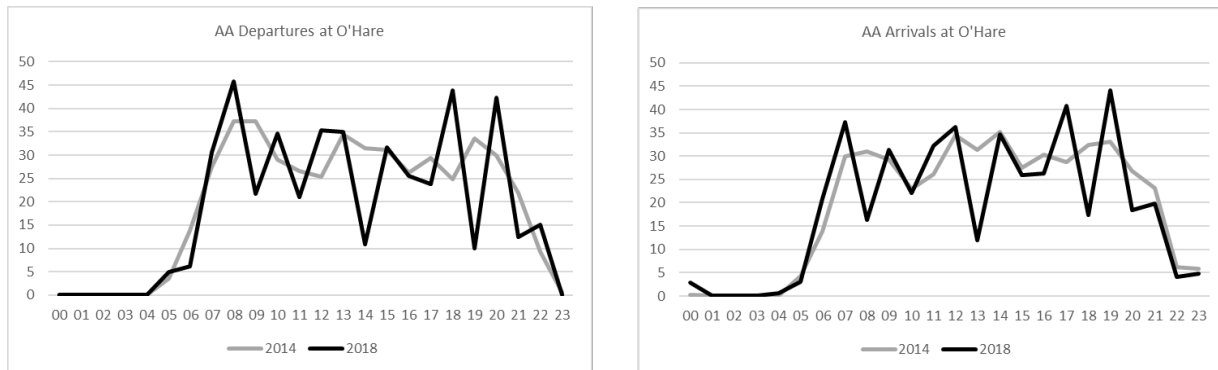
Sources: USDOT O&D Survey, Sabre MIDT, and USDOT T-100



### B.5.2.7 Was re-banking by American and United diminished by facility capacity constraints at O'Hare?

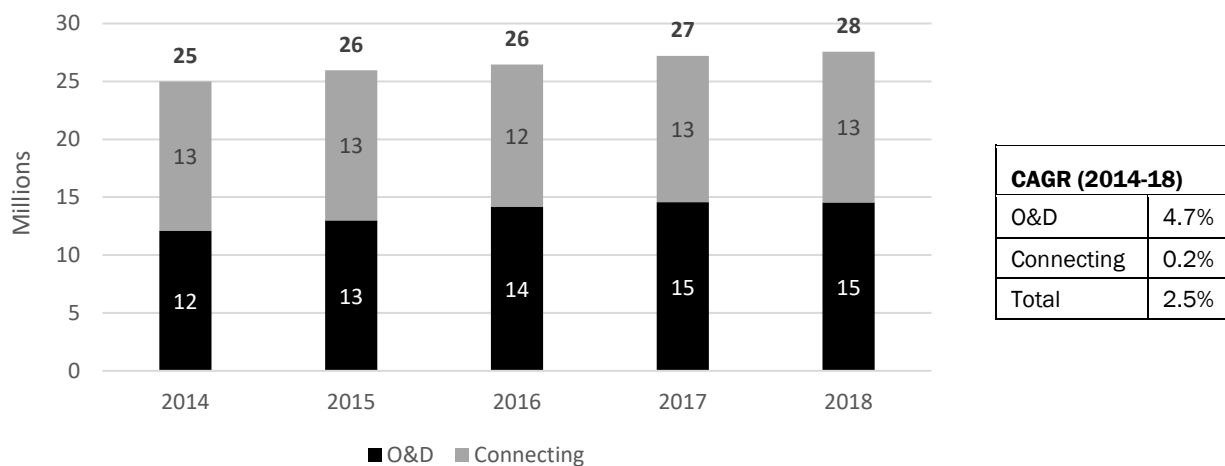
In 2015, American re-banked its Chicago hub into more pronounced banks to facilitate shorter connections, thereby maximizing the number of connections on flights. **Figure B-16** shows the resulting peaks for American and **Figure B-18** shows the same for United.

**FIGURE B-16**  
**AMERICAN'S DEPARTURES AND ARRIVALS AT O'HARE**



Despite a more peaked schedule, American's connecting passengers at O'Hare only increased from 12.9 million in 2014 to 13 million in 2018, as seen in **Figure B-17**. Over the same period, American's O&D traffic increased by 2.4 million passengers.

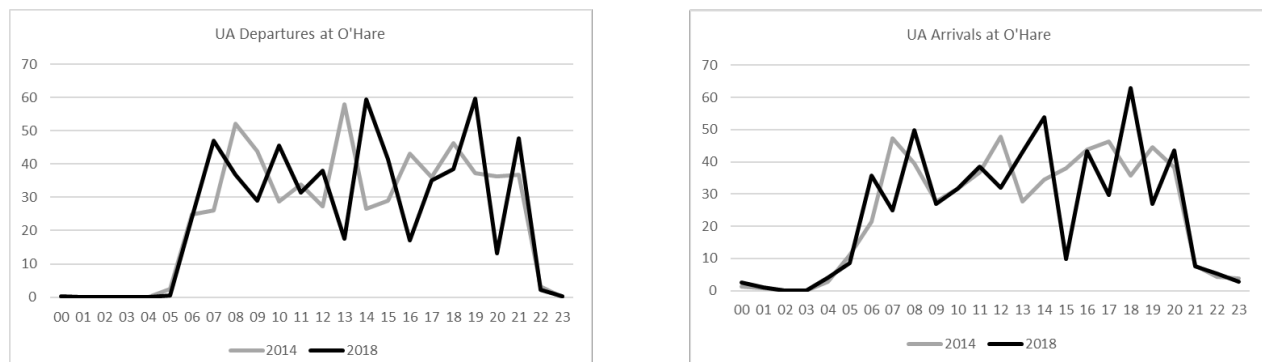
**FIGURE B-17**  
**AMERICAN'S PASSENGER HISTORY AT O'HARE (CY 2014-18)**



Sources: USDOT O&D Survey, Sabre MIDT, and USDOT T-100

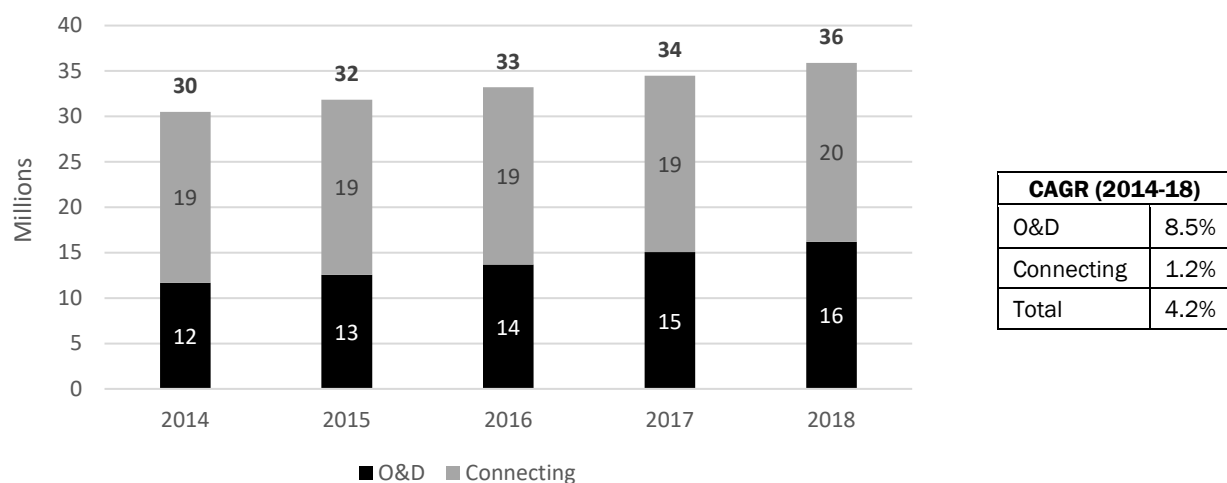
United Airlines also re-banked its O'Hare schedule to a hub with more pronounced peaks than American (**Figure B-18**). Since the re-banking, United has increased its connections by almost one million passengers, as seen in **Figure B-19**, while its O&D experienced an annual CAGR of 8.5 percent.

**FIGURE B-18**  
**UNITED'S DEPARTURES AND ARRIVALS AT O'HARE**



Source: Innovata Schedules; average daily for 2014 and 2018 based on full year

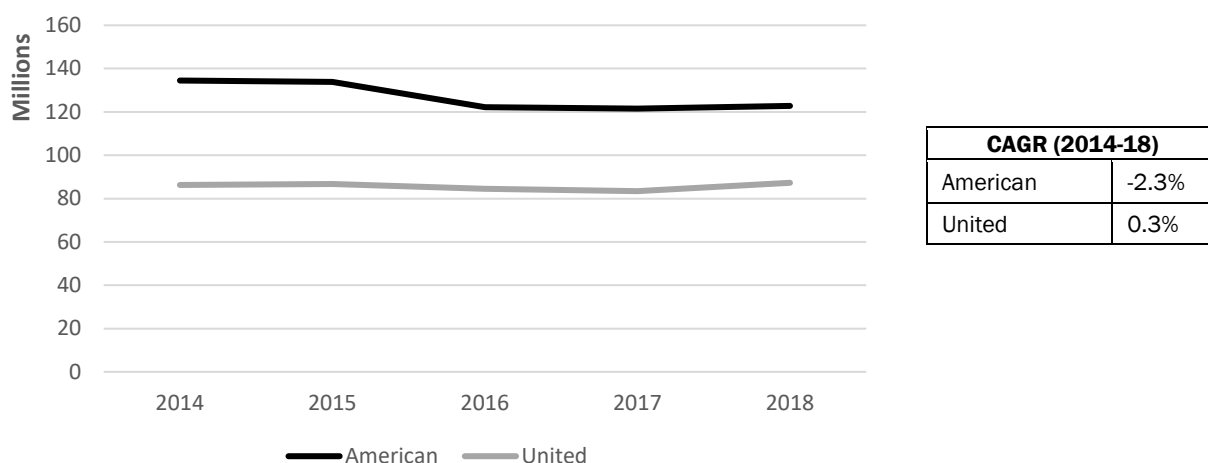
**FIGURE B-19**  
**UNITED'S PASSENGER HISTORY AT O'HARE (CY 2014-18)**



Sources: USDOT O&D Survey, Sabre MIDT, and USDOT T-100

The nominal rebanking outcomes do not indicate facility constraints at O'Hare. Rather, the outcomes align to American's systemwide trend of connecting passenger totals having declined since 2014, while United's have risen 0.3 percent annually in the same period (**Figure B-20**).

**FIGURE B-20**  
**AMERICAN'S AND UNITED'S SYSTEMWIDE CONNECTING PASSENGERS (CY 2014-18, MILLIONS)**

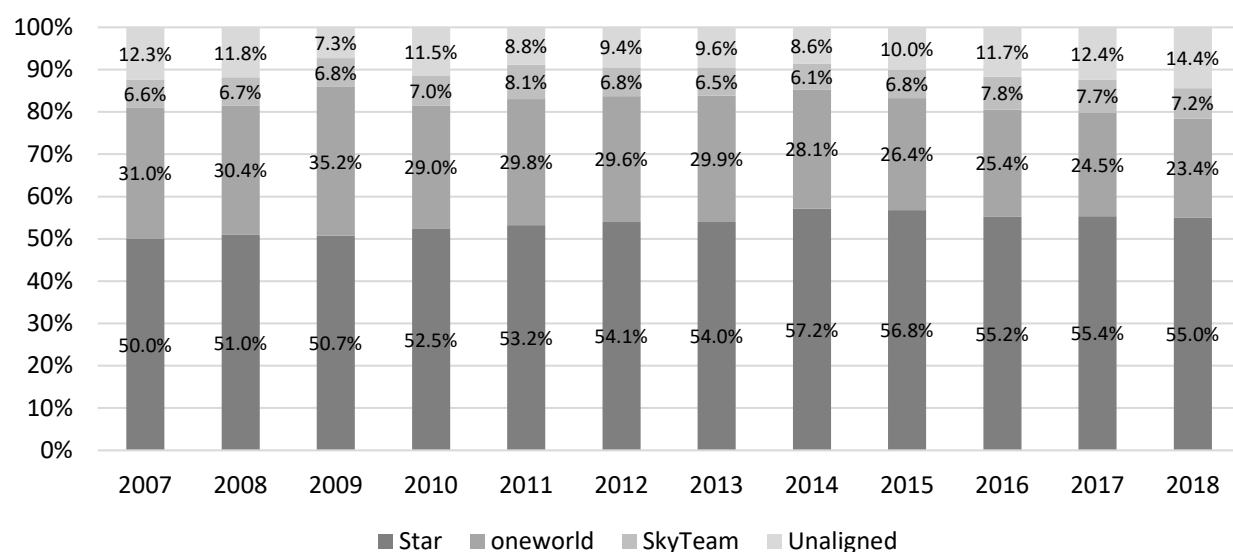


Sources: USDOT O&D Survey, Sabre MIDT, and USDOT T-100 (excludes territories)

#### B.5.2.8 Does room exist for international passengers carried by alliances other than Star and oneworld?

As seen in **Figure B-21**, Star Alliance has increased its share of international passengers at O'Hare while oneworld has lost share. The unaligned carriers re-emerged in 2014 and now account for 14.4 percent of O'Hare's international passengers. While this is lower than the industry share carried by the unaligned carriers, it is consistent with the share that unaligned airlines capture at carrier hubs.

**FIGURE B-21**  
**HISTORICAL SHARE OF O'HARE INTERNATIONAL PASSENGERS BY ALLIANCE (CY 2007-18)**



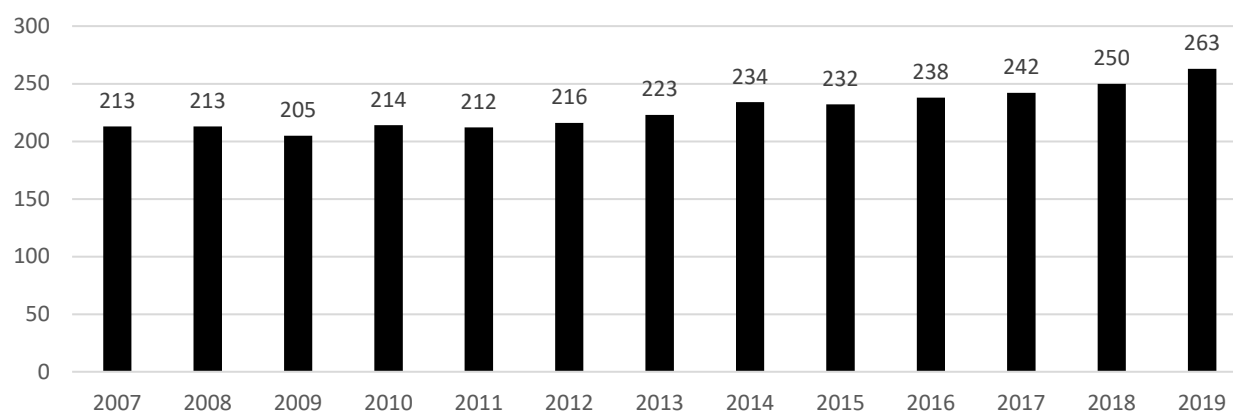
U.S. Industry Unaligned Share of international												
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Share	24.4%	21.4%	20.0%	23.2%	21.8%	20.4%	19.9%	20.7%	22.4%	23.8%	25.2%	26.7%

Source: USDOT T-100

### B.5.2.9 Have new destinations been added at O'Hare?

One possible sign that facility constraints are limiting options for travelers is a lack of new market development. In a healthy market, new destinations are added as 1) growth markets for existing carriers and 2) new markets for new carriers. Prior to 2013, O'Hare's non-stop markets served remained below 220, as seen in **Figure B-22**. Since 2013, the number of markets served grew from 223 to 263 in 2019. As seen in **Table B-5**, many of these new markets are smaller domestic points served by regional carrier partners of United or American, but 22 are international markets. The majority of these new city pairs were not constrained by lack of gate availability.

**FIGURE B-22**  
**NUMBER OF NON-STOP DESTINATIONS SERVED FROM O'HARE (CY 2007-19)**



Source: Innovata Schedules

**TABLE B-5**  
**NEW MARKETS SERVED AT O'HARE SINCE 2013**

New Domestic Markets		
Market	Started Service	Daily Departures
State College	2014	5.0
Erie	2014	2.0
Bismarck	2014	2.0
Ironwood	2014	2.0
Mason City	2014	2.0
Bangor	2014	1.0
Trenton	2014	0.5

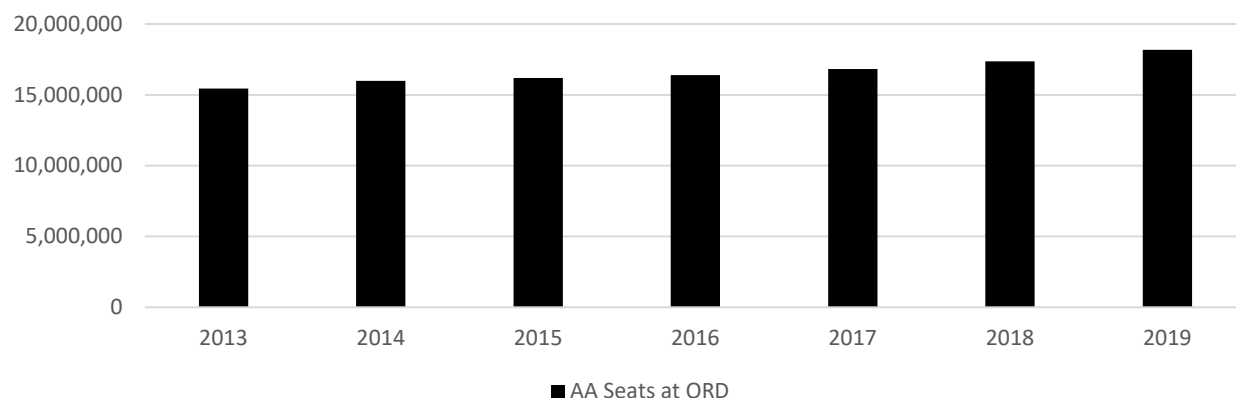
<b>New Domestic Markets</b>		
<b>Market</b>	<b>Started Service</b>	<b>Daily Departures</b>
Oakland	2014	0.5
Great Falls	2016	0.2
Augusta	2016	0.0
Quincy	2017	2.0
Meridian	2017	1.0
Clarksburg	2017	1.0
Key West	2017	1.0
Cape Girardeau	2017	1.0
Wilmington	2018	2.0
Lewisburg	2018	1.0
Staunton	2018	1.0
Salina	2018	1.0
Fresno	2018	0.7
Harlingen	2018	0.2
Brownsville	2018	0.1
Sun Valley	2018	0.1
Joplin	2019	1.0
Ogdensburg	2019	0.6
Eugene	2019	0.5
Redmond	2019	0.4
Watertown	2019	0.3
Mobile	2019	0.2
Branson	2019	0.2
Panama City	2019	0.1
Fort Walton Beach	2019	0.1
Hilton Head Island	2019	0.1
Durango	2019	0.1
Grand Junction	2019	0.1
Cody	2019	0.0
<b>New International Markets</b>		
<b>Market</b>	<b>Started Service</b>	<b>Daily Departures</b>
Dubai	2014	1.0
Edinburgh	2014	0.4
Belize City	2015	0.3
Reykjavik	2016	1.0
Tokyo-Haneda	2016	1.0
Taipei	2016	0.6

<b>New Domestic Markets</b>		
<b>Market</b>	<b>Started Service</b>	<b>Daily Departures</b>
Providenciales	2016	0.2
Ixtapa/Zihuantanejo	2016	0.1
Saint Lucia	2016	0.1
Barcelona	2017	0.7
Krakow	2017	9.2
Leon-Guanajuato	2018	2.0
Addis Ababa	2018	0.6
Venice	2018	0.5
London	2018	0.5
Auckland	2018	0.4
Budapest	2018	0.3
Bogota	2018	0.2
Lisbon	2019	0.4
Athens	2019	0.4
Queretaro	2019	0.2
Chengdu	2019	0.1
Source: Innovata Schedules, New Markets Since 2013		

**B.5.2.10 Did the L-Stinger Gates increase American's growth, suggesting pent-up demand? And was United's increase in destinations in 2018/2019 a competitive response to American?**

Historically, American has grown O'Hare's seat capacity faster than the industry average; however, the differential virtually disappeared in 2019. This would suggest that the growth at O'Hare was consistent with the growth American had system-wide rather than stimulated by the availability of the L-Stinger gates, which opened in May of 2018. As shown in **Figure B-23**, American's seat capacity at O'Hare increased 2.4 percent annually from 2013 through 2018, compared to 0.9 percent systemwide over the same period. In contrast, American's seat capacity at O'Hare increased 4.6 percent in 2019, compared to 4.5 percent systemwide the same year.

**FIGURE B-23**  
**AMERICAN'S SEAT CAPACITY AT O'HARE (CY 2013-19)**

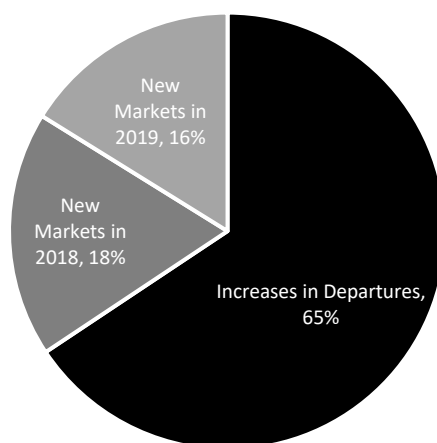


American's Seat Capacity Growth at O'Hare and the U.S. Industry						
	2014	2015	2016	2017	2018	2019
O'Hare	3.5%	1.2%	1.3%	2.5%	3.3%	4.6%
U.S.	1.3%	0.8%	0.4%	0.0%	2.1%	4.5%

Source: Innovata Schedules

American's increase in O'Hare service in 2019 is derived from 36 new markets and an increase in departures in existing markets. As shown on Figure B-24, increases in American flights from 2017 through 2019 were on existing routes 65 percent of the time and new routes 35 percent of the time.

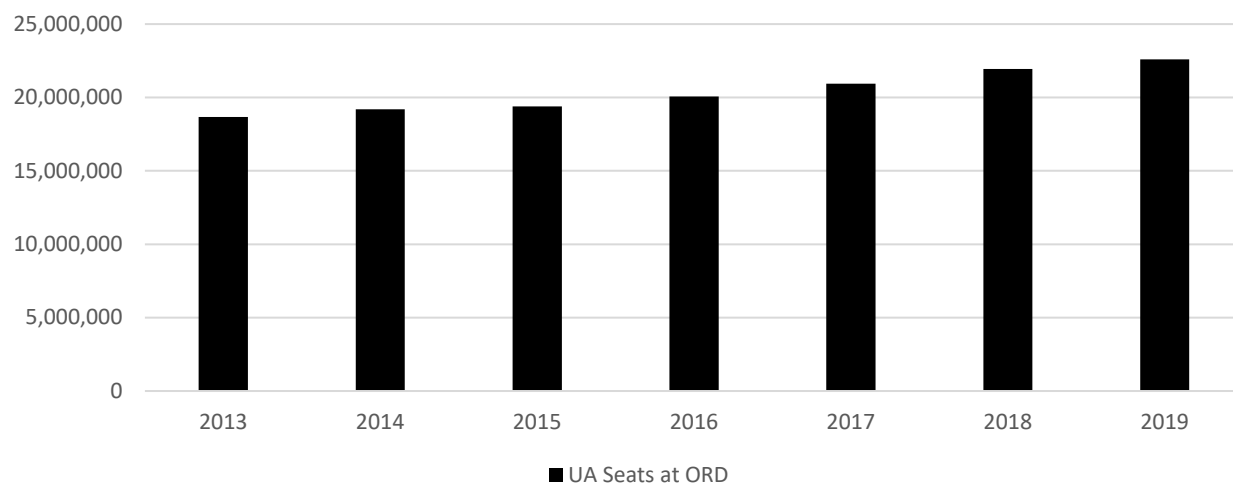
**FIGURE B-24**  
**SOURCES OF AMERICAN'S DEPARTURE GROWTH (CY 2017-19, TOTAL INCREASE OF 18,000)**



Source: Innovata Schedules, pulled July 11, 2019

As shown in **Figure B-25**, United has been growing at O'Hare since 2013. From 2013 through 2016, United grew seat capacity at O'Hare at a faster rate than did the overall airline industry. Since the L-Stinger gates came online in 2018, United has grown capacity at O'Hare more slowly than the broader airline industry.

**FIGURE B-25**  
**UNITED'S SEAT CAPACITY AT O'HARE (CY 2013-19)**



United's Seat Capacity Growth at O'Hare and the U.S. Industry						
Location	2014	2015	2016	2017	2018	2019
O'Hare	2.8%	1.0%	3.5%	4.3%	4.8%	2.9%
U.S.	-1.5%	0.1%	1.8%	4.5%	6.3%	4.0%

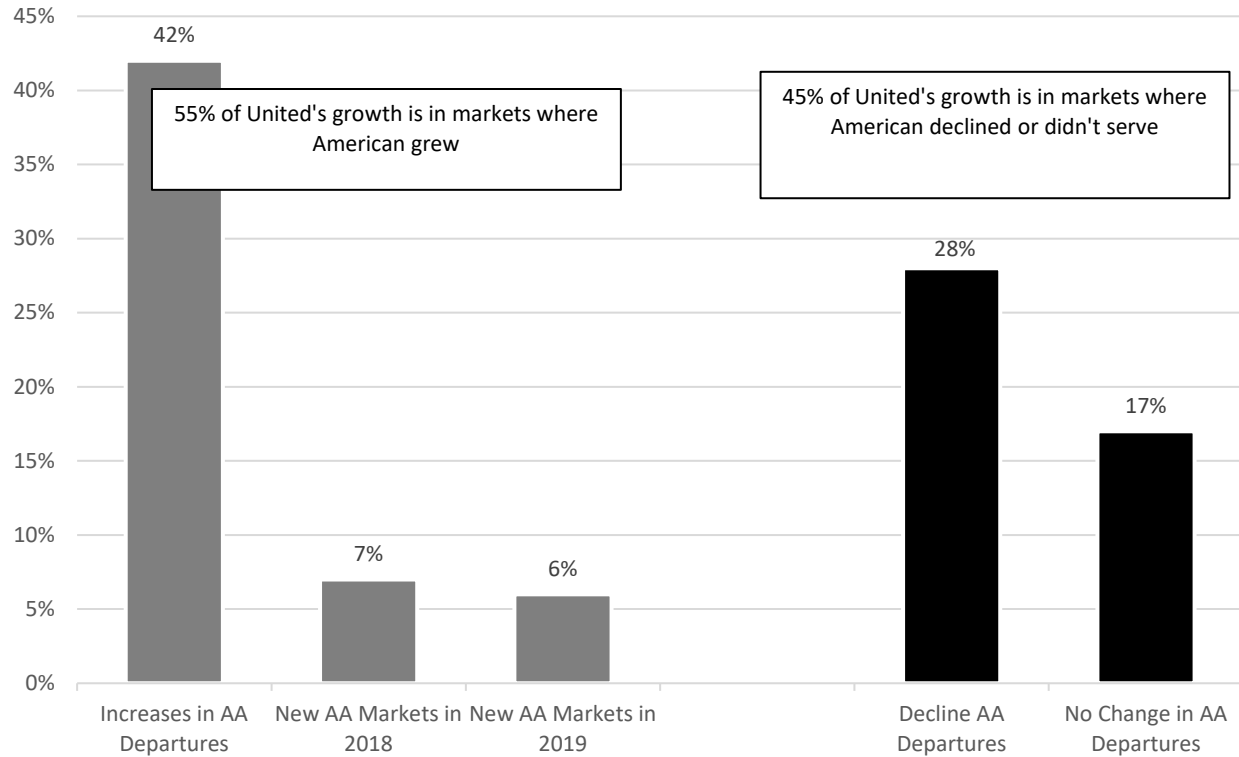
Source: Innovata Schedules

**Figure B-26** categorizes United's growth at Chicago into American's growth segments. While 55 percent of United's increase in departures overlaps with American's increase, 45 percent of United's increase were either in markets that American has no presence or in markets where American has declined during that same time. This suggests that United's growth was not in direct response to American's growth during the 2017–19 span. Rather, United's growth is in response to United's strategy of strengthening the O'Hare hub to improve its connectivity.<sup>11</sup>

<sup>11</sup> United Airlines 4Q/FY 2016 Earnings Call; [9cbedd9b-7cca-430f-ab34-b600024be162 \(united.com\)](#); Slide 10



**FIGURE B-26**  
**SOURCES OF UNITED'S DEPARTURE GROWTH SORTED BY AMERICAN'S GROWTH CATEGORIES (CY 2017-19, TOTAL INCREASE OF 23,000)**



Source: Innovata Schedules, Pulled July 11, 2019

#### **B.5.2.11 FAA's Third Party Consultant Induced Demand conclusions**

The FAA's Third Party Consultant analyzed a series of factors that illustrated the passenger traffic response to the easing of capacity constraints over the most recent 12-year period (2007–18) through adding new runway capacity (and subsequent easing schedule limits) or adding gates. The FAA's Third Party Consultant concluded that the growth that occurred at O'Hare is consistent with that of the airline industry and does not indicate the existence of pent-up demand in the time analyzed.

#### **B.5.3 FAA's Third Party Consultant Passenger Forecast Conclusions**

Based on the analysis the CDA provided on passenger trends at Chicago historically and for the future, the 2018 TAF growth rate for enplanements is reasonable and appropriate for environmental analysis for this EA. The CDA conducted a regression analysis and a market share forecast that supported the TAF's 2018 growth rate of 2.1 percent per year. The FAA's Third Party Consultant analyzed O'Hare's historical passenger trends to understand whether O'Hare's passenger demand was suppressed in the past due to airport facility constraints; the independent analysis concluded that constraints have not led to pent-up demand in the Chicago market in the time analyzed.

## B.6 AIRCRAFT OPERATIONS ANALYSIS

### B.6.1 Passenger Aircraft Operations Forecast

As had been done for the enplanement forecast, the CDA analyzed the FAA's 2018 TAF passenger aircraft operations forecast for O'Hare for this EA. However, while the enplanement forecast is projected to grow by 2.6 percent over the next five years, the TAF is forecasting a decline in annual passenger aircraft operations in the near-term at an average of -1.5 percent per annum as seen in **Table B-6**.

**TABLE B-6**  
**FAA TAF FOR O'HARE – CALENDAR YEARS**

	2018	2019	2020	2021	2022	2023	CAGR
Enplaned Passengers	40,312,189	42,185,986	43,212,898	44,146,257	45,029,152	45,879,185	2.6%
Y-o-Y Growth (%)		4.6%	2.4%	2.2%	2.0%	1.9%	
Passenger Aircraft Operations	898,362	921,599	894,002	884,341	858,687	832,626	-1.5%
Y-o-Y Change (%)		2.6%	-3.0%	-1.1%	-2.9%	-3.0%	
Note: The TAF is converted from federal fiscal years to calendar years							
Source: Federal Aviation Administration, 2018 Terminal Area Forecast							

This decline in passenger aircraft operations caused the CDA to further analyze the TAF operations forecast. As a result, several potential issues were identified:

1. The TAF assumes that all 50-seat regional jet aircraft will be retired by 2023
2. The TAF combines cargo operations with passenger operations

While the TAF forecast was deemed adequate for future enplanement growth, it is the view of both the CDA and the FAA's Third Party Consultant that passenger aircraft operations in the TAF are underrepresented at O'Hare. An adjusted passenger operations forecast was developed and is shown in **Attachment B-2** and shown in **Table B-7**.

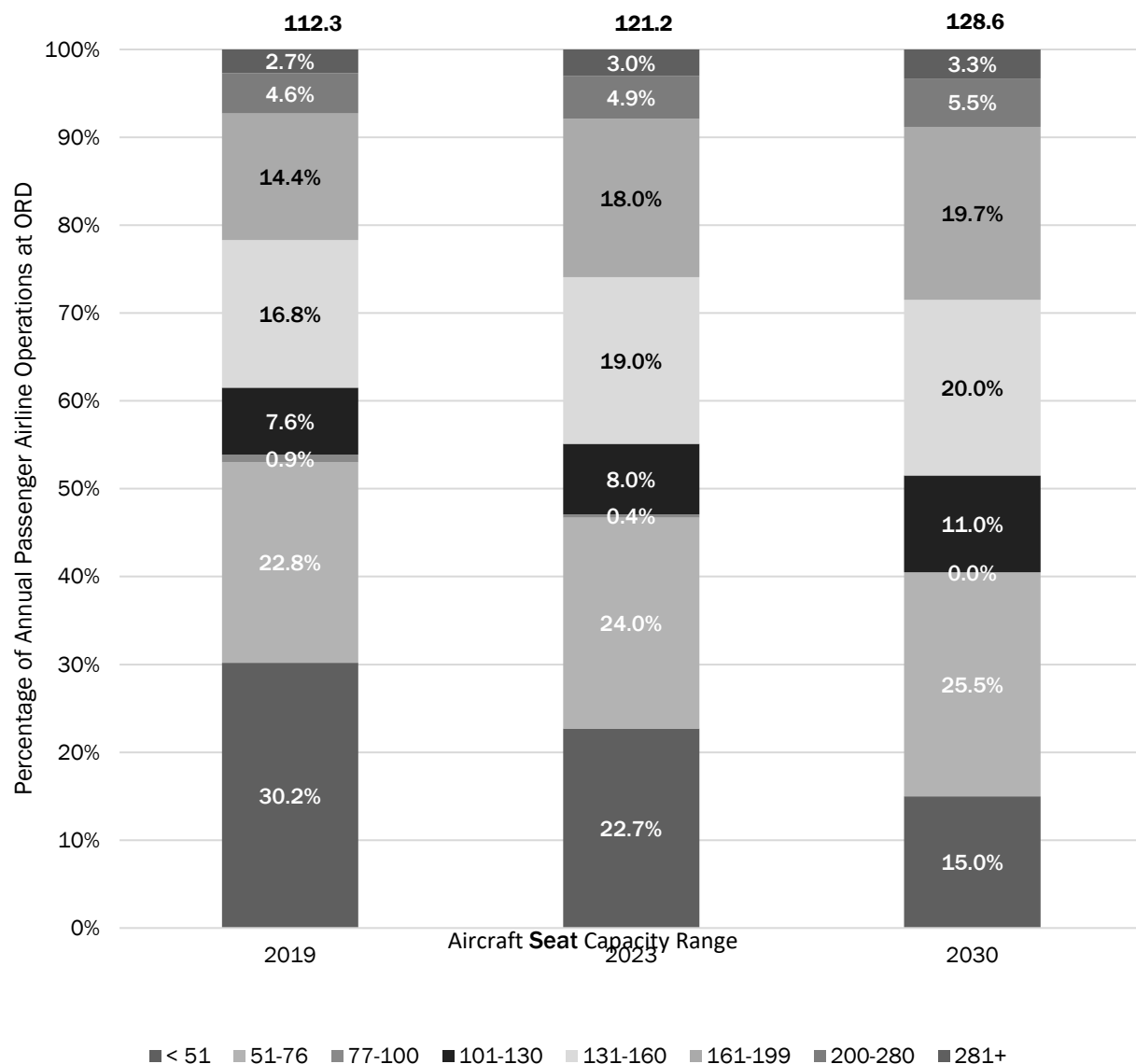
**TABLE B-7**  
**PASSENGER AIRCRAFT OPERATIONS – CALENDAR YEARS**

Year	Total Enplaned Passengers	Total Passenger Aircraft Operations
<b>Historical</b>		
2006	38,122,240	932,874
2007	37,402,803	913,945
2008	34,890,004	874,177
2009	32,440,094	832,398

<b>Year</b>	<b>Total Enplaned Passengers</b>	<b>Total Passenger Aircraft Operations</b>
2010	32,963,479	864,286
2011	32,980,669	875,138
2012	33,242,124	870,956
2013	33,402,530	870,228
2014	35,136,941	872,179
2015	37,317,207	871,583
2016	38,785,696	862,187
2017	39,826,556	862,030
2018	41,623,010	877,461
<b>Forecast</b>		
2019	43,560,290	912,737
2020	44,620,281	914,029
2021	45,583,343	915,044
2022	46,494,099	916,379
2023	47,370,842	918,075
2024	48,212,837	924,654
2025	49,053,364	931,555
2026	49,900,388	939,218
2027	50,779,408	947,240
2028	51,696,340	955,702
2029	52,646,798	964,531
2030	53,625,042	973,592
<b>Compound Annual Growth Rate</b>		
2006-18	0.7%	-0.5%
2018-30	2.1%	0.9%
Sources: Chicago Department of Aviation Terminal Area Plan and Air Traffic Actions Environmental Assessment Annual Activity Forecast; January 24, 2020; FAA 2018 Terminal Area Forecast		

The adjusted aircraft operations forecast was developed after analyzing the future fleet mix, average seats per departure, and average load factors. The CDA's proposed fleet mix is shown in Exhibit 3-2 on page 11 of their report, which can be found in **Attachment B-2**, and in **Figure B-27** below.

**FIGURE B-27**  
**PROPOSED PASSENGER AIRLINE FLEET MIX**



Source: Chicago Department of Aviation Terminal Area Plan and Air Traffic Actions Environmental Assessment Annual Activity Forecast; January 24, 2020

It is the view of the FAA's Third Party Consultant that while the average aircraft size (seats/operation) is rising quite quickly (from 111.9 in 2018 to 128.6 in 2030), it is consistent with the 2013-18 span in which seats/operation increased from 94.0 to 111.9.

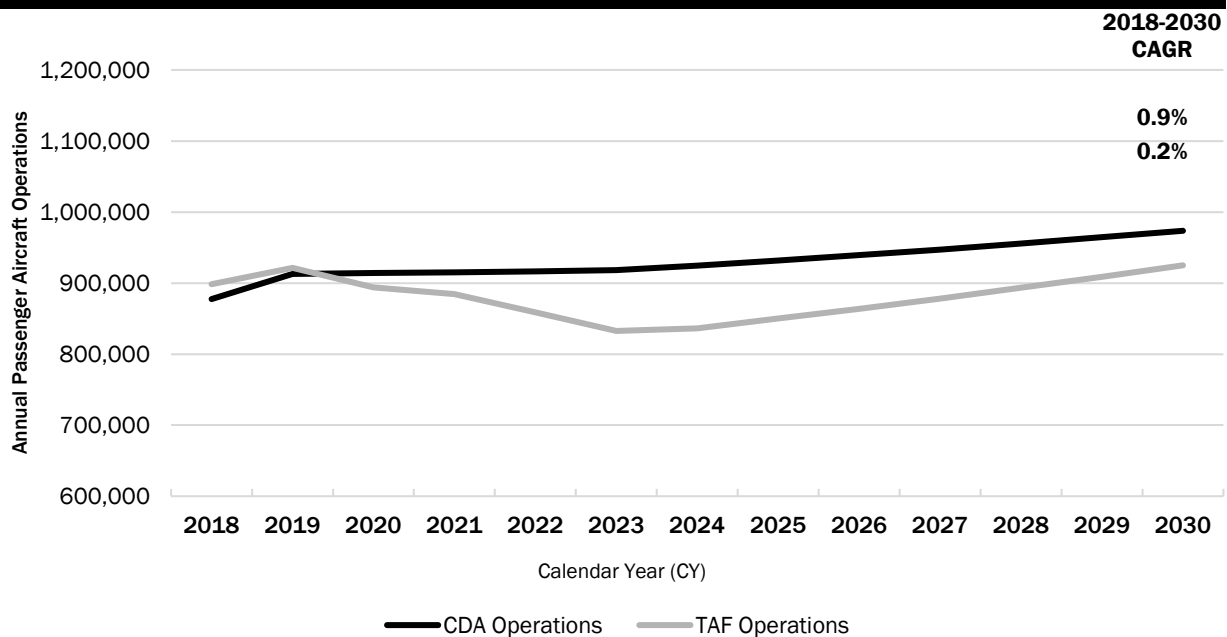
The results of CDA's assumptions regarding the representation of average aircraft types by seat capacity band, along with average occupancy factors, drive the results presented in Table 3-5 of the CDA report, which can be found in **Attachment B-2** as well as in **Table B-8**.

**TABLE B-8**  
**PASSENGER AIRCRAFT OPERATIONS ASSUMPTIONS – CALENDAR YEARS**

Year	Total Passenger Aircraft Operations	Average Seats per Departure	Total Enplaned Passengers	Average Seat Factor
<b>Historical</b>				
2006	932,874	104.2	38,122,240	78.4%
2007	913,945	104.6	37,402,803	78.2%
2008	874,177	104.3	34,890,004	76.5%
2009	832,398	102.7	32,440,094	75.9%
2010	864,286	96.7	32,963,479	78.9%
2011	875,138	95.9	32,980,669	78.6%
2012	870,956	95.1	33,242,124	80.3%
2013	870,228	94.0	33,402,530	81.7%
2014	872,179	97.0	35,136,941	83.1%
2015	871,583	104.6	37,317,207	81.9%
2016	862,187	109.2	38,785,696	82.4%
2017	862,030	113.0	39,826,556	81.8%
2018	877,461	111.9	41,623,010	84.8%
<b>Forecast</b>				
2019	912,737	112.3	43,560,290	85.0%
2020	914,029	114.9	44,620,281	85.0%
2021	915,044	117.1	45,583,343	85.1%
2022	916,379	119.2	46,494,099	85.1%
2023	918,075	121.2	47,370,842	85.1%
2024	924,654	122.2	48,212,837	85.3%
2025	931,555	123.2	49,053,364	85.5%
2026	939,218	124.2	49,900,388	85.6%
2027	947,240	125.2	50,779,408	85.6%
2028	955,702	126.2	51,696,340	85.7%
2029	964,531	127.2	52,646,798	85.7%
2030	973,592	128.6	53,625,042	85.7%
<b>Compound Annual Growth Rate</b>				
2006-2018	-0.5%		0.7%	
2018-2030	0.9%		2.1%	
Source: Chicago Department of Aviation Terminal Area Plan and Air Traffic Actions Environmental Assessment Annual Activity Forecast; January 24, 2020				

These factors were then applied to the TAF passenger forecast. The FAA's Third Party Consultant views these assumptions, and the passenger operations forecast, as reasonable. **Figure B-28** shows a comparison

of CDA's passenger operations forecast and the TAF. The CDA projects passenger operations will grow at an average annual rate of 0.9 percent between 2018 and 2030, while the TAF assumed an average annual growth rate of 0.2 percent over the same period.

**FIGURE B-28****CDA PASSENGER AIRCRAFT OPERATIONS FORECAST VS FAA TAF**

Note: TAF operations include Air Carrier and Air Taxi operations. The TAF is converted from federal fiscal years to calendar years.

Source: Chicago Department of Aviation Terminal Area Plan and Air Traffic Actions Environmental Assessment Annual Activity Forecast; January 24, 2020

**B.6.2 Cargo Operations Forecast**

Since 2014, cargo operations at Chicago have seen a steady increase. With new cargo facilities at O'Hare, the airport can process additional cargo. Unlike passenger operations, cargo activity peaks during the winter months, as well as during the nighttime hours.

The CDA developed cargo operations forecasts based on O'Hare's share of the FAA's forecast of U.S. cargo activity. The CDA confirmed that the FAA's cargo forecast for the U.S. is reasonable in that it links cargo to economic activity in the U.S. The CDA then made assumptions about average aircraft size, load, and routes to derive cargo operations at O'Hare. The FAA's Third Party Consultant has reviewed the methodology and results and finds them reasonable and appropriate for environmental modeling.

**B.6.3 General Aviation and Military Operations Forecast**

Both general aviation and military operations make up a small share of total operations at O'Hare, accounting for 0.6 percent of total operations at the airport. As a result, the CDA assumed the TAF was a sufficient forecast of future operations. The FAA's Third Party Consultant agrees with this approach.

#### **B.6.4 Aircraft Operations Forecast Conclusions**

Based on the CDA's analysis of aircraft operation trends at Chicago, both historically and in the future, and the FAA's Third Party Consultant's independent analysis, the adjusted aircraft operations forecast is reasonable.

---

### **B.7 DESIGN DAY FLIGHT SCHEDULE ANALYSIS**

From the annual forecasts of passengers and aircraft operations, the CDA derived forecasts of peak period activity to develop design day flight schedules for 2023 and 2030 that provide the basis and detail for environmental modeling. Peak period scheduled passenger airline activity in summer 2019 provided the basis for the passenger and passenger aircraft activity. For non-scheduled activity including cargo, general aviation, and military activity, a variety of data sources collected by the U.S. Department of Transportation (DOT) and the City for activity in 2018 were used to form a base schedule of activity by those airport users. The CDA then applied the expected annual growth rates discussed in the previous section to passenger, cargo, general aviation, and military activity to develop design day flight schedules that reflect the amount, time of day, and expected aircraft in 2023 and 2030. The FAA's Third Party Consultant has reviewed the source data, analytical methodology, modeling, and results, and believes that the resultant design day flight schedules are appropriate for environmental modeling purposes.

#### **B.7.1 Baseline Peak Month Average Day**

The CDA developed design day flight schedules based on peak month average day activity at O'Hare, which is appropriate for environmental modeling purposes because it reflects typical activity during the busiest period of the year. Using activity from the busiest time of the year translates to the highest sustained period of noise and emissions generation and, therefore, effects on the environment. Activity at O'Hare peaks in the summer and the peak has historically occurred in July.

##### **B.7.1.1 Passenger Aircraft Activity**

During July, passenger airlines schedule the most flights and have the most seat capacity available of any month of the year. Passenger airline schedules typically include a similar number of flights each weekday, with lower levels of activity on weekends or during holiday weeks such as the week that contains Independence Day, July 4. Published schedules for passenger airline activity throughout 2019 reflect a peak in July and exhibit the typical pattern of peak activity during weekdays. The CDA has selected a weekday outside of a holiday week, all of which have virtually identical schedules in July of 2019. The specific day selected was Wednesday, July 24, 2019. The flight schedule from the selected day provides all the detail of each flight, including arrival and departure times, airline operator, route, and aircraft type. The FAA's Third Party Consultant believes the CDA's approach and its selection of a base design day for passenger activity is reasonable and appropriate for environmental evaluation.

##### **B.7.1.2 Non-Passenger Aircraft Activity**

All cargo, general aviation, and military activity was based on actual activity at O'Hare in the peak month of 2018 (July). The CDA used a variety of sources to develop a base schedule of activity for these operations. These sources included the FAA's Air Traffic Activity Data Systems (ATADS), the FAA's Traffic Flow Management System Counts (TFMSC), and Aerobahn noise monitoring data along with the CDA's own statistics as published on its website. By using available information from each of these sources, the CDA

developed a representative schedule of cargo, general aviation, and military activity that includes arrival and departure times, the operator of the flight, routing, and aircraft type. This schedule provides the same level of detail as published schedules for passenger activity.

While general aviation and military activity are relatively consistent over the course of the year, cargo aircraft activity peaks in the fall and winter. Cargo activity seasonality peaks are driven by increased consumer activity leading up to the holidays toward the end of the calendar year. At O'Hare, cargo operations typically peak in October or November; in 2018 the cargo operations peak occurred in October. To ensure that cargo operations were not under-represented in a design day schedule from July, the CDA reviewed cargo activity from October 2018 and found that the amount of cargo activity at night was not under-represented in aircraft types or operations in the July schedules.

For this reason, the CDA has proceeded with an unadjusted July peak for cargo, general aviation, and military activity. The FAA's Third Party Consultant has reviewed the CDA's data sources, analysis, reasoning, and conclusions, and believes that the July design day flight schedule for cargo, general aviation, and military activity based on 2018 data is reasonable and appropriate for environmental modeling purposes for this EA.

### **B.7.1.3 Passenger Activity**

The CDA developed peak month average day passenger activity by applying load factors and origin and destination versus connecting passengers on a flight-by-flight basis using historical data from 2018. Passenger load factors were sourced from the U.S. Department of Transportation T-100 data base by airline and city pair market; origin and destination passengers were sourced by airline and route from the U.S. Department of Transportation Origin and Destination Passenger Survey. The FAA's Third Party Consultant believes this is reasonable and appropriate.

### **B.7.2 Peak Period Passenger Activity Forecasts**

Over the forecast period, the CDA applied annual forecast growth rates to passengers on a flight-by-flight basis. As load factors on existing aircraft reached operational limits (95 percent), the CDA increased the size of aircraft to the next largest variant of the aircraft group. In addition, the CDA phased out certain aircraft types over the forecast period to reflect aircraft replacement strategies of the various airlines. Consistent with these aircraft replacement plans, the new aircraft is typically larger than the old aircraft it replaced.

Once up-gauging and aircraft replacement opportunities were exhausted, the CDA added flights in the city-pair market. New flights were added proportionally across the day to preserve the peaks and troughs (or waves) of flights typical of O'Hare. New flights also preserved the day-night split of activity, and the relative market shares of the airlines, so as not to change the character of passenger air service at O'Hare. The FAA's Third Party Consultant believes the CDA's analysis and conclusions in developing the design day flight schedules for passenger activity are reasonable and appropriate.

### **B.7.3 Peak Period Non-Passenger Activity Forecasts**

For cargo, general aviation, and military activity, the CDA applied annual forecast growth rates to aircraft operations. As additional operations were appropriate, the CDA added flights to the design day flight schedule that preserved the timing and character of the operations over the course of the day as well as the proportion of operations operated during the day and night. The FAA's Third Party Consultant believes



that the CDA's analysis and conclusions in developing the design day flight schedules for cargo, general aviation, and military activity is reasonable and appropriate.

#### **B.7.4 Daytime and Nighttime Aircraft Activity**

In developing the design day flight schedules, the CDA included the typical share of nighttime aircraft activity at O'Hare between 10:00:00 PM and 06:59:59 AM. As described above, passenger operations were added proportionally across the day in a manner that preserves the hourly profile of flight activity over the course of the day and the night. Additional cargo flights were added in proportion to the day and night split of such activity. While general aviation activity overwhelmingly occurs during the day, the design day flight schedules include general aviation activity at night to ensure appropriate representation.

Historically, nighttime activity at O'Hare has represented approximately 10 percent of total activity at the Airport. In 2019, nighttime activity represented 10.4 percent of total activity during the peak month average day. In the CDA's 2023 design day flight schedule, nighttime activity represents 10.5 percent of total activity, while in the CDA's 2030 design day flight schedule, nighttime activity represents 10.6 percent of total activity. The FAA's Third Party Consultant believes the CDA's design day flight schedule activity in the daytime and the nighttime are reasonable and appropriate for environmental modeling.

# **ATTACHMENT B-1**

## **ANALYSIS OF THE IMPACT OF PROJECT DELAYS ON THE FORECAST OF PASSENGER ACTIVITY**

The construction schedule for the Proposed Action has been revised to commence in Fall 2022 at the earliest, compared to the original scheduled construction start in Spring 2021. This change is due to project-related delays. As a result of revisions to the proposed construction schedule, the FAA asked its Third Party Consultant to analyze the forecasts of the Interim Condition and Build Out Condition to determine whether they remain appropriate for environmental modeling. This memorandum does not address the impact COVID-19 has had on forecast operations at O'Hare. The impact of COVID-19 is addressed in **Appendix N**. The analysis found that while COVID-19 had an immediate and significant impact on O'Hare's passenger traffic and operations, O'Hare will resume growth and is expected to achieve previously forecasted traffic levels for 2030 by 2032.

The original forecast period used to assess the environmental effects of the Proposed Action was 2019–30, with specific design days analyzed for the Interim Condition in 2023, representing a peak construction year, and 2030, reflecting full Build Out. As a result of the revised timetable, the forecast year representing peak construction conditions analyzed in the Interim year would shift from 2023 to 2025 and Build Out would shift from 2030 to 2032. While the proposed construction schedule remains subject to further review, the FAA's Third Party Consultant re-examined the differences in passenger operations, passenger fleet mix, and total aircraft operations from 2023 and 2030 to 2025 and 2032. The following analysis demonstrates that differences in fleet mix and operations are not material and that there would not be significant changes to the forecast if the analysis years are shifted.

**Table B-1-1** shows the passenger operations forecasted by the City of Chicago for O'Hare between 2018 and 2030. As shown, passenger operations are forecast to increase 0.7 percent year-over-year between 2023 and 2025, which equates to an increase of 37 daily operations over the two-year period. In its forecast, the City of Chicago's aircraft operations forecast exceeded that of the FAA's TAF because the TAF assumed a complete retirement of 50-seat regional jets in 2023. These additional aircraft operations made the 2023 Interim Condition forecast conservative. Because the difference in operations between 2023 and 2025 is modest, and the original forecast of operations was conservatively above the TAF, the forecast Interim Condition in 2023 remains relevant for 2025. Furthermore, the results of Total Airspace and Airport Modeler (TAAM) modeling of activity levels in 2023 and 2030 did not trigger delays under a no-action scenario and all flights could be gated (see No Action Build Out gate schedule from TAAM modeling in **Attachment B-2**), which provides further basis for reasoning that a two-year delay in the Interim Condition would have no material impact on results.

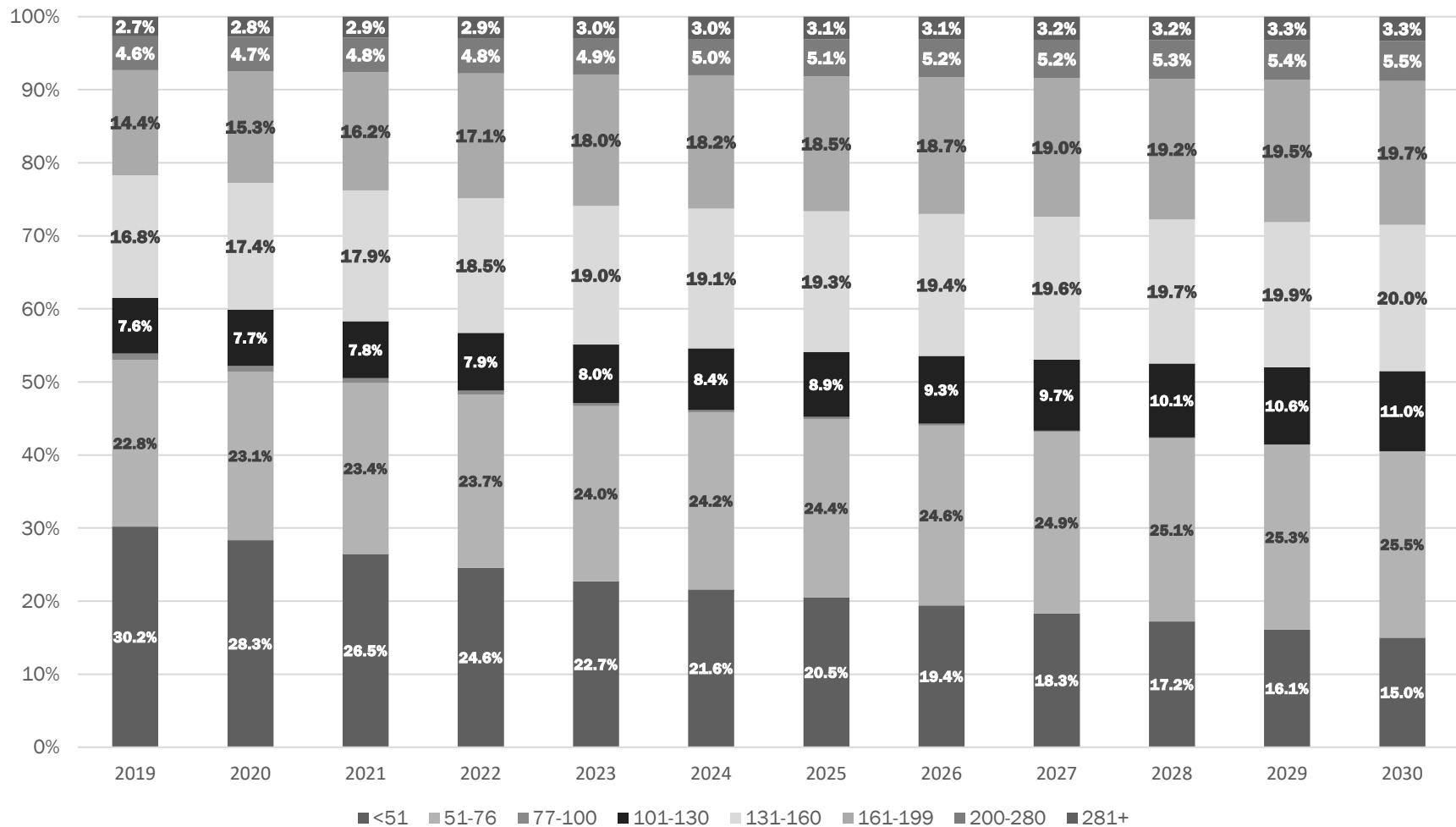
Passenger operations between 2028 and 2030 are forecast to increase 0.9 percent year-over-year, or by 25 daily operations in 2029 and an additional 24 daily operations in 2030, for a total increase of 49 daily operations over the two-year span. The increase in operations between 2028 and 2030 is similar to the expected increase in the operations forecast in 2031 and 2032. These modest increases in activity would not give rise to significant changes to environmental analysis, and therefore the level of activity analyzed for Build Out in 2030 would remain appropriate for 2032.

**TABLE B-1-1**  
**FORECAST OF PASSENGER OPERATIONS AT O'HARE**

Year	Passenger Operations	Percent Change	Average Daily Operations
2018	877,461		2,404
2019	912,737	4.0%	2,501
2020	914,029	0.1%	2,504
2021	915,044	0.1%	2,507
2022	916,379	0.1%	2,511
2023	918,075	0.2%	2,515
2024	924,654	0.7%	2,533
2025	931,555	0.7%	2,552
2026	939,218	0.8%	2,573
2027	947,240	0.9%	2,595
2028	955,702	0.9%	2,618
2029	964,531	0.9%	2,643
2030	973,592	0.9%	2,667

Source: Chicago Department of Aviation Terminal Area Plan and Air Traffic Actions Environmental Assessment Annual Activity Forecast; January 24, 2020

**FIGURE B-1-1**  
**FORECAST OF FLEET MIX FOR O'HARE PASSENGER OPERATIONS**



Note: The share of aircraft operations in the 77-100 category represents less than half a percent throughout the 2023-2030 time period.

Source: Chicago Department of Aviation Terminal Area Plan and Air Traffic Actions Environmental Assessment Annual Activity Forecast; January 24, 2020

The FAA's Third Party Consultant also analyzed the passenger fleet mix that the City forecasted for the years between 2023 and 2030 to assess any significant changes in the passenger aircraft utilized at O'Hare. Based on the fleet forecast that the City provided for 2019, 2023, and 2030, the FAA's Third Party Consultant interpolated the results for 2020–22 and 2024–29. As shown in **Figure B-1-1**, the FAA's Third Party Consultant found no material changes to the passenger fleet mix expected to operate at O'Hare as the significant fleet changes such as the elimination of MD-88 and MD-90 aircraft were forecast to occur prior to 2023, with only incremental changes because of fleet modernization occurring thereafter. The minimal changes in the forecasted fleet mix through 2030 reinforces the analysis that shifting the analysis years to include 2031 and 2032 would not meaningfully impact the forecast of operations or fleet mix.

As shown in **Table B-1-2**, total aircraft operations were analyzed by operation type for the same period between 2023 and 2025 and between 2028 and 2030. Over the life of the forecast, O'Hare's operations are forecast to increase at approximately one percent per year. As discussed earlier, passenger operations are projected to increase at 0.7 percent per year between 2023 and 2025 and 0.9 percent per year between 2028 and 2030. General aviation and military operations are forecasted to remain constant throughout the forecast period and are not expected to change beyond 2030. Cargo operations are forecast to increase at the highest rate of 2.8 percent over the forecast period of 2018–30. However, cargo operations remain a small portion of total operations; they account for approximately three percent of total flights at O'Hare throughout the forecast period, and changes between the years of 2023 and 2025, and 2030 and beyond would not be significant to the overall forecast.

**TABLE B-1-2**  
**TOTAL AIRCRAFT OPERATIONS FORECAST FOR O'HARE**

Total Aircraft Operations Forecast					
Year	Passenger	Cargo	General Aviation	Military	Total
2018	877,461	24,739	5,770	75	908,045
2019	912,737	25,878	5,906	75	944,596
2020	914,029	26,704	5,906	75	946,714
2021	915,044	27,361	5,906	75	948,386
2022	916,379	27,937	5,906	75	950,297
2023	918,075	28,433	5,906	75	952,489
2024	924,654	28,994	5,906	75	959,629
2025	931,555	29,718	5,906	75	967,254
2026	939,218	30,572	5,906	75	975,771
2027	947,240	31,485	5,906	75	984,706
2028	955,702	32,410	5,906	75	994,093
2029	964,531	33,360	5,906	75	1,003,872
2030	973,592	34,283	5,906	75	1,013,856
Compound Annual Growth Rate					
2018–30	0.9%	2.8%	0.2%	0.0%	0.9%
2023–25	0.7%	2.2%	0.0%	0.0%	0.8%

<b>2028-30</b>	0.9%	2.8%	0.0%	0.0%	1.0%
----------------	------	------	------	------	------

Source: Chicago Department of Aviation Terminal Area Plan and Air Traffic Actions Environmental Assessment Annual Activity Forecast; January 24, 2020

In conclusion, the FAA's Third Party Consultant found that changes in passenger operations, the passenger fleet mix and total aircraft operations between 2023-25 and 2028-30 were not significant and therefore shifting the analysis years for the Interim Condition to 2025 and the Build Out Condition to 2032 would not meaningfully impact the forecast.

**ATTACHMENT B-2**

**CHICAGO DEPARTMENT OF AVIATION'S TERMINAL  
AREA PLAN AND AIR TRAFFIC ACTIONS**

**ENVIRONMENTAL ASSESSMENT  
ANNUAL ACTIVITY FORECAST**



# O HARE 21

## TERMINAL AREA PLAN

### Terminal Area Plan and Air Traffic Actions Environmental Assessment Annual Activity Forecast



PREPARED BY:  
RICONDO & ASSOCIATES, INC.

January 24, 2020

DRAFT



JANUARY 2020

[DRAFT]

## Table of Contents

<b>1.</b>	<b>Introduction .....</b>	<b>1</b>
<b>2.</b>	<b>Background .....</b>	<b>1</b>
<b>2.1</b>	<b>Role of the Airport.....</b>	<b>1</b>
<b>2.2</b>	<b>Flight Limitations .....</b>	<b>2</b>
<b>2.3</b>	<b>Terminal Facility Development .....</b>	<b>3</b>
<b>3.</b>	<b>Annual Activity Forecasts .....</b>	<b>3</b>
<b>3.1</b>	<b>Passenger Airline Activity.....</b>	<b>3</b>
3.1.1	Enplaned Passenger Forecasts .....	3
3.1.2	Passenger Airline Operations Forecasts .....	7
3.1.3	Passenger Airline Activity Forecast Summary.....	11
<b>3.2</b>	<b>Cargo Airline Aircraft Operations Forecast .....</b>	<b>14</b>
<b>3.3</b>	<b>General Aviation and Military Aircraft Operations Forecast .....</b>	<b>17</b>
<b>3.4</b>	<b>Total Aircraft Operations Forecasts.....</b>	<b>17</b>
<b>4.</b>	<b>Constrained Activity Analysis .....</b>	<b>20</b>
<b>4.1</b>	<b>Airlines Could Increase Capacity at O'Hare Today to Accommodate Profitable Demand .....</b>	<b>21</b>
<b>4.2</b>	<b>New American Gates Did Not Induce Passenger Growth.....</b>	<b>23</b>
<b>4.3</b>	<b>O'Hare Development is Keeping it Competitive as Other Hubs Undertake Improvements.....</b>	<b>25</b>
<b>5.</b>	<b>Summary and Conclusion.....</b>	<b>26</b>
<b>6.</b>	<b>Project Phasing Overview.....</b>	<b>27</b>
<b>7.</b>	<b>Design Day Flight Schedule Methodology and Assumptions.....</b>	<b>29</b>
<b>7.1</b>	<b>Design Day Flight Schedule Development.....</b>	<b>29</b>
7.1.1	Passenger Airline Flight Schedules.....	31
7.1.2	All-Cargo and General Aviation Flight Schedules .....	32
<b>7.2</b>	<b>Design Day Flight Schedule Results.....</b>	<b>34</b>
7.2.1	Enplaned Passenger Results .....	34

Annual Activity Forecasts

[i]



JANUARY 2020

[DRAFT]

7.2.2	Aircraft Operations Results .....	40
<b>8.</b>	<b>Constrained Schedule Analysis .....</b>	<b>44</b>
<b>8.1</b>	<b>Gate Layout, Gate Gauge, and Airline Allocation .....</b>	<b>44</b>
<b>8.2</b>	<b>Aircraft Turn Times .....</b>	<b>44</b>
<b>8.3</b>	<b>Gate Separation, Tow-On, and Tow-Off Times .....</b>	<b>44</b>
<b>8.4</b>	<b>Gating Summary .....</b>	<b>46</b>

## List of Appendices

Appendix A	Gated 2030 Flight Schedule
------------	----------------------------

## List of Tables

Table 3-1: 2018 Terminal Area Forecast – Fiscal and Calendar Years .....	4
Table 3-2: Enplaned Passenger Forecast .....	6
Table 3-3: Comparison of Socioeconomic Model Outputs .....	7
Table 3-4: O'Hare Share of Total US Enplaned Revenue Passengers .....	8
Table 3-5: Passenger Aircraft Operations Forecast and Seat Factor .....	12
Table 3-6: Enplaned Passengers and Aircraft Operations Forecast .....	13
Table 3-7: Cargo Aircraft Revenue Ton Mile Forecast .....	15
Table 3-8: Cargo Aircraft Operations Forecast .....	16
Table 3-9: General Aviation and Military Aircraft Operations Forecasts .....	18
Table 3-10: Total Aircraft Operations Forecasts .....	19
Table 4-1: Additional Seats That Could Be Offered With Higher-Capacity Aircraft .....	22
Table 4-2: O'Hare Hub Carrier Schedule Metrics .....	24
Table 6-1: Gate Count and Selected Metrics Per Gate .....	28
Table 6-2: Incremental Gate Capacity During TAP Construction .....	28
Table 7-1: CY 2019 O'Hare Total Scheduled Passenger Airline Activity by Month .....	29



JANUARY 2020

[DRAFT]

Table 7-2: Scheduled O'Hare Passenger Airline Activity – July 2019 .....	30
Table 7-3: July Block Hour Operations Allocations – Cargo Airlines .....	35
Table 7-4: July Block Hour Operations Allocations – General Aviation .....	36
Table 7-5: Annual and DDFS Total Passengers .....	37
Table 7-6: Hourly Summary – Enplaned Passengers .....	39
Table 7-7: Annual and DDFS Passenger Airline Operations .....	40
Table 7-8: Non-passenger Airline and Total Airport Aircraft Operations .....	40
Table 7-9: Hourly Summary – Total Aircraft Operations .....	42
Table 7-10: Passenger Aircraft Operations Fleet Mix .....	43
Table 7-11: Cargo Aircraft Operations Fleet Mix .....	43
Table 8-1: Minimum Time at Gate (Domestic Operations) .....	46
Table 8-2: Minimum Time at Gate (International Operations) .....	46

## List of Exhibits

Exhibit 3-1: 2018 TAF Aircraft Operations Forecast .....	9
Exhibit 3-2: Proposed Passenger Airline Fleet Mix .....	11
Exhibit 3-3: Comparison of Aircraft Operations Forecasts .....	20
Exhibit 4-1: Service at O'Hare That Could be Operated with Higher-Capacity Aircraft .....	21
Exhibit 4-2: Gating Chart of Selected Airlines at O'Hare .....	22
Exhibit 4-3: Seats per Departure and Average Seat Factor at Major Hubs .....	23
Exhibit 7-1: Cargo Aircraft Day and Night Operations .....	34
Exhibit 7-2: Rolling Hour O&D Passenger Activity .....	37
Exhibit 7-3: Rolling Hour Connecting Passenger Activity .....	38
Exhibit 7-4: Rolling Hour Total Passenger Activity .....	38
Exhibit 7-5: Rolling Hour Passenger Aircraft Operations .....	41
Exhibit 7-6: Rolling Hour Total Aircraft Operations .....	41
Exhibit 8-1: No Action – Full Build Gate Layout .....	45



JANUARY 2020

[DRAFT]

## 1. Introduction

This document presents information on annual activity forecasts (passenger airline, cargo airline, general aviation, and military) at Chicago O'Hare International Airport (O'Hare or the Airport) for use in the Terminal Area Plan and Air Traffic Actions Environmental Assessment (TAP EA). The TAP EA is evaluating the addition of facilities and various airspace changes at O'Hare. The Airport plays a critical role in the national airport system serving as one of the busiest airports in the U.S. It services the fourth largest population base in the country and serves as a connecting hub for United Airlines (United) and American Airlines (American). The Federal Aviation Administration's 2018 *Terminal Area Forecast* (TAF) provides a forecast of airport activity unconstrained by facility development that reflects continued growth. This memo evaluates the use of the FAA's TAF as the forecast of passenger growth and includes various factors that could influence deviations from the TAF forecast. This includes factors such as:

- An understanding of recent and upcoming terminal facility development
- The potential influence of the terminal facility projects, or lack thereof, on activity forecasts
- Potential constraints of a no-action scenario, a description of the TAP project phasing, and a constrained schedule analysis.

As discussed herein, the analyses support the use of the passenger activity forecast included in the TAF. A modified version of the TAF aircraft operations is being proposed in order to address airport-specific considerations. While there are many factors that could influence future activity levels, some materially, the FAA TAF activity levels reflect a reasonable assumption of activity for purposes of the EA.

## 2. Background

The passenger and operational forecast analysis discussed in this memo includes consideration of potential historical and future constraints and their impact to historical or forecast activity levels.

### 2.1 Role of the Airport

The airport serves Origin and Destination (O&D) passengers to and from the Chicago area. Population, personal income, and other economic factors are strong indicators of passenger demand. The Chicago 15-county Air Trade Area (ATA) includes a large population and robust personal income. The ATA is the fourth most populous metropolitan region in the U.S. and the per capita personal income is 10.4 percent higher than that of the U.S. in 2017.

The large economic base and central geographic location make it a natural location for an airline hub. O'Hare serves as an international connecting hub for United and American. It is the busiest airport in United's system measured in terms of passengers and the fourth busiest airport in American's network.





JANUARY 2020

[DRAFT]

## 2.2 Flight Limitations

O'Hare has historically been under restricted flight operations in various forms. The "High Density Rule" established in 1969 to manage congestion at five high-density airports. Following the phasing out of the High Density Rule which was completed in 2002, the Airport experienced the first unconstrained operational activity in several decades. The operational activity increased, and significant delays occurred. Flight caps were imposed starting in 2004 to address these delays. In 2005, construction of the O'Hare Modernization Program (OMP) began, which implemented an airfield program designed to reduce delays and increase airfield capacity. The flight caps expired in 2008 in conjunction with the completion of the first OMP runway project. The period from 2008 through present reflects activity not constrained by FAA imposed flight restrictions and can be used to inform analysis of future activity at the airport.

The OMP airfield projects include a comprehensive reconfiguration of the airfield from sets of converging parallel runways in three main directional orientations (northeast/southwest, east/west, and northwest/southeast) to six parallel runways in the east/west direction and two crosswind runways in the northeast/southwest direction. The first component, Runway 9L/27R, was completed and opened in 2008. The relocation of two runways and extension of two additional runways are complete and the final new runway and runway extension are anticipated to be completed in 2020 and 2021 respectively.

The increase in flights following the phasing out of the High Density Rule occurred during a period of economic growth. Also, during this time, airlines were retiring older narrow body aircraft, such as the Boeing 737 Classics and MD-80s and increasing the use of regional jet aircraft. These factors are reflected in the growth of aircraft operations at O'Hare, which led to delays that ultimately resulted in the FAA's implementation of flight caps. The period immediately following the flight caps included an economic recession. As the economy recovered from the recession, operational activity growth was limited while airlines implemented capacity discipline throughout the industry, retired smaller regional jets, and upgauged aircraft throughout airline fleets. These factors resulted in stagnant aircraft operations growth until recently.

While operations are returning to levels that occurred when flight caps were implemented, the OMP airfield projects enhanced the capacity of the airport and improved the operational performance. As evidence, the average hourly arrival throughput rates have increased approximately 20 percent the minutes of FAA system impact delays attributed to O'Hare have been reduced by approximately 63 percent when comparing the six years prior to the OMP (2003–2008) to the period since the OMP began (2009–2018).<sup>1</sup> While it is possible for the FAA to implement measure to regulate flights, the evaluation would be based on airport performance (i.e. delays) and not an operational level without consideration of delays.

---

<sup>1</sup> Source: FAA Aviation System Performance Metrics (System Impact Delays), May 2019; Ricondo & Associates, Inc. (calculations); May 2019. System Impact Delays are delays assigned to causal facilities in FAA's operations network and composed of traffic management initiatives delays, departure delays, and airborne delays.



JANUARY 2020

[DRAFT]

## 2.3 Terminal Facility Development

The City of Chicago has begun terminal facility development with most of the OMP runway projects now complete or under construction. As of April 2017, there were 185 gates at O'Hare.<sup>2</sup> The L-concourse stinger expansion in 2018 was the first terminal project, adding 535 linear feet of gate frontage and five additional gate positions. Near-term gate projects are included in the No Action scenario of the TAP EA. These include an additional L-concourse stinger expansion and the terminal extension which are collectively anticipated to result in an additional 1,827 feet and 10-16 gates depending on the configuration. The TAP project is anticipated to include approximately 3,858 linear feet of increment frontage and up to 219 total gates depending on the configuration. The gate facility projects are discussed in more detail in Section 6.

## 3. Annual Activity Forecasts

As reflected herein, the Federal Aviation Administration's *2018 Terminal Area Forecast* (TAF), published in March 2019 is proposed as the primary source of the forecast used in the TAP EA. The various components of the TAF were assessed to determine their reasonableness to serve as the basis for analyses supporting the TAP EA. Specifically, the enplaned passenger forecast and passenger, cargo, general aviation, and military aircraft operations forecasts were each separately evaluated to determine whether to adopt them as published in the TAF, or whether adjustments were necessary. The following sections summarize the process used to confirm the appropriateness of the TAF for the TAP EA, and any adjustments made to better reflect anticipated O'Hare activity.

### 3.1 Passenger Airline Activity

#### 3.1.1 Enplaned Passenger Forecasts

The TAF was reviewed for adoption as the annual enplaned passenger forecast. The TAF is prepared by the FAA using a combination of methodologies including review of recent industry trends and expectations of future airline service and schedule data to inform near-term forecasts, and statistical analysis of the relationship between historical demand and local and national economic conditions to inform longer-term forecasts. Per the FAA, the TAF assumes a demand driven forecast for aviation services based upon local and national economic conditions, as well as conditions within the aviation industry and is developed independent of the ability of the airport and air traffic control system to furnish the capacity required to meet demand.

Certain adjustments and assumptions were made in order to provide a complete forecast that is directly comparable to annual demand anticipated to be used for the TAP EA. The TAF is published using federal fiscal years (October-September). Therefore, it was converted to calendar year for the purposes of this analysis using US DOT Form T-100 data (from December 2017 through November 2018) to apportion

---

<sup>2</sup> For purposes of this memo a gate is an active aircraft parking position that is accessed through the terminal building, either via a passenger loading bridge or other means. The number of gates is subject to change based on the configuration of aircraft parking.



JANUARY 2020

[DRAFT]

passengers by month in the calendar year based on actual passengers over that time period. **Table 3-1** presents the 2018 TAF in Federal fiscal years and calendar years.

TABLE 3-1: 2018 TERMINAL AREA FORECAST – FISCAL AND CALENDAR YEARS

Year	2018 TAF (Fiscal Years)	2018 TAF (Calendar Years)
<b>Historical</b>		
2006	36,969,264	36,913,006
2007	36,742,947	36,217,744
2008	34,630,139	33,786,366
2009	31,235,776	31,412,704
2010	31,947,531	31,917,226
2011	31,825,619	31,932,654
2012	32,256,202	32,185,877
2013	31,973,296	32,342,340
2014	33,457,901	34,021,847
2015	35,726,566	36,130,416
2016	37,351,189	37,554,536
2017	38,169,220	38,568,476
2018 <sup>1</sup>	39,775,365	40,309,141
<b>Forecast</b>		
2019	41,922,662	42,184,491
2020	42,975,959	43,211,552
2021	43,923,714	44,144,993
2022	44,813,884	45,027,930
2023	45,674,957	45,878,026
2024	46,491,870	46,694,565
2025	47,307,278	47,509,690
2026	48,121,550	48,331,092
2027	48,964,505	49,183,402
2028	49,845,092	50,072,333
2029	50,759,245	50,993,653
2030	51,702,230	51,941,815
<b>Compound Annual Growth Rate</b>		
2006-2018	0.6%	0.7%
2009-2018	2.7%	2.8%
2018-2030	2.2%	2.1%

NOTE: Excludes nonrevenue passengers.

<sup>1</sup> 2018 values in the TAF are forecast.

SOURCE: Federal Aviation Administration, 2018 Terminal Area Forecast, March 2019.





JANUARY 2020

[DRAFT]

While the TAF forecasts passengers by individual market pair, it does not present forecasts of origin and destination (O&D) and connecting passengers separately. As a hub for United and American, O'Hare serves both O&D and connecting passengers, and the airlines are able to adjust the share of each type that they accommodate at ORD. In recent years, the share of O&D passengers has grown at O'Hare as new nonstop flying by both hub and non-hub carriers has increased. For the purposes of these analyses, and consistent with the assumptions used by the FAA in the development of the TAF, this share is assumed to remain stable during the forecast period, although this share could change in the future.

Additionally, the TAF reflects revenue passengers only. Therefore, the TAF was further adjusted to include nonrevenue passengers<sup>3</sup>, providing a more complete representation of traffic at the Airport. Chicago Department of Aviation data indicate that an additional 3.5 percent of domestic passengers, and 1.8 percent of international passengers were served on a nonrevenue basis in 2018.

The 2018 TAF, converted to calendar years and adjusted for nonrevenue passengers, is presented in **Table 3-2**. Enplaned passengers grew from 2006, the peak year of passenger activity prior to 2016, to CY 2018 at a compound annual growth rate of 0.7 percent. For comparison, the growth rate between CY 2009, the recent low of O'Hare passenger activity, and CY 2018 was 2.9 percent compounded annually. This growth reflects recovery from the 2008 recession.

As shown in Table 2, enplaned passenger volumes are forecast to grow from approximately 41.6 million in CY 2018 to 53.6 million in CY 2030, a compound annual growth rate of 2.1 percent. The 2018 TAF projected 40.3 million revenue enplaned passengers at O'Hare in CY 2018. According to U.S. DOT T-100 data<sup>4</sup>, the actual number of total enplaned passengers was 40.0 million.

The reasonableness of the passenger forecast in the TAF was also assessed through an analysis of the relationship between historical total passenger demand and local and national socioeconomic statistics. Single variable regression analysis was used to determine the predictive relationship between a dependent variable (passenger volume) and an independent demographic and economic variable, including earnings, employment, gross regional/domestic product, population, personal income, and personal income per capita for the Chicago-Naperville CSA and the United States since 2009. The year 2009 was selected as it represents the first full year of activity after the FAA removed flight caps at the Airport in October 2008.

These relationships, in the form of an equation, were used with independent forecasts of socioeconomic activity to project passenger volumes through 2030. The coefficient of determination, or r-squared, for each of these relationships, and the 2018-2030 predicted passenger compound annual growth rates are presented in **Table 3-3**. The 2018 TAF growth rate is also shown for purposes of comparison.

<sup>3</sup> Nonrevenue passengers are crew members and other airline employees or their family members or designees travelling without a purchased ticket.

<sup>4</sup> Accessed from Diio Mi, July 2019



JANUARY 2020

[DRAFT]

The growth rate of total enplaned passengers is generally in-line with the socioeconomic-derived growth rates and, as shown on Table 3, higher than the average growth rate of the identified relationships, and equal to the highest growth rate observed.

TABLE 3-2: ENPLANED PASSENGER FORECAST

Calendar Year	Domestic Enplaned Passengers	International Enplaned Passengers	Total Enplaned Passengers
<b>Historical</b>			
2006	32,734,360	5,387,880	38,122,240
2007	32,040,915	5,361,887	37,402,803
2008	29,783,283	5,106,721	34,890,004
2009	27,753,594	4,686,500	32,440,094
2010	28,344,394	4,619,085	32,963,479
2011	28,431,477	4,549,192	32,980,669
2012	28,654,893	4,587,231	33,242,124
2013	28,715,964	4,686,566	33,402,530
2014	30,195,419	4,941,522	35,136,941
2015	32,225,132	5,092,075	37,317,207
2016	33,353,966	5,431,730	38,785,696
2017	33,872,060	5,954,497	39,826,556
2018 <sup>1</sup>	35,339,515	6,283,495	41,623,010
<b>Forecast</b>			
2019	37,036,425	6,523,866	43,560,290
2020	37,904,594	6,715,687	44,620,281
2021	38,675,123	6,908,220	45,583,343
2022	39,391,826	7,102,273	46,494,099
2023	40,073,734	7,297,109	47,370,842
2024	40,720,194	7,492,643	48,212,837
2025	41,364,862	7,688,502	49,053,364
2026	42,015,906	7,884,482	49,900,388
2027	42,698,941	8,080,467	50,779,408
2028	43,419,833	8,276,506	51,696,340
2029	44,174,116	8,472,683	52,646,798
2030	44,956,023	8,669,019	53,625,042
<b>Compound Annual Growth Rate</b>			
2006-2018	0.6%	1.3%	0.7%
2009-2018	2.7%	3.3%	2.8%
2018-2030	2.0%	2.7%	2.1%

NOTE: The values depicted in this table have been converted from Federal fiscal year to calendar year and adjusted for nonrevenue passengers.

<sup>1</sup> 2018 values in the TAF are forecast.

SOURCE: Federal Aviation Administration, 2018 Terminal Area Forecast, March 2019.



JANUARY 2020

[DRAFT]

TABLE 3-3: COMPARISON OF SOCIOECONOMIC MODEL OUTPUTS

Socioeconomic Variable	R-Squared Value	2018-2030 Predicted Passenger CAGR
United States-Total Personal Income	91.7%	2.1%
<b>2018 TAF</b>	<b>NA</b>	<b>2.1%</b>
Time Series	88.6%	2.0%
United States-Gross Regional Product	93.8%	2.0%
United States-Total Population	88.8%	2.0%
United States-Total Earnings	91.2%	1.9%
United States-Total Personal Income Per Capita	91.3%	1.8%
Chicago-Naperville, IL-IN-WI-Gross Regional Product	90.7%	1.8%
United States-Total Employment	91.5%	1.7%
Chicago-Naperville, IL-IN-WI-Total Personal Income	89.7%	1.7%
Chicago-Naperville, IL-IN-WI-Total Employment	91.5%	1.6%
Chicago-Naperville, IL-IN-WI-Total Earnings	87.0%	1.5%
Chicago-Naperville, IL-IN-WI-Total Personal Income Per Capita	91.2%	1.4%
<b>Average</b>	<b>NA</b>	<b>1.8%</b>

SOURCES: Federal Aviation Administration 2018 Terminal Area Forecast, March 2019; US DOT Form T-100 (historical), date accessed June 2019; Woods & Poole Economics, Inc., June 2019; Ricondo & Associates, Inc. (analysis), June 2019.

A market share analysis was also conducted to determine ORD's enplaned passenger volumes relative to the US, presented in **Table 3-4**.

ORD's share of total US enplaned passengers has remained stable at between 4.4 and 4.5 percent since 2009. Based on the 2018 TAF converted to calendar year, O'Hare is forecast to grow at a similar rate as the US and maintain a 4.5 percent share of US enplaned passengers throughout the forecast period.

### 3.1.2 Passenger Airline Operations Forecasts

The 2018 TAF operations forecast was considered for use in the TAP EA analysis. The 2018 TAF aircraft operations forecast is presented in **Exhibit 3-1**. The TAF forecasts a decline in total operations through 2023, before resuming growth beyond 2023.



JANUARY 2020

[DRAFT]

TABLE 3-4: O'HARE SHARE OF TOTAL US ENPLANED REVENUE PASSENGERS

Calendar Year	O'Hare Revenue Enplaned Passengers	US Revenue Enplaned Passengers	O'Hare Share
<b>Historical</b>			
2006	36,912,685	738,795,907	5.0%
2007	36,214,745	754,260,798	4.8%
2008	33,781,548	734,472,232	4.6%
2009	31,413,715	697,321,055	4.5%
2010	31,917,053	707,845,516	4.5%
2011	31,933,265	724,958,030	4.4%
2012	32,185,476	731,874,265	4.4%
2013	32,344,447	739,134,860	4.4%
2014	34,025,067	761,743,554	4.5%
2015	36,132,722	795,434,978	4.5%
2016	37,555,697	828,578,799	4.5%
2017	38,570,756	856,674,314	4.5%
2018 <sup>1</sup>	40,312,189	897,114,014	4.5%
<b>Forecast</b>			
2019	42,185,986	933,366,426	4.5%
2020	43,212,898	956,904,903	4.5%
2021	44,146,257	978,954,986	4.5%
2022	45,029,152	1,000,221,142	4.5%
2023	45,879,185	1,020,615,320	4.5%
2024	46,695,722	1,039,812,533	4.5%
2025	47,510,846	1,058,787,011	4.5%
2026	48,332,289	1,077,903,370	4.5%
2027	49,184,652	1,097,583,073	4.5%
2028	50,073,630	1,117,817,939	4.5%
2029	50,994,991	1,138,584,800	4.5%
2030	51,943,183	1,159,771,269	4.5%
<b>Compound Annual Growth Rate</b>			
2006-2018	0.7%	1.6%	
2018-2030	2.1%	2.2%	

NOTE: The values depicted in this table have been converted from Federal fiscal year to calendar year.

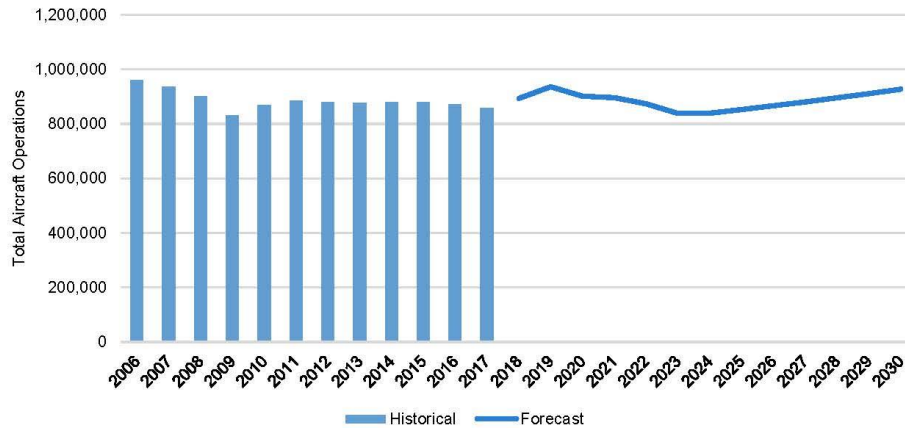
<sup>1</sup> 2018 values in the TAF are forecast. Revenue passengers shown and converted to calendar year.

SOURCE: Federal Aviation Administration, 2018 Terminal Area Forecast, March 2019.



JANUARY 2020

[DRAFT]

**EXHIBIT 3-1: 2018 TAF AIRCRAFT OPERATIONS FORECAST**

SOURCE: Federal Aviation Administration, 2018 Terminal Area Forecast, March 2019.

Although the passenger forecast discussed in the prior section appears reasonable, this decline in aircraft operations, which was largely associated with passenger airline operations, warranted additional analysis. A discussion was held with the FAA's TAF Office to discuss the methodology used in the development of the 2018 TAF for ORD, with particular attention to assumptions that influenced the operations forecasts. One challenge of the TAF is it combines passenger aircraft operations with cargo aircraft operations under the Air Carrier and Air Taxi categories, and it is not possible to separate passenger and cargo aircraft operations forecasts. Additionally, certain fleet mix assumptions used in the development of the TAF may not be appropriate for ORD. According to the FAA TAF Office, the TAF assumes that all 50-seat regional jets will be retired from airline fleets by 2023. Further, the TAF does not incorporate fleet changes specific to an airport; rather it uses industry-wide fleet change assumptions applied uniformly to airports' existing fleet. Therefore, a bottom-up assessment of the passenger aircraft fleet mix specific to O'Hare was prepared to more accurately reflect fleet changes likely to occur at the Airport. The resulting fleet mix was used in the development of the passenger aircraft operations forecast.

The future O'Hare fleet mix was developed based on current and future aircraft models expected to be available in airline fleets during the forecast period. Sources for these data include published fleet orders for US and major foreign airlines operating at the Airport, annual company filings, and aircraft manufacturer press releases. These were evaluated, as well as the replacement of older aircraft by aircraft on order. Evaluation of the fleet mix extended to the assumptions used by the FAA in the development of the TAF. For example, the FAA assumes the complete retirement of 50-seat aircraft by 2023. We believe that the airlines operating aircraft with 50 seats or fewer will retire some of these aircraft, but that these aircraft will





JANUARY 2020

[DRAFT]

continue to operate at O'Hare beyond 2023. Other specific assumptions used in the development of the proposed fleet mix for O'Hare include:

- Retirements of 50-seat aircraft at O'Hare are expected to continue throughout the forecast period
  - Retirement of older regional jets will accelerate during the next five years (through 2023)
  - Limited CRJ-200 and ERJ-145 operations are assumed at O'Hare in 2030
  - CRJ-550 aircraft operations have been assumed to operate at O'Hare through 2030
- The McDonnell Douglas MD-83/88 and MD-90 aircraft are not expected to operate at O'Hare beyond 2022
- Airbus A320ceo/neo and Boeing 737NG/MAX family aircraft are modeled in future schedules in proportion with currently-published order books and fleet plans. This fleet mix assumes that:
  - Despite the grounding of the Boeing 737 MAX in March 2019, the aircraft will be operating in airline fleets in 2023
  - By 2023, approximately 30% of A320 and B737 family aircraft at O'Hare will be new engine variants
  - By 2030, approximately 50% of A320 and B737 family aircraft at O'Hare will be new engine variants
- Growth in average aircraft gauge is forecast considering existing orders for large narrow body aircraft (e.g., Airbus A321neo and Boeing 737 MAX 9 and 10 aircraft)
- Boeing 757 operations will be phased out of O'Hare prior to 2030 and replaced by either Boeing 737 MAX, Airbus A321, or Boeing 787 aircraft depending on the type of flight segment (e.g., short haul or long haul)
- Growth in long haul international flying at O'Hare will be supported by both US and foreign carriers
  - Most Boeing 767-300 aircraft will be replaced by Boeing 787 aircraft by 2030
  - The largest aircraft (Airbus A380 and Boeing 747-8) are assumed to operate at O'Hare throughout the forecast period even though there are limited outstanding future orders for the passenger variants of these aircraft

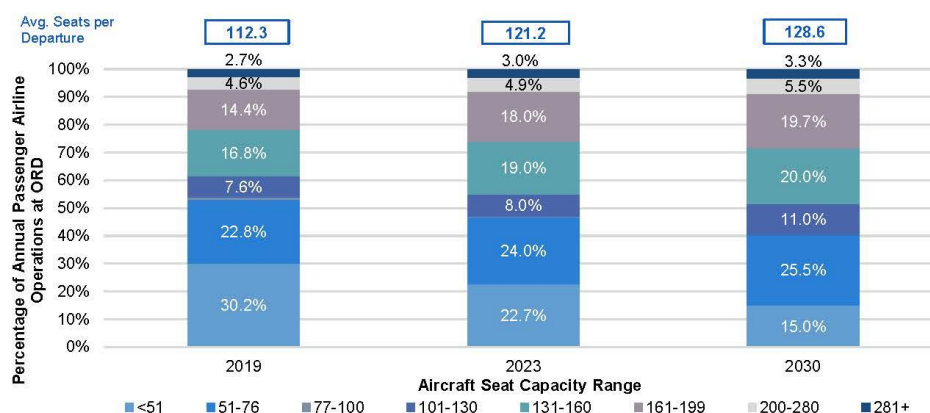
The fleet mix for the base year, 2023, and 2030 are presented in **Exhibit 3-2**. The fleet mix is shown in terms of average seats per departure and by the percentage of aircraft operations conducted within these aircraft seat capacity ranges.



JANUARY 2020

[DRAFT]

## EXHIBIT 3-2: PROPOSED PASSENGER AIRLINE FLEET MIX



SOURCES: Innovata, June 2019; Ricondo &amp; Associates, Inc. (analysis), June 2019.

Seat factors have grown in recent years reaching a peak in 2018 at 84 percent.<sup>5</sup> . Seat factors are forecast to remain largely steady throughout the forecast period. This is consistent with the assumptions used in the 2018 TAF, which forecasts revenue passenger-only seat factors at O'Hare to grow slightly from 82 percent in 2018, to 84 percent by 2045, the final year of forecast activity in the TAF.

The fleet mix, seats per departure, and seat factor forecasts were then applied to the forecast of enplaned passengers to develop the passenger aircraft operations forecast. The passenger aircraft operations forecast is presented in **Table 3-5**. Based on this forecast, passenger aircraft operations are forecast to grow from approximately 877,000 operations in 2018 to nearly 974,000 operations in 2030, a compound annual growth rate of 0.9 percent, lower than the forecast of enplaned passengers.

### 3.1.3 Passenger Airline Activity Forecast Summary

The TAF has been selected as the annual enplaned passenger forecast. The 2018 TAF is a reasonable projection of long-term passenger growth, which is demonstrated by correlation to economic factors and its conservatively-high growth rate relative to growth rates derived from the socioeconomic models explored in Section 3.1.1. Future activity growth is further supported by ORD's role serving a robust origin and destination passenger market within a strong and growing local economy. The Airport's geographic location also makes it a natural connecting hub for the two hub airlines operating from the Airport.

<sup>5</sup> Seat factor is the percentage of seats filled on an aircraft. Although seat factor is often referred to as load factor, load factor takes into account distance and represents revenue passenger miles divided by available seat miles.



JANUARY 2020

[DRAFT]

TABLE 3-5: PASSENGER AIRCRAFT OPERATIONS FORECAST AND SEAT FACTOR

Year	Total Passenger Aircraft Operations	Average Seats Per Departure	Total Enplaned Passengers <sup>1</sup>	Average Seat Factor
<b>Historical</b>				
2006	932,874	104.2	38,122,240	78.4%
2007	913,945	104.6	37,402,803	78.2%
2008	874,177	104.3	34,890,004	76.5%
2009	832,398	102.7	32,440,094	75.9%
2010	864,286	96.7	32,963,479	78.9%
2011	875,138	95.9	32,980,669	78.6%
2012	870,956	95.1	33,242,124	80.3%
2013	870,228	94.0	33,402,530	81.7%
2014	872,179	97.0	35,136,941	83.1%
2015	871,583	104.6	37,317,207	81.9%
2016	862,187	109.2	38,785,696	82.4%
2017	862,030	113.0	39,826,556	81.8%
2018	877,461	111.9	41,623,010	84.8%
<b>Forecast</b>				
2019	912,737	112.3	43,560,290	85.0%
2020	914,029	114.9	44,620,281	85.0%
2021	915,044	117.1	45,583,343	85.1%
2022	916,379	119.2	46,494,099	85.1%
2023	918,075	121.2	47,370,842	85.1%
2024	924,654	122.2	48,212,837	85.3%
2025	931,555	123.2	49,053,364	85.5%
2026	939,218	124.2	49,900,388	85.6%
2027	947,240	125.2	50,779,408	85.6%
2028	955,702	126.2	51,696,340	85.7%
2029	964,531	127.2	52,646,798	85.7%
2030	973,592	128.6	53,625,042	85.7%
<b>Compound Annual Growth Rate</b>				
2006-2018	(0.5%)		0.7%	
2018-2030	0.9%		2.1%	

NOTE: The values depicted in this table have been converted from Federal fiscal year to calendar year.

<sup>1</sup> 2018 values in the TAF are forecast

SOURCES: Federal Aviation Administration, 2018 Terminal Area Forecast, March 2019 (converted to calendar year); US DOT Form T-100 (historical), date accessed June 2019; Ricondo &amp; Associates, Inc. (analysis), June 2019.





JANUARY 2020

[DRAFT]

The passenger aircraft operations forecast is based on an independent analysis of airline fleet plans and expectations of airlines' use of aircraft at the Airport, and the TAF passenger forecast. While certain assumptions used in the 2018 TAF aircraft operations forecast have been considered, the adjusted passenger aircraft operations forecast has been modelled using specific assumptions for future aircraft gauge and seat factors at ORD. These have been applied to the 2018 TAF enplaned passenger forecast to generate a forecast of passenger airline operations. The forecast of total enplaned passengers and aircraft operations is summarized in **Table 3-6**.

**TABLE 3-6: ENPLANED PASSENGERS AND AIRCRAFT OPERATIONS FORECAST**

Year	Total Enplaned Passengers <sup>1</sup>	Total Passenger Aircraft Operations
<b>Historical</b>		
2006	38,122,240	932,874
2007	37,402,803	913,945
2008	34,890,004	874,177
2009	32,440,094	832,398
2010	32,963,479	864,286
2011	32,980,669	875,138
2012	33,242,124	870,956
2013	33,402,530	870,228
2014	35,136,941	872,179
2015	37,317,207	871,583
2016	38,785,696	862,187
2017	39,826,556	862,030
2018	41,623,010	877,461
<b>Forecast</b>		
2019	43,560,290	912,737
2020	44,620,281	914,029
2021	45,583,343	915,044
2022	46,494,099	916,379
2023	47,370,842	918,075
2024	48,212,837	924,654
2025	49,053,364	931,555
2026	49,900,388	939,218
2027	50,779,408	947,240
2028	51,696,340	955,702
2029	52,646,798	964,531
2030	53,625,042	973,592
<b>Compound Annual Growth Rate</b>		
2006-2018	0.7%	(0.5%)
2018-2030	2.1%	0.9%

NOTE: The values depicted in this table have been converted from Federal fiscal year to calendar year.

<sup>1</sup> 2018 values in the TAF are forecast, enplaned passenger volumes include nonrevenue passengers.

SOURCES: Federal Aviation Administration, *2018 Terminal Area Forecast*, March 2019 (converted to calendar year); US DOT Form T-100 (historical), June 2019; Ricondo & Associates, Inc. (analysis), June 2019.



JANUARY 2020

[DRAFT]

## 3.2 Cargo Airline Aircraft Operations Forecast

Cargo airline operations were developed using forecasts of future cargo volumes carried by freighter aircraft (excluding belly cargo on passenger aircraft) and the expected average volume per operation. Cargo carried by freighter aircraft represented approximately 77 percent of all cargo handled at O'Hare in 2018. O'Hare has experienced a resumption of growth in cargo activity since 2014 (the first year of growth since the recession). This growth is consistent with industry-wide activity which has grown during the same period. It is further supported by Chicago's role as a worldwide logistics hub, and as a major port for international cargoes.

Two methodologies were explored to forecast cargo volumes:

- **Single Variable Regression Analysis:** This approach uses a similar methodology as described in the evaluation of the enplaned passenger forecast. Predictive relationships between historical cargo activity at the Airport and historical variables such as population and economic activity were identified. Independent projections of these socioeconomic variables were then used to forecast cargo volumes carried by freighter aircraft at the Airport.
- **Market Share Analysis:** This approach is based on the expectation of how cargo activity at O'Hare will grow relative to the rest of the industry. Since 2014, ORD's share of total US freighter revenue ton miles (RTMs) has grown from 5.0 percent to 6.3 percent. RTMs are a measure of one revenue-producing ton of freight carried one mile. An increasing share was assumed to continue during the forecast period based on historical trends. By 2030 ORD's share of US volumes is assumed to grow to 6.6 percent, which is the same magnitude of change experienced at O'Hare between 2016 and 2018. This increased share was applied to the cargo RTM forecast from the *2019 FAA Aerospace Forecast* which resulted in a freighter aircraft RTM forecast.

The FAA's forecasts of RTMs use models that link cargo activity to GDP. Forecasts of domestic cargo RTMs use real U.S. GDP as the primary driver of activity. Projections of international cargo RTMs depend on growth in world and regional GDP, adjusted for inflation. FAA forecasts the distribution of RTMs between passenger and all-cargo carriers based on an analysis of historic trends in shares, changes in industry structure, and market assumptions. Other forecasts of cargo activity were evaluated, including the Boeing World Cargo forecast which projects domestic air cargo to grow at up to 2.8 percent over the next 20 years.

The single variable regression analysis yielded a 2018 to 2030 compound annual growth rate of 3.0 percent, while the market share analysis yielded a 4.0 percent growth rate during the period. The market share analysis was selected for use since it yielded a higher growth rate and passenger forecast, and thus more conservative for purposes of the TAP EA analysis. The forecast of cargo RTMs is presented in **Table 3-7**.



JANUARY 2020

[DRAFT]

TABLE 3-7: CARGO AIRCRAFT REVENUE TON MILE FORECAST

Year	O'Hare Cargo Aircraft Departing RTMs (Millions)	US Total RTMs (Millions)	O'Hare Share of Total
<b>Historical</b>			
2006	1,854	36,235	5.1%
2007	1,906	36,235	5.3%
2008	1,643	36,235	4.5%
2009	1,237	36,235	3.4%
2010	1,550	36,235	4.3%
2011	1,533	36,823	4.2%
2012	1,429	35,127	4.1%
2013	1,503	34,287	4.4%
2014	1,764	35,025	5.0%
2015	2,115	35,762	5.9%
2016	2,157	36,604	5.9%
2017	2,483	40,079	6.2%
2018	2,712	43,384	6.3%
<b>Forecast</b>			
2019	2,873	45,736	6.3%
2020	3,001	47,559	6.3%
2021	3,112	49,097	6.3%
2022	3,216	50,502	6.4%
2023	3,312	51,775	6.4%
2024	3,417	53,177	6.4%
2025	3,543	54,890	6.5%
2026	3,687	56,859	6.5%
2027	3,840	58,960	6.5%
2028	3,997	61,101	6.5%
2029	4,160	63,310	6.6%
2030	4,322	65,487	6.6%
<b>Compound Annual Growth Rate</b>			
2014-2018	3.2%	1.5%	
2018-2030	4.0%	3.5%	

NOTES: The 2019 FAA Aerospace forecast has been converted to calendar year for use in these analyses

RTMs- Revenue Ton Miles.

SOURCES: US DOT Form T-100 (historical), date accessed June 2019; 2019 FAA Aerospace Forecast, April 2019; Ricondo & Associates, Inc. (analysis), June 2019.

Cargo airline operations were forecast by applying an average RTM per departure to the forecast of freighter aircraft RTMs. Since 2014 cargo RTMs per departure have increased from 93,189 to 109,624, driven by the use of larger capacity aircraft and longer lengths of haul, resulting from increased international cargo activity. This trend is expected to continue as international cargo volumes are forecast to grow at a faster rate during the forecast period. Increased RTMs per operation will occur through increased capacity of cargo aircraft and the longer lengths of haul. International cargo activity is predominantly conducted with



JANUARY 2020

[DRAFT]

large widebody aircraft such as the B747F and B777F, which have higher average capacities than cargo aircraft operating domestically such as the MD-11F, B767F, A300F, and B757F. International flights travel longer distances than domestic cargo flights, including those transiting at ANC, and will thus result in a longer length of haul for each operation. RTMs per departure are forecast to grow from 109,624 in 2018 to 126,068 in 2030, a compound annual growth rate of 1.2 percent. Total cargo aircraft operations are forecast to grow from 24,739 in 2018 to 34,283 in 2030, a compound annual growth rate of 2.8 percent. The forecast of cargo RTMs, RTMs per departure, and cargo airline operations are presented in **Table 3-8**.

**TABLE 3-8: CARGO AIRCRAFT OPERATIONS FORECAST**

Year	O'Hare Departing RTMs (millions)	RTMs Per Departure	Total Operations
<b>Historical</b>			
2006	1,854	71,575	25,896
2007	1,906	74,283	25,652
2008	1,643	77,080	21,309
2009	1,237	71,743	17,242
2010	1,550	82,076	18,885
2011	1,533	78,999	19,399
2012	1,429	80,598	17,730
2013	1,503	83,831	17,929
2014	1,764	93,189	18,924
2015	2,115	98,103	21,559
2016	2,157	96,561	22,333
2017	2,483	103,140	24,074
2018	2,712	109,624	24,739
<b>Forecast</b>			
2019	2,873	111,002	25,878
2020	3,001	112,361	26,704
2021	3,112	113,739	27,361
2022	3,216	115,116	27,937
2023	3,312	116,484	28,433
2024	3,417	117,852	28,994
2025	3,543	119,221	29,718
2026	3,687	120,584	30,572
2027	3,840	121,963	31,485
2028	3,997	123,326	32,410
2029	4,160	124,700	33,360
2030	4,322	126,068	34,283
<b>Compound Annual Growth Rate</b>			
2006-2018	3.2%	3.6%	(0.4%)
2018-2030	4.0%	1.2%	2.8%

NOTES: The 2019 FAA Aerospace forecast was used to forecast RTMs and has been converted to calendar year for use in these analyses.

RTMs- Revenue Ton Miles.

SOURCES: US DOT Form T-100 (historical), date accessed June 2019; 2019 FAA Aerospace Forecast, April 2019; Ricondo & Associates, Inc. (analysis), June 2019.



JANUARY 2020

[DRAFT]

### 3.3 General Aviation and Military Aircraft Operations Forecast

Historically, general aviation and military aircraft operations have been minor components of traffic at the Airport. At O'Hare, general aviation and military activity combined accounted for 0.6 percent of total aircraft operations<sup>6</sup>. O'Hare is surrounded by multiple reliever airports that handle most of the general aviation traffic around the Chicago region, including Chicago Executive Airport (PWK) and DuPage County Airport (DPA). Military activity is limited at O'Hare as there are no military aircraft based at the Airport. Due to the limited nature of these historical activities, the TAF was reviewed and ultimately selected to serve as the forecast of general aviation and military activity.

The TAF provides forecasts for both segments of activity. In the TAF, general aviation forecasts are based primarily on time series analyses of recent activity. Military activity is forecast at present levels unless the Department of Defense has provided specific inputs (e.g., a base closure moving a tenant unit to another airport). The forecasts of general aviation and military activity converted to calendar year are contained in **Table 3-9**.

### 3.4 Total Aircraft Operations Forecasts

The aircraft operations forecasts are summarized in **Table 3-10**. A comparison to the 2018 TAF aircraft operations forecast is presented in **Exhibit 3-3**.

These forecasts are unconstrained, which is consistent with the methodology used for the TAF<sup>7</sup>. Aircraft operations in the proposed forecast grow from 893,497 in 2018 to 1,013,856 in 2030, a compound annual growth rate of 0.9 percent. Aircraft operations in the 2018 TAF grow from 893,497 in 2018<sup>8</sup> to 926,881 in 2030, a compound annual growth rate of 0.3 percent. The difference between the forecasts is due to the different assumptions used in the passenger aircraft forecasts, as explained in Section 3.1.2.

<sup>6</sup> Based on 2018 data.

<sup>7</sup> However, if the airport historically functions under constrained conditions, the FAA forecast may reflect those constraints since they are embedded in historical data.

<sup>8</sup> 2018 values in the TAF are forecast.



JANUARY 2020

[DRAFT]

TABLE 3-9: GENERAL AVIATION AND MILITARY AIRCRAFT OPERATIONS FORECASTS

Year	General Aviation Aircraft Operations	Military Aircraft Operations
<b>Historical</b>		
2006	21,745	248
2007	12,480	187
2008	8,622	158
2009	7,050	164
2010	7,471	172
2011	7,674	151
2012	7,698	194
2013	7,560	153
2014	7,233	156
2015	6,903	152
2016	6,696	109
2017	5,885	108
2018 <sup>1</sup>	5,770	75
<b>Forecast</b>		
2019	5,906	75
2020	5,906	75
2021	5,906	75
2022	5,906	75
2023	5,906	75
2024	5,906	75
2025	5,906	75
2026	5,906	75
2027	5,906	75
2028	5,906	75
2029	5,906	75
2030	5,906	75
<b>Compound Annual Growth Rate</b>		
2006-2018	(10.5%)	(9.5%)
2018-2030	0.2%	0.0%

NOTES: The 2018 Terminal Area Forecast has been converted from Federal fiscal year to calendar year for use in these analyses.

<sup>1</sup> 2018 values in the TAF are forecast

SOURCE: Federal Aviation Administration, 2018 Terminal Area Forecast, March 2019.





JANUARY 2020

[DRAFT]

TABLE 3-10: TOTAL AIRCRAFT OPERATIONS FORECASTS

Year	Passenger Airline	Cargo Airline	General Aviation	Military	Total
<b>Historical</b>					
2006	932,874	25,896	21,745	248	980,763
2007	913,945	25,652	12,480	187	952,264
2008	874,177	21,309	8,622	158	904,266
2009	832,398	17,242	7,050	164	856,854
2010	864,286	18,885	7,471	172	890,814
2011	875,138	19,399	7,674	151	902,362
2012	870,956	17,730	7,698	194	896,578
2013	870,228	17,929	7,560	153	895,870
2014	872,179	18,924	7,233	156	898,492
2015	871,583	21,559	6,903	152	900,197
2016	862,187	22,333	6,696	109	891,325
2017	862,030	24,074	5,885	108	892,097
2018 <sup>1/</sup>	877,461	24,739	5,770	75	908,045
<b>Forecast</b>					
2019	912,737	25,878	5,906	75	944,596
2020	914,029	26,704	5,906	75	946,714
2021	915,044	27,361	5,906	75	948,386
2022	916,379	27,937	5,906	75	950,297
2023	918,075	28,433	5,906	75	952,489
2024	924,654	28,994	5,906	75	959,629
2025	931,555	29,718	5,906	75	967,254
2026	939,218	30,572	5,906	75	975,771
2027	947,240	31,485	5,906	75	984,706
2028	955,702	32,410	5,906	75	994,093
2029	964,531	33,360	5,906	75	1,003,872
2030	973,592	34,283	5,906	75	1,013,856
<b>Compound Annual Growth Rate</b>					
2006-2018	(0.5%)	(0.4%)	(10.5%)	(9.5%)	(0.6%)
2018-2030	0.9%	2.8%	0.2%	0.0%	0.9%

NOTES: The 2018 Terminal Area Forecast has been converted from Federal fiscal year to calendar year for use in these analyses.

1 2018 values in the TAF are forecast

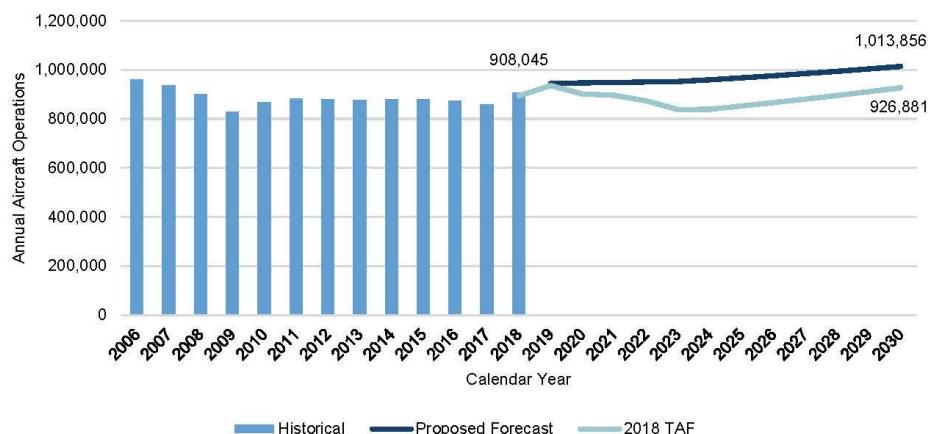
SOURCES: Federal Aviation Administration, 2018 Terminal Area Forecast, March 2019; Ricondo &amp; Associates, Inc. (analysis), June 2019.



JANUARY 2020

[DRAFT]

EXHIBIT 3-3: COMPARISON OF AIRCRAFT OPERATIONS FORECASTS



NOTES: The 2018 Terminal Area Forecast has been converted from Federal fiscal year to calendar year for use in these analyses. 2018 values in the TAF are forecast.

SOURCES: Federal Aviation Administration, 2018 Terminal Area Forecast, March 2019; Ricondo & Associates, Inc. (analysis), June 2019.

## 4. Constrained Activity Analysis

As previously mentioned, the TAF is assumed to reflect the unconstrained demand for aviation activity at O'Hare. This section assesses whether there is any evidence that, because O'Hare has operated in a constrained environment, demand exists that may be generated above that forecast in the TAF, induced by near-term or TAP facility development.

Specifically, the following questions were investigated:

- Have O'Hare gate constraints resulted in fewer passengers historically flowing to, from, or through ORD, thus causing the TAF to start future growth from an artificially low base?
- Have or will the addition of gates create facility capacity and therefore a more competitive environment that has or would result in passenger activity greater than would exist without the facility changes?
- Will product improvements prompted by the TAP cause a higher proportion of passenger traffic to choose O'Hare to support their journeys?

A review of passenger and operational activity growth following the lifting of flight caps in 2008 includes several factors that could mask the influence of gates on passenger activity. For example, the period included an economic recession, airline mergers, and a shift to a profit-driven, rather than a market share-





JANUARY 2020

[DRAFT]

driven, airline industry business model. Therefore, in order to determine if there is evidence that terminal facilities at the airport may induce demand above that of the TAF, the following was assessed:

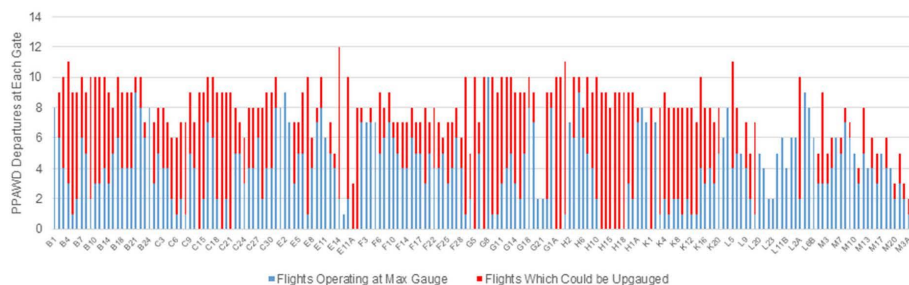
- Evidence that airlines could increase capacity at O'Hare today to accommodate profitable demand, and gate capacity has not caused passenger flow diversion.
- An illustration that American's new gates (growth from 66 to 71) have not enabled growth that couldn't have been accommodated on its original 66 gates and has not resulted in passenger growth at O'Hare greater than system growth.
- An illustration that while O'Hare will have improvements that will be attractive for airlines operations, O'Hare is not unique, and several other large hub airports are also adding gates and improving terminal facilities.

#### 4.1 Airlines Could Increase Capacity at O'Hare Today to Accommodate Profitable Demand

An analysis of terminal facility capacity was performed to determine if profitable demand was currently unserved in the market due to facility constraints. A variety of evidence supports the case that airlines could serve additional passengers with the existing terminal facilities.

Airlines serving O'Hare could offer additional seat capacity using the gate resources offered today. **Exhibit 4-1** illustrates the current use of O'Hare gates on a representative day and indicates in red, aircraft that could be replaced with higher capacity aircraft while complying with the operational rules of each gate. **Table 4-1** illustrates the airline-specific opportunities to increase aircraft size at O'Hare with aircraft currently operating in airline fleets today. Upgauging could provide an additional 15.9 percent growth over the seat capacity offered today. With over 24,000 additional seats on the representative day, this could result in an estimated 9 million annual seats. This would be an aggressive utilization of the facilities and constraints or delays may prevent this level of use, but it does demonstrate that there is material growth potential with the existing facilities.

**EXHIBIT 4-1: SERVICE AT O'HARE THAT COULD BE OPERATED WITH HIGHER-CAPACITY AIRCRAFT**



SOURCES: Innovata, June 2019; Ricondo & Associates, Inc. (analysis), June 2019.



JANUARY 2020

[DRAFT]

TABLE 4-1: ADDITIONAL SEATS THAT COULD BE OFFERED WITH HIGHER-CAPACITY AIRCRAFT

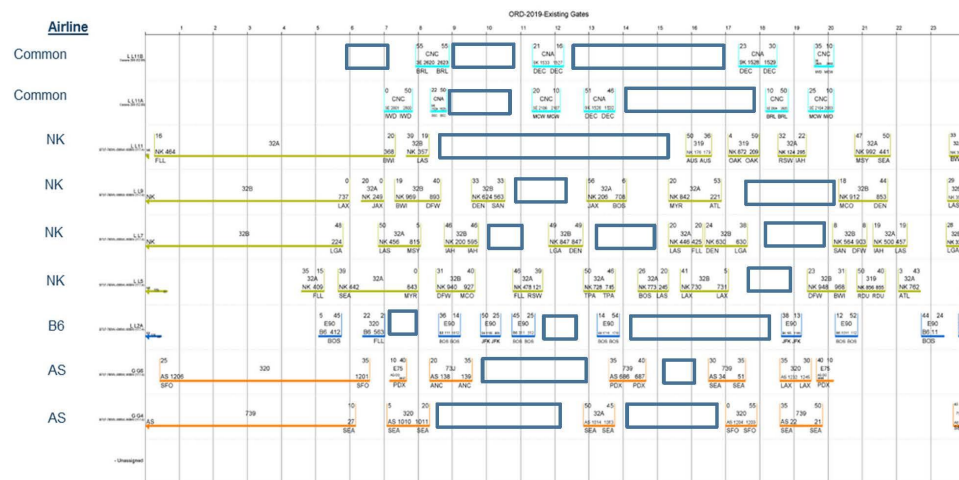
Airline	Current Seats	Maximum Seats	Difference	Percentage
United	66,384	77,423	11,039	16.6%
American	55,445	65,746	10,301	18.6%
Common Use Carriers	16,357	16,832	475	2.9%
Delta	6,884	8,297	1,413	20.5%
Spirit	5,947	6,840	893	15.0%
Alaska	1,705	1,856	151	8.9%
JetBlue	850	1,200	350	41.2%
Air Canada	1,182	1,182	0	0.0%
Total Airport	154,754	179,376	24,622	15.9%

NOTE: United, American, Delta, Spirit, Alaska, JetBlue, and Air Canada operate from preferential use gates. All other airlines operate from common use gates.

SOURCES: Innovata, June 2019; Ricondo & Associates, Inc. (analysis), June 2019.

In addition to the ability of airlines to increase seat capacity at O'Hare using larger aircraft, airlines could offer additional flights at the Airport throughout the day at numerous times when gates are unused. **Exhibit 4-2** shows gate use on a representative day for several airlines in the L Concourse at O'Hare (non-American) and Alaska which operates from G Concourse. These carriers, which operate at O'Hare with relatively few gates still have periods throughout the day where additional flights could be added. While not shown, similar opportunities exist for an increase in flights throughout the day for United and American.

EXHIBIT 4-2: GATING CHART OF SELECTED AIRLINES AT O'HARE



SOURCES: Innovata, Ricondo & Associates, Inc. (analysis), June 2019.

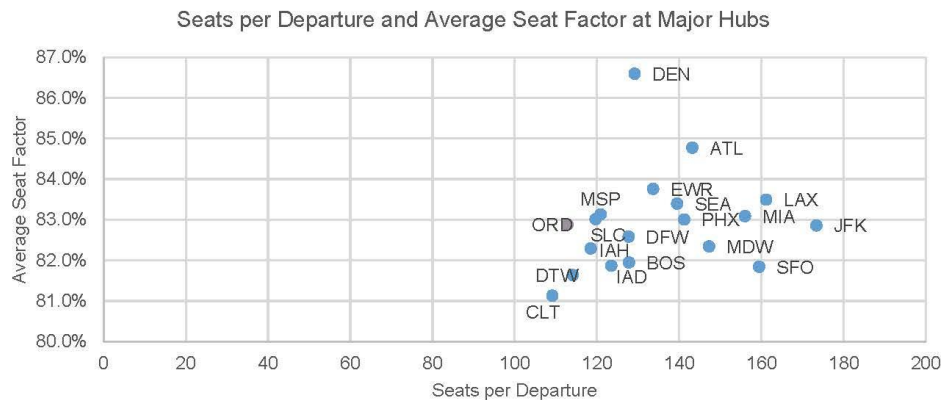


JANUARY 2020

[DRAFT]

In addition to upgauging and additional flights, seat factors may be able to increase, allowing airlines to accommodate additional passengers with existing capacity. **Exhibit 4-3** demonstrates that O'Hare could grow in terms of seat factors, as there are several airports with higher seat factors including mid-continent hubs.

**EXHIBIT 4-3: SEATS PER DEPARTURE AND AVERAGE SEAT FACTOR AT MAJOR HUBS**



NOTE: Data are for the twelve months ending November 2018.

SOURCE: U.S. DOT T-100, June 2019.

## 4.2 New American Gates Did Not Induce Passenger Growth

In May 2018 five new gates were opened at ORD. These gates are preferential use gates for American. The new gate capacity gained by American does not appear to be the catalyst that was required for the carrier to offer seat growth at ORD. **Table 4-2** presents a comparison of schedule metrics (daily departures and seats – both in total and on a per-gate basis) for American and United at O'Hare for the third and fourth quarters of 2017 (before American gained five incremental gates in May 2018), and the same quarters in 2018 and 2019. United's gate allotment remained unchanged throughout this period. Exhibit 16 also shows peak hour arrivals, departures, and total operations (these peaks do not necessarily occur in the same hour, so the numbers are not additive) both on a total and per-gate basis. American could provide its 2019 departure and seat capacity on its original 66 gates by operating at similar per-gate levels operated by United. American grew seat capacity at a rate that was higher than United, but American's seat capacity and flights could have been accommodated on existing gates when measured by utilization rate. United's growth during the same period was done without additional gates and achieved through higher utilization of gates. It may be reasonable to question if the incremental gate capacity induced competition resulting in better utilization of gates and increased seat capacity. However, United's systemwide departure growth was in-line with that experienced at O'Hare in the same period (10.9% system vs 10.4% at ORD). Additional gate capacity did not induce demand at the Airport.



JANUARY 2020

[DRAFT]

TABLE 4-2: O'HARE HUB CARRIER SCHEDULE METRICS

Comparison of Schedule Metrics for Q3 and Q4 Only

Year	Gates	Daily Depts	Daily Seats	Daily Depts Per Gate	Daily Seats Per Gate	Seats/ Dept	Arrivals	Departures	Peak Hour			
									Operations	Arr/Gate	Dept/ Gate	Ops/Gate
United Airlines												
2017	81	557	60,064	6.9	742	107.9	66	69	116	0.81	0.85	1.4
2018	81	605	62,901	7.5	777	104.0	66	72	126	0.81	0.89	1.6
2019	81	615	63,764	7.6	787	103.7	67	70	131	0.83	0.86	1.6
2017-2019 Change	0.0%	10.4%	6.2%	10.4%	6.2%	-3.9%	1.5%	1.4%	12.9%	1.5%	1.4%	12.9%
American Airlines												
2017	66	458	47,516	6.9	720	103.8	53	54	91	0.80	0.82	1.4
2018	71	461	48,801	6.5	687	105.9	55	57	90	0.77	0.80	1.3
2019	71	499	51,988	7.0	732	104.2	56	57	89	0.79	0.80	1.3
2019 (if at 66 gates)	66	499	51,988	7.6	788	104.2	56	57	89	0.85	0.86	1.3
2017-2019 Change	7.6%	9.0%	9.4%	1.3%	1.7%	0.4%	5.7%	5.6%	-2.2%	-1.8%	-1.9%	-9.1%

NOTE: American added five gates in May 2018.

SOURCES: Innovata for Q3 and Q4 of years indicated, Ricondo &amp; Associates, Inc. (analysis)

Annual Activity Forecasts

[24]



JANUARY 2020

[DRAFT]

### 4.3 O'Hare Development is Keeping it Competitive as Other Hubs Undertake Improvements

The TAP will improve facilities and connectivity at the airport potentially making it a more attractive facility for airlines or passengers to travel. However, there are many other airports in the U.S. undergoing terminal projects which will compete with O'Hare for passengers or airline capacity. The list below illustrates examples of other airport facility growth that will compete with O'Hare limiting the likelihood that traffic will shift significantly from other hubs. The information presented was gathered from various financial disclosure documents and press releases.

- ATL - 10-gate Concourse G, which would be international-arrivals capable and connected to an existing US Customs and Border Protection (CBP) facility
- BOS - 7 gates are expected to be added over two phases. This project also includes the addition of ticket counters, increases in CBP facilities, and additional luggage carousels
- CLT - Concourse A expansion: relocate the existing gates and 5 additional new gates
- DFW – New Terminal F
- DEN - Expansion of Concourses A, B, and C: 12 gates added to Concourse A, 11 gates added to Concourse B, and 16 gates added to Concourse C
- JFK – New or Redeveloped Terminal 6/7 and Terminal 1
- LGA – Redevelopment of Terminals B (new 1.39-million-square-foot Terminal B, including 35 gates) and C/D (1.2 million square feet, 37 gates)
- LAX - New 12-gate 800,000-square-foot concourse (Midfield Satellite Concourse)
- MIA - Terminal Optimization Program (TOP): rehabilitating and renovating Central Terminal
- EWR - Terminal One Redevelopment Program will replace Terminal A, the airport's oldest terminal, with a modern terminal building. Terminal One will have 33 aircraft gates
- MCO - South Terminal Complex: 16 gates to accommodate domestic and international arrivals and widebody aircraft
- SLC - Terminal Redevelopment Program (TRP): replace terminal complex and development of a consolidated terminal facility. North Concourse Program (NCP): 31-gate midfield concourse and connection from the South Concourse and TRP
- SFO - Ascent Program: Terminal 1 redevelopment and includes the addition of 6 new gates
- SEA - New International Arrivals Facility, North Satellite Renovation and Expansion Project: includes renovating, reconfiguring, and expanding the terminal to add 8 gates
- TPA- Main Terminal Expansion: adds 33,000 square feet





JANUARY 2020

[DRAFT]

## 5. Summary and Conclusion

The FAA's TAF is a reasonable forecast of passenger activity. The growth is in-line with, or exceeds, the implied growth rates of passenger demand based on predictive relationships identified with key socioeconomic variables. The TAF passenger growth is also in-line with assumptions of market growth and ORD's portion of that market. The near-term operational activity included in the 2018 TAF appears to be low, and an alternative operational forecast is proposed to better reflect anticipated ORD-specific fleet changes.

Recent, future baseline, or TAP projects that increase gate capacity are anticipated to accommodate the TAF passenger and proposed operational forecast growth. These gate projects do not induce passenger activity above that included in the TAF. The industry has evolved and is able to accommodate profitable growth through capacity growth and is no longer "shrinking to profitability". O'Hare is a critical component of the domestic and global route network, and the Airport should be expected to be utilized to accommodate profitable demand through additional airline capacity. The airlines serving O'Hare today, including both the hub carriers American and United, as well as other low-cost and traditional network carriers can add seat capacity and are not currently constrained by gates. Additional gate capacity provided through near-term gate projects and the TAP will help the Airport's airlines accommodate future growth that is expected to materialize as depicted by the FAA's TAF for O'Hare and keep the Airport competitive with other airports as they develop.

The following conclusions reflect the findings to the specific questions presented in the beginning of Section 3:

- The historical basis for the TAF does not appear to reflect an artificially low base. The concern that passenger activity has been constrained due to gate capacity at ORD, and therefore the TAF is forecast on an artificially low base, presumes that there exists a component of passenger demand today that is not served due to lack of gate capacity at the Airport. The analysis included in Section 3.1 has shown that airlines will increase capacity to accommodate profitable passengers, and that airlines at O'Hare could reasonably add capacity without additional gates. Therefore, all components of profitable demand are currently being served, with O'Hare maintaining a leading role in the nationwide route network, and no latent demand exists.
- Gate capacity has not, and is not, anticipated to induce passenger activity that is greater than that included in the TAF. Review of gate capacity demonstrates airlines could currently add seat capacity through additional flights, increased load factors, and upgauging of fleet. New American gates added in May 2018 did not induce airline capacity that either could not be accommodated on existing gates or was greater than systemwide capacity growth.
- The improvements prompted by TAP are not anticipated to cause a higher proportion of connecting passenger traffic at ORD. While there could be some increase, similar improvements at other airports will compete for connecting traffic.



JANUARY 2020

[DRAFT]

## 6. Project Phasing Overview

An understanding of historical and future terminal facilities is necessary to gauge the utilization that will occur over time with the proposed forecast. The TAP is anticipated to be developed in phases during the construction process. Key considerations in the development of the phasing schedule included: (1) that airfield flows must be maintained around the terminal core; (2) that all gates when delivered will have a capable pedestrian route from curb to gate; and (3) the construction phasing will rely on but minimize, the use of temporary facilities. The phasing plan will use increments of additional linear gate frontage in order to facilitate the closure of existing terminal facilities for construction purposes. At various stages, some of this construction is anticipated to result in incremental gate frontage. Gate sizes are not uniform and are dependent on aircraft gauge. The TAP includes Multiple Aircraft Ramp System (MARS) gates which can accommodate multiple aircraft gauges. Because these gates allow airlines to dynamically shift gate capabilities as their schedules demand, the total number of gates at the Airport will vary at any given point.

**Table 6-1** depicts historical and planned gate counts and linear gate frontage, respectively, between 2006 and 2023, as well as calculations of enplaned passengers, departing seats, and total passenger aircraft operations per gate.

The airport gate count has fluctuated from 186 in 2006, up to 189 in 2012, and then to 185 in 2017 despite no change in linear gate frontage as airlines reconfigured gate positions to accommodate the changing average aircraft size. In 2018, an additional 535 linear feet of gate frontage was added on concourse L, resulting in five additional gate positions. A sixth gate was added by reconfiguring the existing linear gate frontage for United.

Linear gate frontage and the airport gate count will increase again when the future baseline projects are completed in 2021. These are non-TAP projects including the Terminal 5 extension and the L-concourse stinger expansion. This results in the addition of between 16 and 22 gates from the existing condition (April 2017), depending on configuration of the gates. Beyond 2021, linear gate frontage will not decrease at any point during the construction process. Incremental linear gate frontage will primarily be used to offset closures in other areas of the Airport as a part of the construction process.

Between completion of the future baseline and 2024, no incremental gate frontage will be provided. By the end of 2024, an incremental 644 linear feet of gate frontage will be available. By the end of 2025, a further 928 linear feet of incremental gate frontage will become available. The number of gates this frontage could accommodate is variable and will depend on the aircraft gauge capabilities of any gates. Beyond Q4 2025, no incremental linear gate frontage will be available until completion of TAP Phase I in 2029. The increments of linear gate frontage available between the future baseline and completion of TAP Phase I are shown in **Table 6-2**.

Additional detail on the current project phasing and detailed depictions of each operating condition are provided in the *O'Hare 21 Project Descriptions Appendix C, Summary of Gates and Frontage* document.



JANUARY 2020

[DRAFT]

TABLE 6-1: GATE COUNT AND SELECTED METRICS PER GATE

Year	Gate Count <sup>1</sup>	Enplaned Passengers Per Gate	Departing Seats Per Gate	Passenger Aircraft Operations Per Gate	Linear Gate Frontage (ft)
<b>Historical</b>					
2006	186	204,958	255,032	4,839	24,770
2007	186	201,090	251,877	4,750	24,770
2008	186	187,581	238,257	4,516	24,770
2009	186	174,409	220,483	4,260	24,770
2010	186	177,223	220,277	4,490	24,770
2011	186	177,315	217,321	4,480	24,770
2012	189	175,884	211,640	4,441	24,770
2013	188	177,673	213,025	4,489	24,770
2014	188	186,899	219,274	4,460	24,770
2015	187	199,557	233,797	4,436	24,770
2016	187	207,410	242,429	4,412	24,770
2017	185	215,279	253,227	4,463	24,770
2018	191	217,922	253,868	4,505	25,305
<b>Forecast</b>					
2019	191	228,064	268,311	4,779	25,305
2020	191	233,614	274,840	4,785	25,305
2021	201-207	220,209 - 226,783	258,765 - 266,490	4,421 - 4,552	27,132
2022	201-207	224,609 - 231,314	263,936 - 271,814	4,427 - 4,559	27,132
2023	201-207	228,845 - 235,676	268,913 - 276,940	4,435 - 4,568	27,132
<b>With TAP</b>					
2030	192-219	279,297 - 259,058	285,854 - 326,052	5,073 - 4,446	30,990

## NOTE:

1 The Terminal 5 extension project will provide flexible Multiple Aircraft Ramp System parking positions, resulting in a variable gate count

SOURCES: Federal Aviation Administration, *2018 Terminal Area Forecast*, March 2019 (converted to calendar year); US DOT Form T-100 (historical), date accessed June 2019; Ricondo & Associates, Inc. (analysis), June 2019.

TABLE 6-2: INCREMENTAL GATE CAPACITY DURING TAP CONSTRUCTION

Condition	Net Frontage Change (linear Feet)	Cumulative Frontage (linear Feet)	Change from April 2017 (%)	Change from Future Baseline	Minimum-Maximum Gate Count
Existing (April 2017)	--	24,770	--	--	185
Future Baseline	+2,362	27,132	+9.5%	--	201-207
End of 2024	+644	27,776	+12.1%	2.4%	TBD
End of 2025	+928	28,704	+15.9%	5.8%	TBD
TAP Phase I	+2,286	30,990	+25.1%	14.2%	192-219

NOTE: The total airport gate count will vary depending on the size of the aircraft using each gate at a given time. Incremental changes are calculated from the preceding condition.

Source: *O'Hare 21 Project Descriptions Appendix C, Summary of Gates and Frontage*. Ricondo & Associates, Inc. (analysis), May 2019.





JANUARY 2020

[DRAFT]

As shown in Table 14, the enplaned passenger per gate and operations per gate fluctuates as passenger and operational activity grows and gates are added and reconfigured. The maximum enplaned passengers per gate in Table 14 occurs in 2030. The maximum operations per gate in Table 13 occurs in 2020 or 2030 depending on the use of the minimum or maximum gate count.

## 7. Design Day Flight Schedule Methodology and Assumptions

This section describes the development and results of the O'Hare design day flight schedules (DDFS). Flight schedules were developed for the base year (2019), and two planning horizons, 2023 and 2030.

### 7.1 Design Day Flight Schedule Development

In order to develop the passenger airline DDFS, the monthly scheduled passenger airline activity levels (scheduled seat capacity and operations) for 2019 were reviewed to determine the Airport's peak month. As shown in **Table 7-1**, July was identified as the peak month for both scheduled seats and operations.

TABLE 7-1: CY 2019 O'HARE TOTAL SCHEDULED PASSENGER AIRLINE ACTIVITY BY MONTH

Month	Monthly Flights	Avg. Daily Flights	Monthly Seat Capacity	Avg. Daily Seat Capacity
January	69,909	2,255	7,699,385	248,367
February	63,763	2,277	7,011,249	250,402
March	73,748	2,379	8,259,383	266,432
April	73,302	2,443	8,260,689	275,356
May	77,482	2,499	8,771,642	282,956
June	77,880	2,596	8,948,938	298,298
July	80,928	2,611	9,248,077	298,325
August	80,873	2,609	9,157,040	295,388
September	76,790	2,560	8,612,971	287,099
October	79,604	2,568	8,913,020	287,517
November	74,047	2,468	8,264,078	275,469
December	78,020	2,517	8,657,861	279,286

SOURCES: Innovata, May 2019.

Airlines typically operate fewer flights during holidays and weekends. Due to this, the average weekday (excluding the days surrounding fourth of July holiday when weekday activity is lower than typical), was identified. As depicted in **Table 7-2**, July 24, 2019 was identified for use as the base flight schedule. The Innovata airline schedule for this date provides the airline, type of aircraft, number of seats, origin, destination, and flight times for each scheduled passenger airline flight.



JANUARY 2020

[DRAFT]

TABLE 7-2: SCHEDULED O'HARE PASSENGER AIRLINE ACTIVITY – JULY 2019

Date	Day of Week	Aircraft Operations	Seat Capacity
1	Monday	2,645	301,016
2	Tuesday	2,567	292,135
3	Wednesday	2,273	267,000
4	Thursday	2,053	244,266
5	Friday	2,241	262,583
6	Saturday	2,362	275,691
7	Sunday	2,666	304,398
8	Monday	2,726	309,711
9	Tuesday	2,705	306,512
10	Wednesday	2,720	308,544
11	Thursday	2,717	306,966
12	Friday	2,730	310,785
13	Saturday	2,398	278,306
14	Sunday	2,665	303,941
15	Monday	2,727	309,959
16	Tuesday	2,705	306,844
17	Wednesday	2,717	308,146
18	Thursday	2,710	305,786
19	Friday	2,728	310,495
20	Saturday	2,395	277,989
21	Sunday	2,661	303,338
22	Monday	2,727	310,316
23	Tuesday	2,707	307,274
24	Wednesday	2,721	309,223
25	Thursday	2,718	307,631
26	Friday	2,730	311,060
27	Saturday	2,398	278,356
28	Sunday	2,662	303,186
29	Monday	2,725	309,982
30	Tuesday	2,707	307,068
31	Wednesday	2,722	309,570
<b>Total</b>			
Average Day (PMAD)		2,611	298,325
Average Weekday (PMAWD)		2,719	308,660

NOTE: The fourth of July holiday and dates surrounding it have excluded from the average weekday calculation.

SOURCE: Innovata, May 2019.



JANUARY 2020

[DRAFT]

The number of passengers on each flight was determined by calculating the average monthly seat factor for each airline and market pairing based on July 2018 US DOT T-100 data. This airline/market seat factor was applied to the number of seats in the base schedule resulting in the number of passengers for each flight. Subsequently, O&D and connecting passenger volumes were sourced from US DOT DB1b data on an airline/market basis. Volumes were determined for each flight segment by operating airline, with flight-specific adjustments depending on the time of day (i.e., a flight departing at 5:00 a.m. would have very few connecting passengers, because it departs before most arrivals, and it is assumed passengers are not connecting overnight at ORD).

Published schedule data are not available for all-cargo and general aviation aircraft operations. The all-cargo and general aviation DDFS elements were based average day during the Airport's peak month (July). Multiple sources were used to populate these DDFS elements. These included FAA Air Traffic Activity Data Systems (ATADS), FAA Traffic Flow Management System Counts (TFMSC), and Aerobahn data for the month of July 2018. While cargo and general aviation activity peak in months other than July, the DDFSs used July activity as this month represents the total airport's peak, and provides the most representative profile of activity during the Airport's peak month average weekday.

### 7.1.1 Passenger Airline Flight Schedules

Future year DDFSs were based on the annual activity forecasts discussed in section 3. Overall assumptions used in developing the DDFSs include:

- Forecast growth for passengers and operations was based on the corresponding domestic and international annual growth rates presented in the forecasts.
- Announced new service (i.e. Delta to Boston [BOS], American to Charleston, WV [CRW]) scheduled to begin after the selected base schedule (July 24, 2019), was incorporated into the 2023 DDFS.
- Future activity growth would be accommodated through a combination of larger aircraft, new flights, and/or higher load factors

The base year DDFS was used in the progressive development of the 2023 and 2030 DDFSs. Seat factors and available seat capacity were determined through an iterative process that attempted to simulate an individual airline's changes in flight frequency and aircraft size in response to forecast growth in enplaned/deplaned passengers and aircraft operations. The steps listed below describe an overview of the schedule development process:

1. Forecasts of domestic and international passenger and aircraft operation growth rates were applied to the base year schedule in order to establish "targets" (passenger and aircraft operation levels) for each of the future DDFSs. These targets provide guidance by identifying the number of additional daily seats, passengers, and aircraft operations needed in each of the future schedules.



JANUARY 2020

[DRAFT]

2. Forecast passenger growth rates from 2018 to 2023 were applied to the base schedule on a route-by-route basis. This was followed by a test calculation (run on a route-by-route basis) to determine whether forecast 2023 passenger volumes could be accommodated on base year aircraft seat capacity (i.e., was the load factor below 100 percent). If the load factor was greater than the flight-specific threshold (approximately 95 percent), the base year aircraft was either (1) increased in gauge, (2) unchanged and a new flight added to the airline-market combination, and/or (3) unchanged if the load factor was below 100 percent in order to meet forecast operations and projected fleet mix targets. If the forecast passenger growth resulted in reasonable load factors and acceptable aircraft types/sizes, the aircraft assigned in the schedule remained unchanged. In some instances, passenger growth resulted in reasonable load factors; however, the aircraft was changed to represent changes in planned airline fleets (i.e., retirement of specific aircraft).
3. In some cases, professional judgment was used to determine whether an increase in aircraft gauge and/or a new flight(s) was added to an airline-market combination. These decisions were based primarily on whether (1) each airline fleet consists of, or the airline has on order, larger gauge aircraft for the applicable DDFS period, (2) a larger gauge aircraft is available that could reasonably and effectively operate in the market, and (3) a new flight addition would be consistent with forecast growth of additional aircraft operations.
4. If an additional flight(s) was added to an existing market, passengers were redistributed across all flights in that airline-market combination. Flights added to the DDFS were matched with new flight arrivals/departures and based on typical turnaround times for the specific airline and fleet types serving the Airport. If applicable, new flights were assumed to return to their origins/destinations rather than "flowing through" to other origins and destinations. Times for additional flights to existing markets were established considering flights currently provided by the specific airline, estimates of times airline travelers would typically prefer to arrive at and depart from the Airport, and timings of connections in destination hubs (if applicable).
5. Once the 2023 DDFS was complete, the process was repeated for the 2030 DDFS.

It was assumed that aircraft gauge would not decrease in future years, unless (1) no larger gauge aircraft was available in the fleet, and (2) the new additional flight in the airline-market combination resulted in unreasonably low load factors for the combination. For example, a single daily Airbus 321 operation may have been down-gauged to an Airbus 320 when a new flight using an Airbus 319 was added to the airline-market combination. This was done in order to maintain reasonable load factors that are consistent with airline practices.

### 7.1.2 All-Cargo and General Aviation Flight Schedules

As noted, all-cargo and other air taxi/general aviation DDFSs were based on Airport and FAA data and developed in accordance with annual operational growth defined in Annual Activity Forecasts. Overall assumptions used in the all-cargo and general aviation components of the DDFSs include:

- The base year to annual ratio of operations would remain stable throughout the forecast period.



JANUARY 2020

[DRAFT]

- New all-cargo and general aviation operations added in the 2023 and 2030 schedules were based on assumptions developed for the annual forecast (e.g., larger aircraft, faster international growth), and
- Specific arrival and departure times vary throughout the peak month, so representative flight times were developed instead
  - Arrival and departure times were based on a monthly average percentage of peak month operations within each block hour.
  - As an example, 10 percent of all-cargo arrivals occur during the 22:00 to 22:59 block hour during the peak month. If there are 20 all-cargo aircraft arriving in the DDFS, 2 arrivals (20 arrivals x 10 percent) were assigned to the corresponding block hour

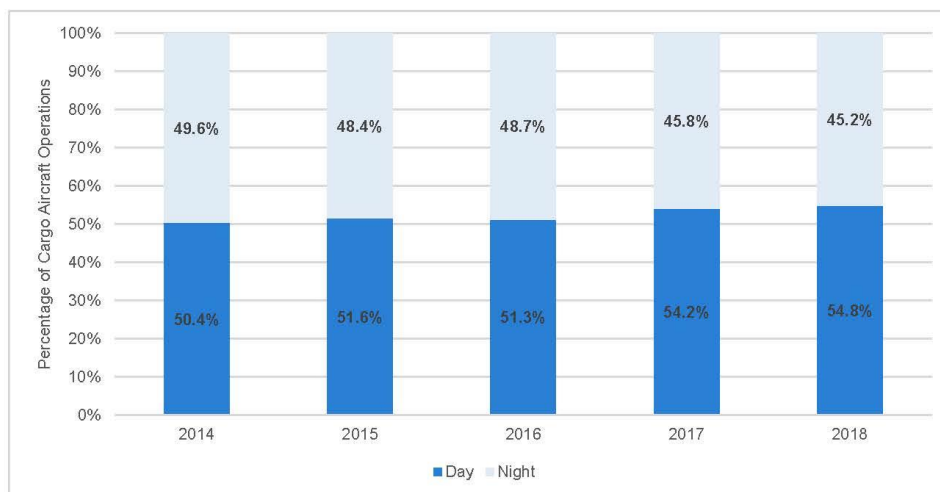
Arrival and departure times for new flights were based on the average monthly percentage of all cargo or general aviation flights during peak month (July) operations in the block hour, as reported from Aerobahn. This entailed a staggered distribution of arrival and departures times within the block hour since air taxi/general aviation times in the Airport data varied significantly. **Table 7-3** and **Table 7-4** provide the percentage of block hour operations conducted during the month of July for cargo and general aviation activity, respectively. Shown alongside of this is the number of flights allocated in the DDFS during a given block. In some cases, the percentage in a given block hour results in less than a whole aircraft operation, and as a result, the number of operations shown in the DDFS may not equal the observed percentage over the course of the month. When this occurred, flights were allocated based on professional judgement, with an effort to allocate the aircraft operation to a night time block hour. For the purposes of these analyses, day is defined as 07:00-21:59 and night is defined as 22:00-06:59. The distribution day time and night time cargo aircraft flights over the past five years was evaluated. The percentage of night time activity has varied from 49.6 percent in 2014 to 45.2 percent in 2018, as shown in **Exhibit 7-1**. The ratio of day-to-night cargo and general aviation flights was modelled to remain constant over the forecast period.





JANUARY 2020

[DRAFT]

**EXHIBIT 7-1: CARGO AIRCRAFT DAY AND NIGHT OPERATIONS**

SOURCE: Aerobahn, August 2019.

**7.2 Design Day Flight Schedule Results****7.2.1 Enplaned Passenger Results**

The annual and DDFS total (two-way) passenger volumes for the base year, 2023, and 2030 schedules are shown in **Table 7-5**. Rolling hour profiles of O&D passengers, connecting passengers and total passengers are presented in **Exhibit 7-2**, **Exhibit 7-3**, and **Exhibit 7-4** respectively.

Block hour enplaned and deplaned passenger activity is presented in **Table 7-6**.



JANUARY 2020

[DRAFT]

TABLE 7-3: JULY BLOCK HOUR OPERATIONS ALLOCATIONS – CARGO AIRLINES

Block Hour	Day/Night	Monthly Arrivals	Monthly Departures	DDFS Arrivals	DDFS Departures
0	Night	4.7%	1.9%	1	2
1	Night	2.4%	4.3%	0	1
2	Night	0.8%	8.0%	1	2
3	Night	4.1%	4.2%	2	0
4	Night	10.0%	2.6%	4	0
5	Night	6.8%	0.8%	3	1
6	Night	2.7%	2.5%	5	0
7	Day	2.4%	4.3%	3	0
8	Day	4.1%	3.5%	1	2
9	Day	4.6%	1.3%	0	0
10	Day	4.4%	1.6%	1	0
11	Day	2.8%	3.6%	1	0
12	Day	2.4%	3.2%	0	1
13	Day	2.9%	3.2%	0	2
14	Day	3.1%	3.3%	0	1
15	Day	2.9%	2.1%	0	0
16	Day	5.6%	3.5%	0	0
17	Day	5.6%	3.2%	1	1
18	Day	3.6%	3.3%	2	1
19	Day	4.9%	3.3%	0	2
20	Day	3.1%	3.9%	1	0
21	Day	3.1%	8.6%	1	3
22	Night	4.3%	10.1%	1	4
23	Night	8.8%	13.5%	4	9
<b>TOTAL</b>		<b>100%</b>	<b>100%</b>	<b>32</b>	<b>32</b>
Day		55.5%	51.9%	11	13
Night		44.6%	47.9%	21	19

NOTE: The percentages shown are for the entire month of July, while the operations reflect what is included in the DDFS.

SOURCE: Aerobahn, June 2019.



JANUARY 2020

[DRAFT]

TABLE 7-4: JULY BLOCK HOUR OPERATIONS ALLOCATIONS – GENERAL AVIATION

Block Hour	Day/Night	Monthly Arrivals	Monthly Departures	DDFS Arrivals	DDFS Departures
0	Night	0.0%	0.0%	0	0
1	Night	0.3%	0.3%	0	0
2	Night	0.8%	0.3%	0	0
3	Night	0.3%	0.3%	0	0
4	Night	0.8%	0.3%	0	0
5	Night	0.5%	0.0%	1	0
6	Night	2.7%	2.2%	0	0
7	Day	5.6%	2.9%	0	0
8	Day	5.6%	5.4%	1	1
9	Day	5.4%	4.8%	1	1
10	Day	4.8%	3.2%	1	1
11	Day	6.7%	9.6%	1	1
12	Day	7.8%	6.1%	1	1
13	Day	9.1%	6.7%	1	1
14	Day	7.5%	9.3%	1	1
15	Day	11.3%	13.4%	0	1
16	Day	9.4%	7.7%	0	0
17	Day	6.2%	7.7%	0	0
18	Day	6.7%	3.8%	0	0
19	Day	2.2%	5.1%	0	0
20	Day	2.2%	5.4%	0	0
21	Day	1.6%	1.6%	0	0
22	Night	1.9%	2.2%	0	0
23	Night	0.5%	1.6%	0	0
<b>TOTAL</b>		<b>100%</b>	<b>100%</b>	<b>8</b>	<b>8</b>
Day		92.1%	92.7%	7	8
Night		7.8%	7.2%	1	0

NOTE: The percentages shown are for the entire month of July, while the operations reflect what is included in the DDFS.

SOURCE: Aerobahn, June 2019.





JANUARY 2020

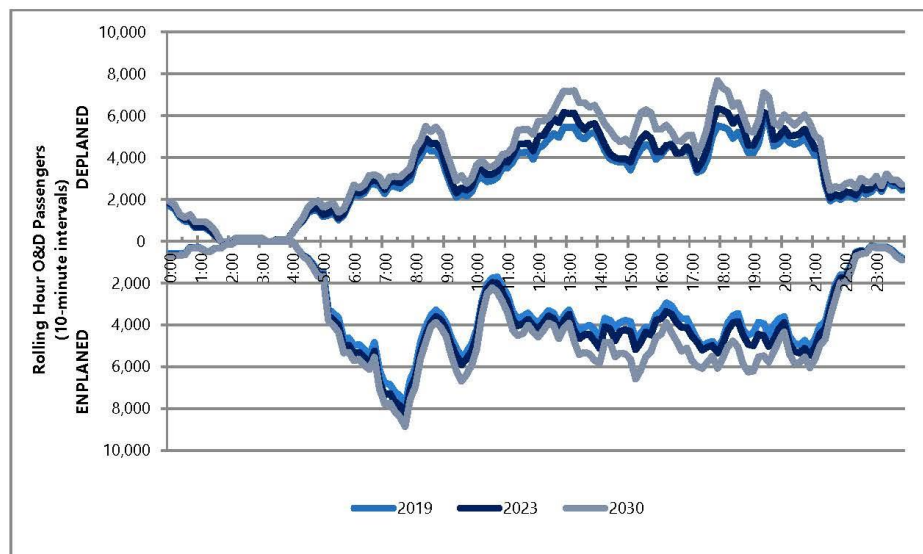
[DRAFT]

TABLE 7-5: ANNUAL AND DDFS TOTAL PASSENGERS

Year	DDFS	Annual	Ratio
2019	280,427	87,120,580	0.322%
2023	305,193	94,741,685	0.322%
2030	344,901	107,250,084	0.322%
<b>Compound Annual Growth Rate</b>			
2019-2023	2.1%	2.1%	
2019-2030	1.9%	1.9%	

SOURCES: US DOT Form T-100; Ricondo &amp; Associates, Inc. (analysis), August 2019.

EXHIBIT 7-2: ROLLING HOUR O&amp;D PASSENGER ACTIVITY



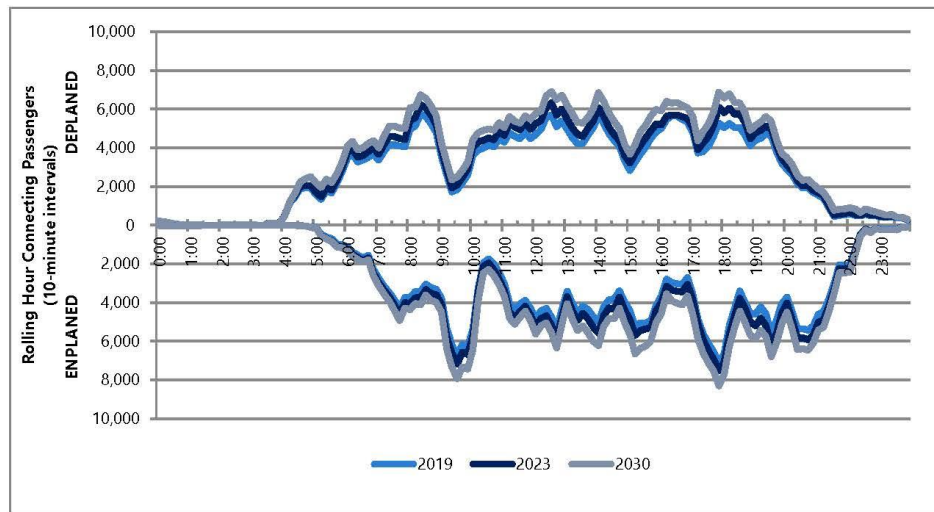
SOURCES: US DOT Form T-100; Ricondo &amp; Associates, Inc. (analysis), August 2019.



JANUARY 2020

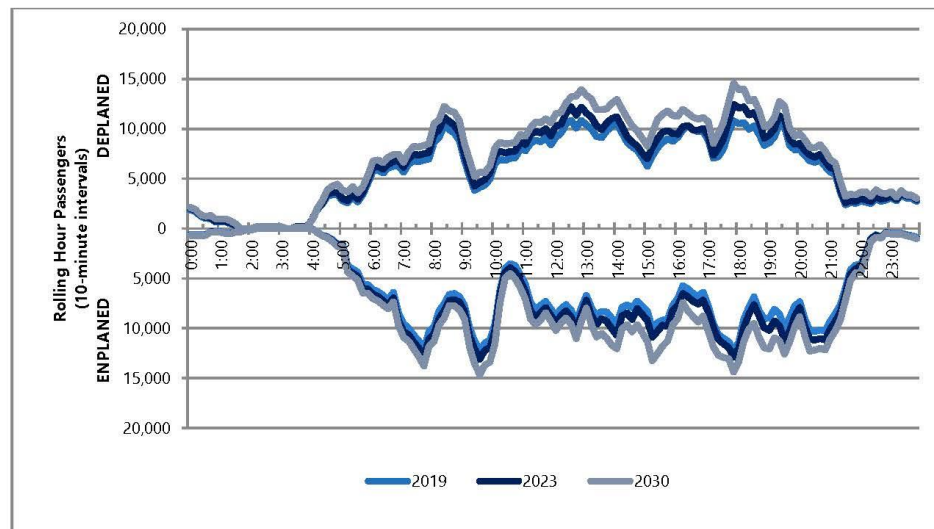
[DRAFT]

EXHIBIT 7-3: ROLLING HOUR CONNECTING PASSENGER ACTIVITY



SOURCES: US DOT Form T-100; Ricondo &amp; Associates, Inc. (analysis), August 2019.

EXHIBIT 7-4: ROLLING HOUR TOTAL PASSENGER ACTIVITY



SOURCES: US DOT Form T-100; Ricondo &amp; Associates, Inc. (analysis), August 2019.



JANUARY 2020

[DRAFT]

TABLE 7-6: HOURLY SUMMARY – ENPLANED PASSENGERS

Time of Day (Hourly)	2019 Enplaned Passengers	2019 Deplaned Passengers	2019 Total Passengers	2023 Enplaned Passengers	2023 Deplaned Passengers	2023 Total Passengers	2030 Enplaned Passengers	2030 Deplaned Passengers	2030 Total Passengers
0:00 - 0:59	1,866	606	2,472	2,015	690	2,695	2,108	696	2,794
1:00 - 1:59	660	333	993	728	351	1,078	951	351	1,302
2:00 - 2:59	0	144	144	0	149	149	0	159	159
3:00 - 3:59	148	0	148	169	0	169	180	0	180
4:00 - 4:59	846	0	846	889	0	889	843	0	843
5:00 - 5:59	2,767	1,548	4,315	2,983	1,697	4,680	3,829	1,788	5,617
6:00 - 6:59	5,778	6,104	11,882	6,163	6,593	12,755	6,766	7,014	13,780
7:00 - 7:59	5,640	9,528	15,168	6,138	10,321	16,459	6,640	10,906	17,546
8:00 - 8:59	8,644	9,830	18,474	9,418	10,527	19,945	10,515	11,323	21,838
9:00 - 9:59	8,603	7,665	14,468	7,389	8,269	15,657	8,533	9,031	17,564
10:00 - 10:59	6,538	9,578	16,116	7,350	10,189	17,539	8,089	11,586	19,674
11:00 - 11:59	7,806	5,591	13,397	8,426	6,301	14,728	9,258	7,087	16,345
12:00 - 12:59	9,145	8,718	17,863	10,264	9,469	19,733	11,512	10,203	21,715
13:00 - 13:59	10,407	6,697	17,104	11,577	7,177	18,754	13,359	7,979	21,338
14:00 - 14:59	10,571	9,578	20,149	11,210	10,896	21,906	12,933	12,036	24,968
15:00 - 15:59	6,240	8,280	14,520	7,008	8,210	15,217	8,272	11,305	19,577
16:00 - 16:59	9,147	7,013	16,160	9,463	7,699	17,162	11,278	9,020	20,298
17:00 - 17:59	8,828	7,768	16,594	9,269	8,392	17,660	10,694	10,319	21,013
18:00 - 18:59	10,507	11,377	21,884	12,086	11,955	24,041	13,914	13,307	27,222
19:00 - 19:59	8,616	8,955	17,571	9,370	10,191	19,561	10,373	12,071	22,444
20:00 - 20:59	7,913	7,321	15,234	8,508	7,908	16,415	9,529	8,834	18,364
21:00 - 21:59	5,661	9,286	14,947	6,092	10,081	16,173	6,921	11,066	17,987
22:00 - 22:59	2,763	3,647	6,410	3,026	4,003	7,029	3,648	4,429	8,077
23:00 - 23:59	3,094	474	3,568	3,270	530	3,800	3,702	554	4,256
<b>Total</b>	<b>140,386</b>	<b>140,041</b>	<b>280,427</b>	<b>152,809</b>	<b>152,385</b>	<b>305,193</b>	<b>173,846</b>	<b>171,055</b>	<b>344,901</b>
Peak Block Hour	10,571	11,377	21,884	12,086	11,955	24,041	13,914	13,307	27,222
Peak Rolling Hour (10-minute intervals)	10,845	12,271	23,027	12,453	13,090	25,324	14,563	14,633	28,938

SOURCES: Innovata, Ricardo &amp; Associates, Inc. (analysis), August 2019.



JANUARY 2020

[DRAFT]

## 7.2.2 Aircraft Operations Results

The annual and DDFS passenger aircraft and non-passenger aircraft operations volumes for the base year, 2023, and 2030 schedules are shown in **Table 7-7** and **Table 7-8**, respectively. Rolling hour profiles of passenger aircraft and total aircraft operations are presented in **Exhibit 7-5** and **Exhibit 7-6** respectively.

Block hour total aircraft operations are presented in **Table 7-9**.

**TABLE 7-7: ANNUAL AND DDFS PASSENGER AIRLINE OPERATIONS**

Year	DDFS	Annual	Ratio
2019	2,720	914,712	0.297%
2023	2,734	918,075	0.298%
2030	2,889	973,592	0.297%
<b>Compound Annual Growth Rate</b>			
2019-2023	0.1%	0.1%	
2019-2030	0.5%	0.6%	

SOURCES: Innovata, Ricondo & Associates, Inc. (analysis), August 2019.

**TABLE 7-8: NON-PASSENGER AIRLINE AND TOTAL AIRPORT AIRCRAFT OPERATIONS**

Year	Cargo	General Aviation	Military	Non-Passenger Airline Total	Passenger Airline Total	Airport Total
<b>DDFS Operations</b>						
2019	64	16	0	80	2,720	2,800
2023	70	16	0	86	2,734	2,820
2030	88	16	0	104	2,889	2,993
<b>Annual Operations</b>						
2019	25,878	5,906	75	31,859	914,712	946,571
2023	28,433	5,906	74	34,413	918,075	952,489
2030	34,283	5,906	74	40,263	973,592	1,013,856
<b>DDFS to Annual Operations Ratio</b>						
2019	0.247%	0.271%	0.000%	0.251%	0.297%	0.296%
2023	0.246%	0.271%	0.000%	0.250%	0.298%	0.296%
2030	0.257%	0.271%	0.000%	0.258%	0.297%	0.295%

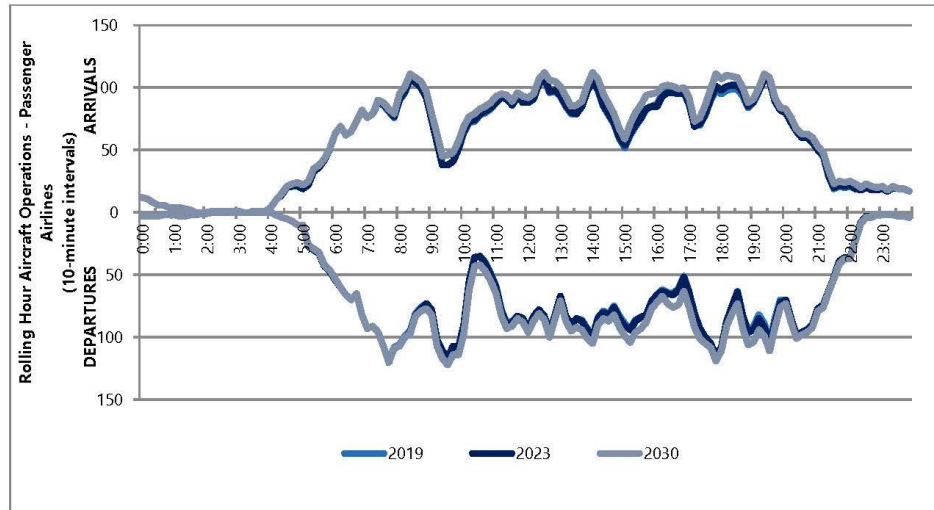
SOURCES: Innovata, Ricondo & Associates, Inc. (analysis), August 2019.



JANUARY 2020

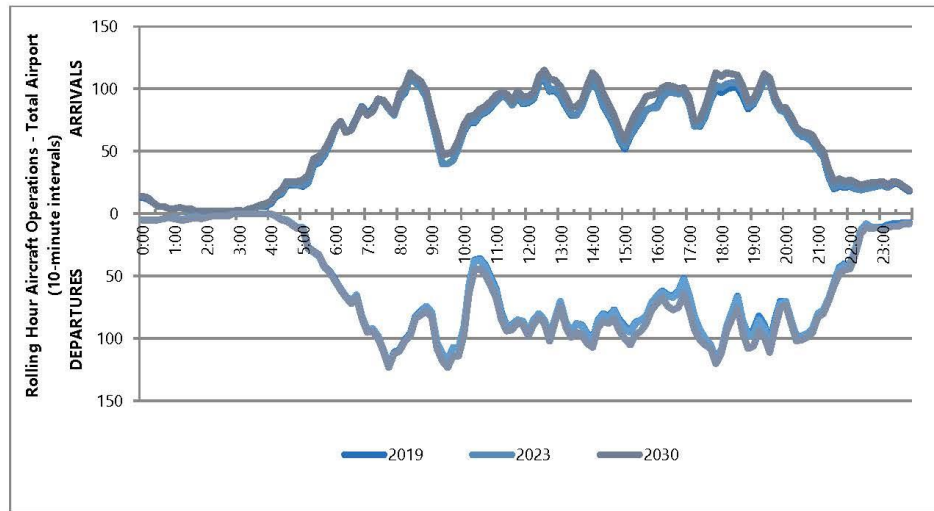
[DRAFT]

EXHIBIT 7-5: ROLLING HOUR PASSENGER AIRCRAFT OPERATIONS



SOURCES: Innovata; Ricondo &amp; Associates, Inc. (analysis), August 2019.

EXHIBIT 7-6: ROLLING HOUR TOTAL AIRCRAFT OPERATIONS



SOURCES: Innovata; Ricondo &amp; Associates, Inc. (analysis), August 2019.



JANUARY 2020

[DRAFT]

TABLE 7-9: HOURLY SUMMARY – TOTAL AIRCRAFT OPERATIONS

Time of Day (Hourly)	2019 Arrivals	2019 Departures	2019 Total	2023 Arrivals	2023 Departures	2023 Total	2030 Arrivals	2030 Departures	2030 Total
0:00 - 0:59	13	5	18	14	5	19	14	5	19
1:00 - 1:59	4	3	7	4	3	7	4	4	8
2:00 - 2:59	1	3	4	1	3	4	2	3	5
3:00 - 3:59	3	0	3	3	0	3	3	0	3
4:00 - 4:59	8	0	8	9	0	9	10	0	10
5:00 - 5:59	22	11	33	23	11	34	27	12	39
6:00 - 6:59	68	53	121	68	54	122	69	55	124
7:00 - 7:59	80	93	173	79	93	172	79	95	174
8:00 - 8:59	92	109	201	92	110	202	96	110	206
9:00 - 9:59	75	79	154	75	79	154	80	83	163
10:00 - 10:59	66	91	157	67	91	158	71	98	169
11:00 - 11:59	90	60	150	90	62	152	95	67	162
12:00 - 12:59	89	95	184	90	95	185	94	98	192
13:00 - 13:59	94	70	164	95	70	165	102	74	176
14:00 - 14:59	106	101	207	106	102	208	113	107	220
15:00 - 15:59	52	90	142	54	92	146	59	100	159
16:00 - 16:59	87	66	153	85	66	151	96	72	168
17:00 - 17:59	89	65	154	88	65	153	93	77	170
18:00 - 18:59	97	111	208	101	109	210	110	112	222
19:00 - 19:59	88	93	181	89	96	185	92	106	198
20:00 - 20:59	81	70	151	81	70	151	85	73	158
21:00 - 21:59	51	80	131	51	80	131	55	83	138
22:00 - 22:59	22	40	62	23	40	63	27	44	71
23:00 - 23:59	23	11	34	23	13	36	26	13	39
Total	1,401	1,399	2,800	1,411	1,409	2,820	1,502	1,491	2,993
Peak Block Hour	106	111	208	106	110	210	113	112	222
Peak Rolling Hour (10-minute intervals)	109	122	218	111	122	219	115	123	233

SOURCES: Innovata, Ricardo &amp; Associates, Inc. (analysis), August 2019.

Annual Activity Forecasts

[42]



JANUARY 2020

[DRAFT]

The DDFS passenger aircraft and cargo aircraft operations fleet mix were based on the factors described in section 3, and are provided in **Table 7-10** and **Table 7-11**, respectively.

**TABLE 7-10: PASSENGER AIRCRAFT OPERATIONS FLEET MIX**

Year	Regional/ Commuter	Narrowbody	Widebody	Total
<b>Passenger Aircraft Operations</b>				
2019	1,439	1,131	150	2,720
2023	1,420	1,122	192	2,734
2030	1,454	1,221	214	2,889
<b>Share of Passenger Aircraft Operations</b>				
2019	53%	42%	6%	100%
2023	52%	41%	7%	100%
2030	50%	42%	7%	100%
<b>Average Seats per Departure</b>				
2019	59.0	160.8	282.7	113.7
2023	60.1	168.7	293.5	121.0
2030	63.6	175.2	301.9	128.4

SOURCES: Innovata, Ricondo & Associates, Inc. (analysis), August 2019.

**TABLE 7-11: CARGO AIRCRAFT OPERATIONS FLEET MIX**

Year	Regional/ Commuter	Narrowbody	Widebody	Total
<b>Cargo Aircraft Operations</b>				
2019	0	2	62	64
2023	0	4	66	70
2030	0	6	82	88
<b>Share of Cargo Aircraft Operations</b>				
2019	0%	3%	97%	100%
2023	0%	6%	94%	100%
2030	0%	7%	93%	100%

SOURCES: US DOT T-100, Ricondo & Associates, Inc. (analysis), August 2019.



JANUARY 2020

[DRAFT]

## 8. Constrained Schedule Analysis

A gating analysis of the draft 2030 Design Day Flight Schedule (DDFS) was performed to determine whether a constrained schedule should be explored for the 2030 No Action scenario.

The gating analysis considered factors such as airline/gate allocation, gate gauge, aircraft turn times, and gate separation times (time between a gate departure and subsequent gate arrival). The following assumptions were used for the analysis of the 2030 No Action scenario.

### 8.1 Gate Layout, Gate Gauge, and Airline Allocation

**Exhibit 8-1** shows the gate layout, gate gauge, and airline allocation assumed in the 2030 No Action gating scenario. The following gate changes were assumed to have occurred between July 2019 and 2030:

- The Terminal 5 Concourse M Extension is complete and operational
- The Terminal 3 Concourse L 2-gate expansion is complete and operational
- The Concourse L/Concourse G gate swap has occurred, allocating the entirety of Concourse L to American and the west side of Concourse G to Alaska, Spirit Airlines (Spirit), and CDA Common Use.
- Delta Air Lines (Delta) and the EAS operators have moved to the north portion of Terminal 5 Concourse M.

### 8.2 Aircraft Turn Times

Aircraft turn times utilized for this analysis were obtained from the matched draft 2030 DDFS.

### 8.3 Gate Separation, Tow-On, and Tow-Off Times

**Table 8-1** and **Table 8-2** outline the minimum time-at-gate for domestic and international operations, respectively, used in the gating exercise. The minimum time-at-gate ranges from 30 minutes for a domestic Regional Jet to 105 minutes for an ADG-VI international operation.

Gate separation times, or time when a gate is empty between a departure and successive arrival, were assumed to be 10 minutes for aircraft using common use international gates (based on existing schedule activity), 20 minutes for narrowbody aircraft using preferential use gates, and 30 minutes for widebody aircraft using preferential use gates. 20 minutes of gate separation was used between tow-on and/or tow-off operations at preferential use gates.





JANUARY 2020

[DRAFT]

EXHIBIT 8-1: NO ACTION – FULL BUILD GATE LAYOUT

Annual Activity Forecasts

[45]



JANUARY 2020

[DRAFT]

TABLE 8-1: MINIMUM TIME AT GATE (DOMESTIC OPERATIONS)

Aircraft Size	Minimum Time at Gate After Arrival (Arrival + Tow-OFF)	Minimum Time at Gate before Departure (Tow-ON + Departure)
Regional Jet	30 minutes	30 minutes
ADG-III	40 minutes	40 minutes
ADG-IV	40 minutes	40 minutes
ADG-V	60 minutes	90 minutes
ADG-VI	60 minutes	90 minutes

SOURCE: Ricondo &amp; Associates, Inc., July 2019.

TABLE 8-2: MINIMUM TIME AT GATE (INTERNATIONAL OPERATIONS)

Aircraft Size	Minimum Time at Gate After Arrival (Arrival + Tow-OFF)	Minimum Time at Gate before Departure (Tow-ON + Departure)
Regional Jet	45 minutes	45 minutes
ADG-III	45 minutes	45 minutes
ADG-IV	60 minutes	75 minutes
ADG-V	60 minutes	90 minutes
ADG-VI	75 minutes	105 minutes

SOURCE: Ricondo &amp; Associates, Inc., July 2019.

## 8.4 Gating Summary

**Appendix A** contains the gating output of the 2030 No Action scenario in Gantt chart format. Gate numbers are shown on the left side of the chart and time of day is shown along the top. All flights were able to be gated successfully without hard standing for enplaning or deplaning passengers. However, gate separation times and minimum times at gate needed to be reduced in certain instances to accommodate all flights. Airline scheduling practices suggest that it is reasonable to assume these modifications could occur to accommodate a peak summer schedule.

### Modifications to Gate Separation Times

- There were 45 instances at Terminals 1, 2, and 3 where gate separation times were reduced below 20 minutes. Of those 45 instances, there were 3 instances where gate separation times were reduced below 10 minutes.
- There were 4 instances at Terminal 5 where gate separation times were reduced below 10 minutes.



JANUARY 2020

[DRAFT]

***Modifications to Minimum Time at Gate***

- There were no instances at Terminals 1, 2, and 3 where minimum time at gate after arrival (arrival + tow-off) was reduced below the minimums recommended in Tables 15 and 16.
- There were 6 instances at Terminals 1, 2, and 3 where minimum time at gate before departure (tow-on + departure) was reduced below the minimums recommended in Tables 15 and 16.
- There was 1 instance at Terminal 5 where minimum time at gate after arrival (arrival + tow-off) was reduced below the minimums recommended in Tables 15 and 16.
- There were no instances at Terminal 5 where minimum time at gate before departure (tow-on + departure) was reduced below the minimums recommended in Tables 15 and 16.

Additionally, a total of 168 tow-on and tow-off movements were required, with 55 of those tow movements being from Terminal 5 to Terminals 1, 2, and 3 to accommodate international arrivals for United and American. A peak remote aircraft parking requirement of 20 positions (11 for United, 7 for American, and 2 for Spirit) is needed to accommodate aircraft towed off gates at Terminals 1, 2, and 3. This requirement could be accommodated on existing facilities in the Northwest Maintenance Hangar Area and the Centralized Deicing Facility. A peak remote aircraft parking requirement of 4 positions (3 for Delta, 1 for other airlines) is needed to accommodate aircraft towed off gates at Terminal 5. This requirement could be accommodated on the hardstand area east of the Terminal 5 Concourse M Extension.

Without consideration for other factors such as aircraft delay, the gating analysis of the draft 2030 DDFS for the 2030 No Action scenario indicates that a constrained schedule would not be necessary.



JANUARY 2020

[DRAFT]

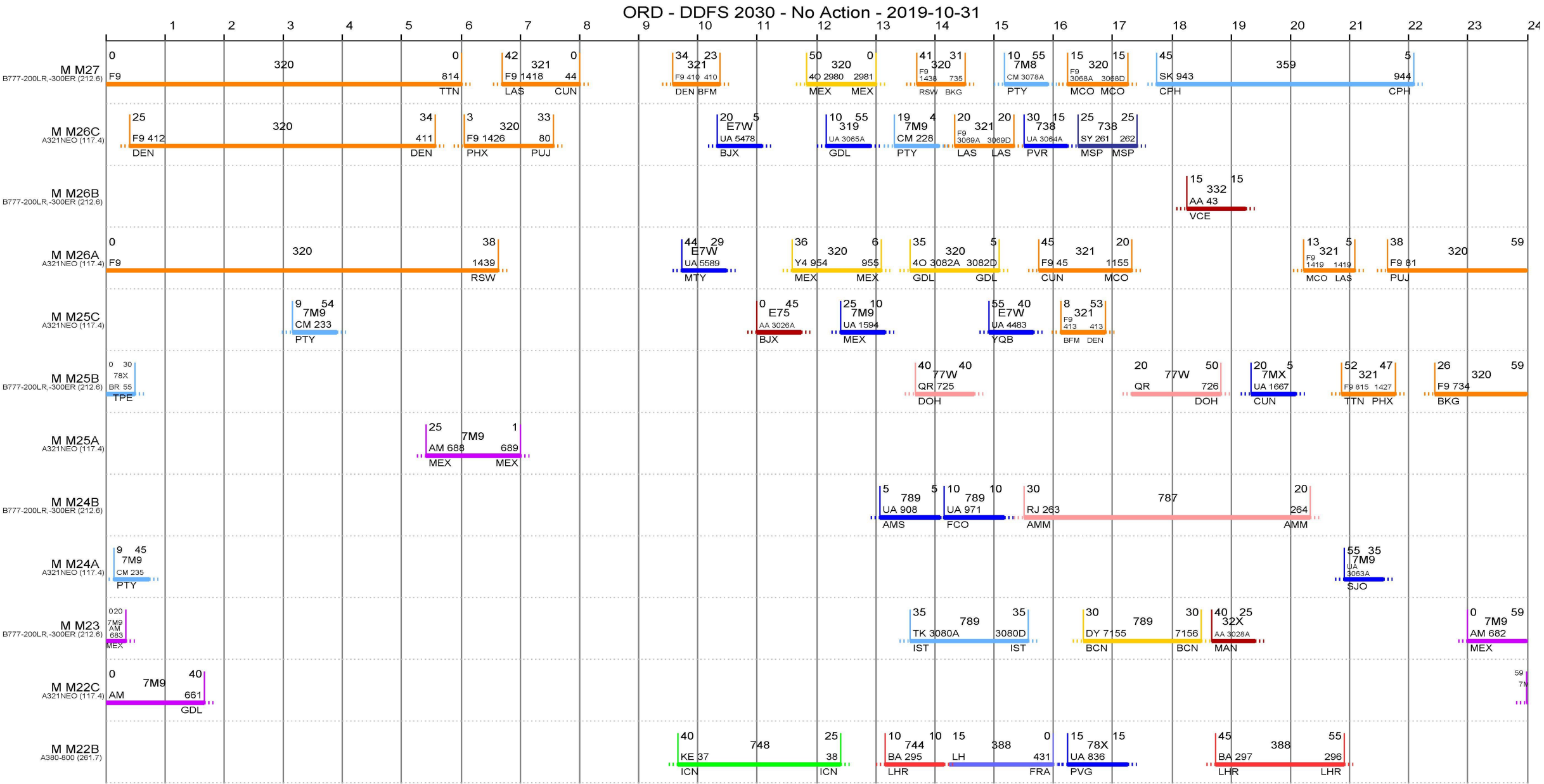
## Appendix A Gated 2030 Flight Schedule

Annual Activity Forecasts

[A-1]

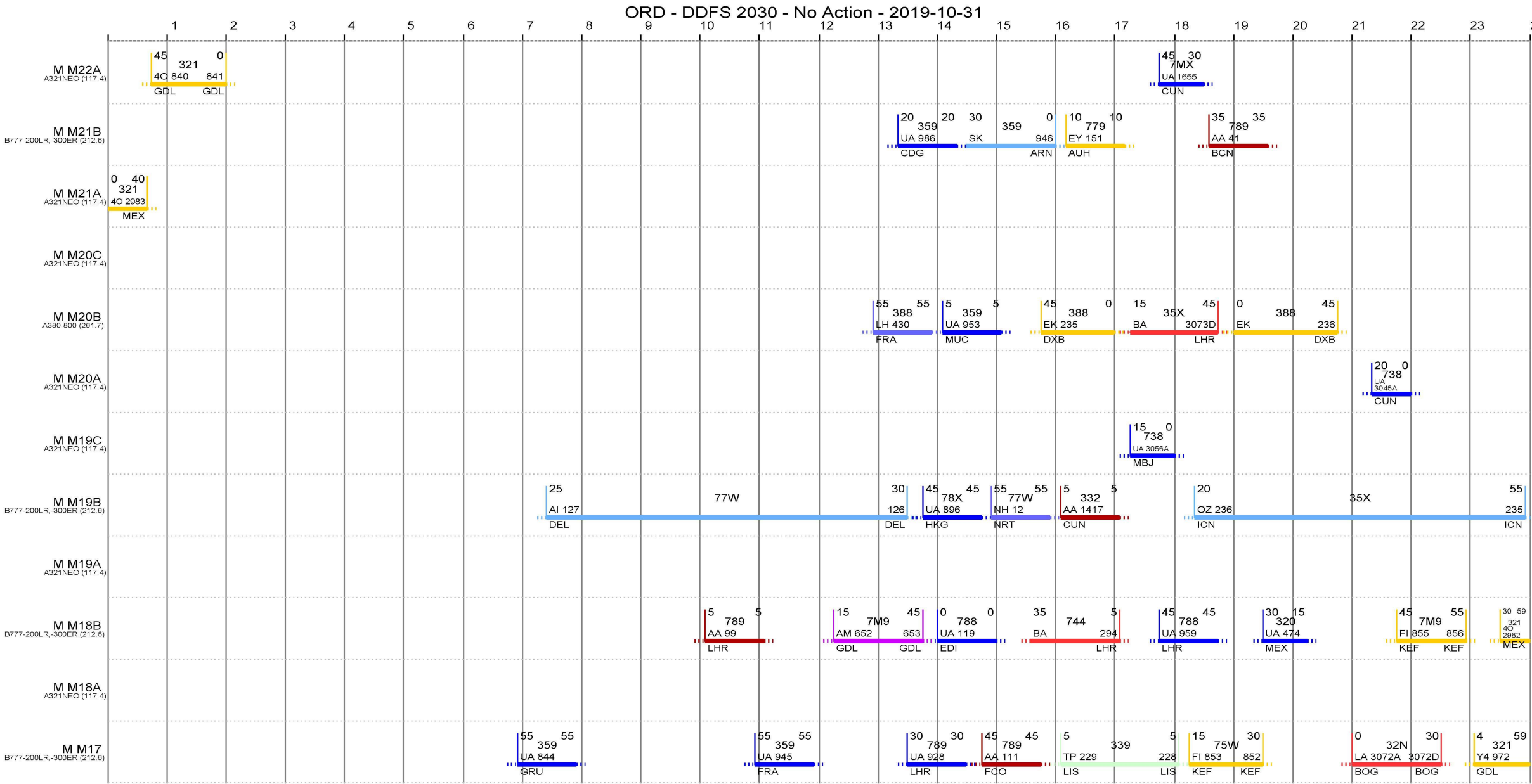
(ORD) O'Hare International IL, United States

OCTOBER 2019



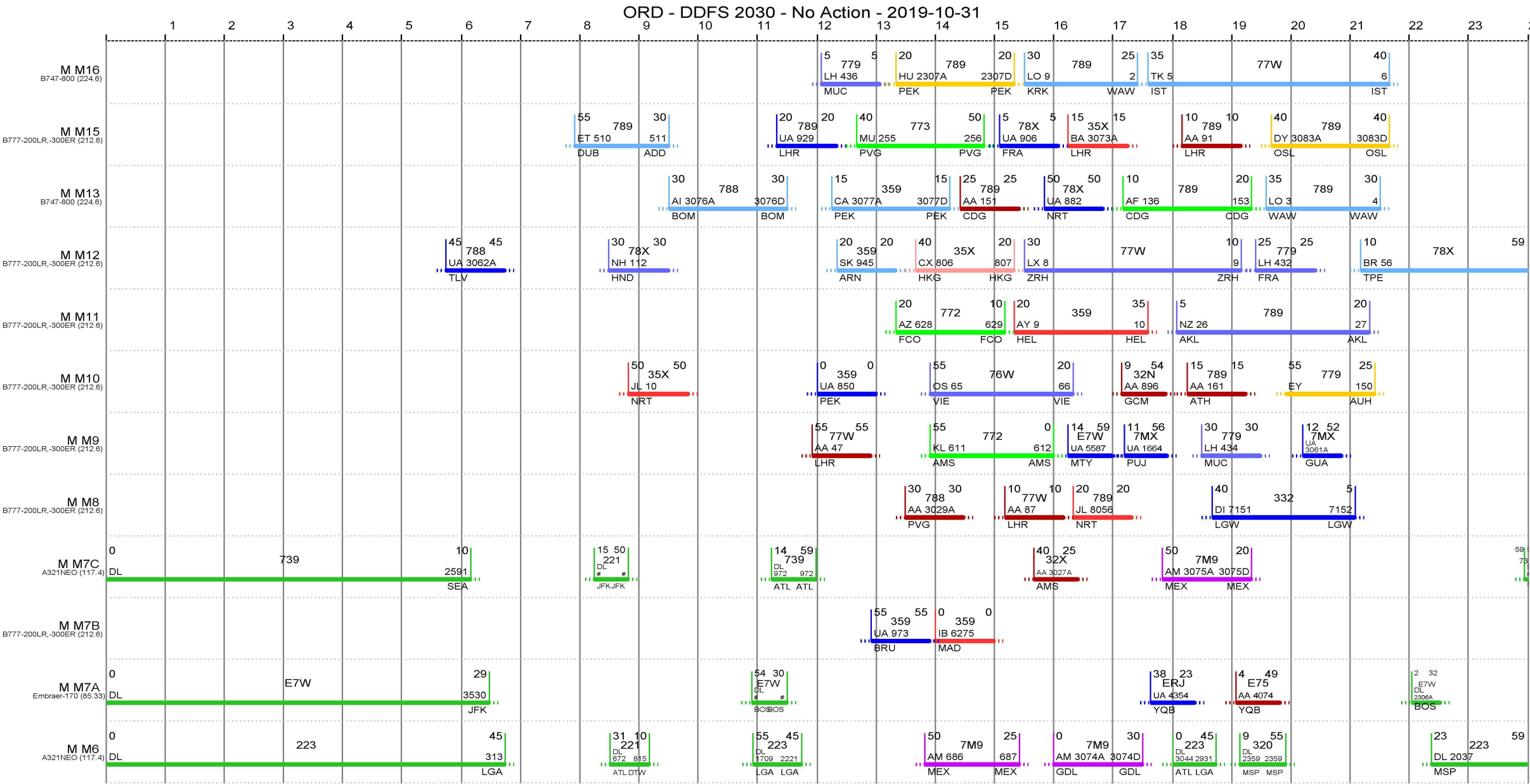
(ORD) O'Hare International IL, United States

OCTOBER 2019



(ORD) O'Hare International IL, United States

OCTOBER 2019

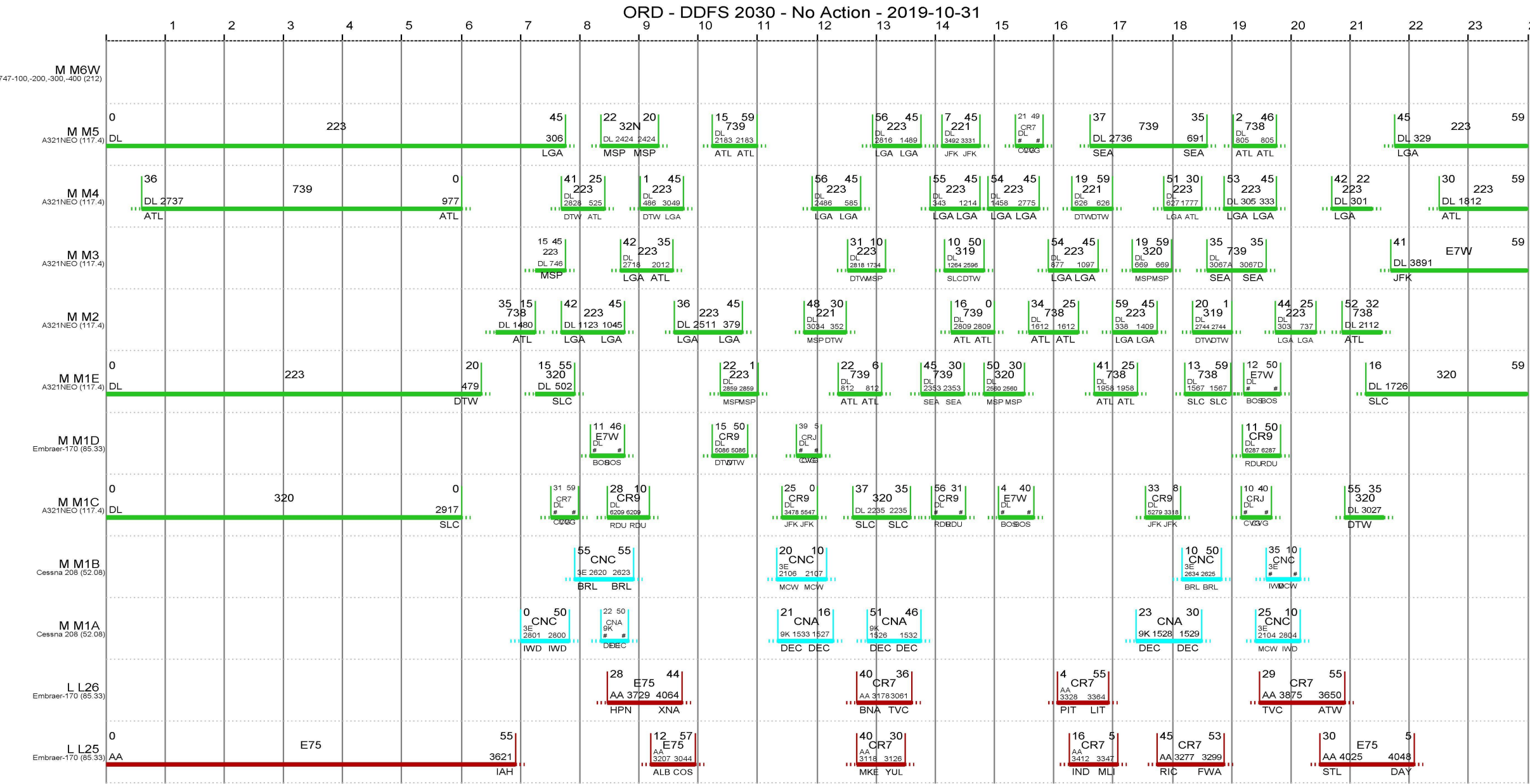


TAP EA - 2030 No Project



(ORD) O'Hare International IL, United States

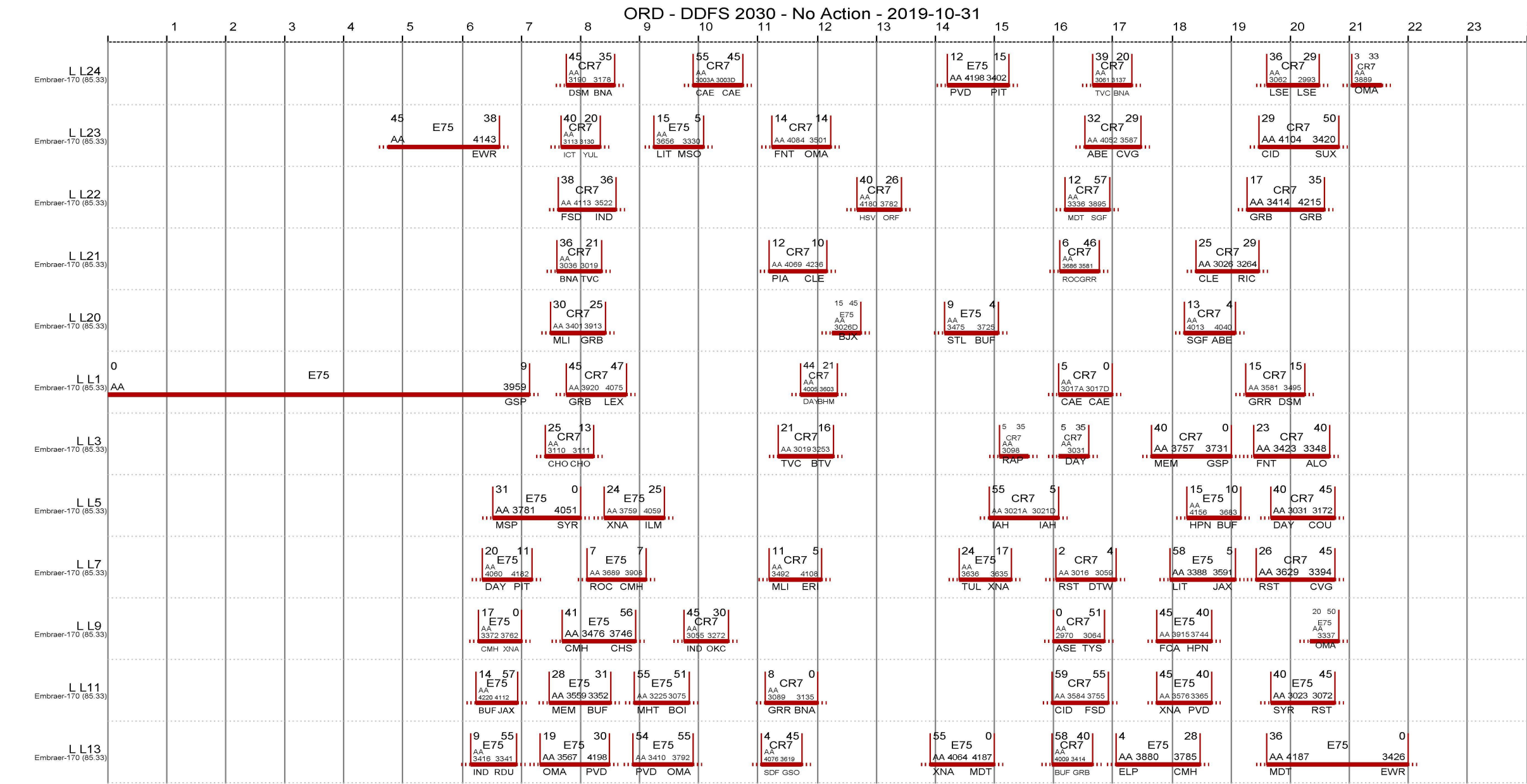
OCTOBER 2019





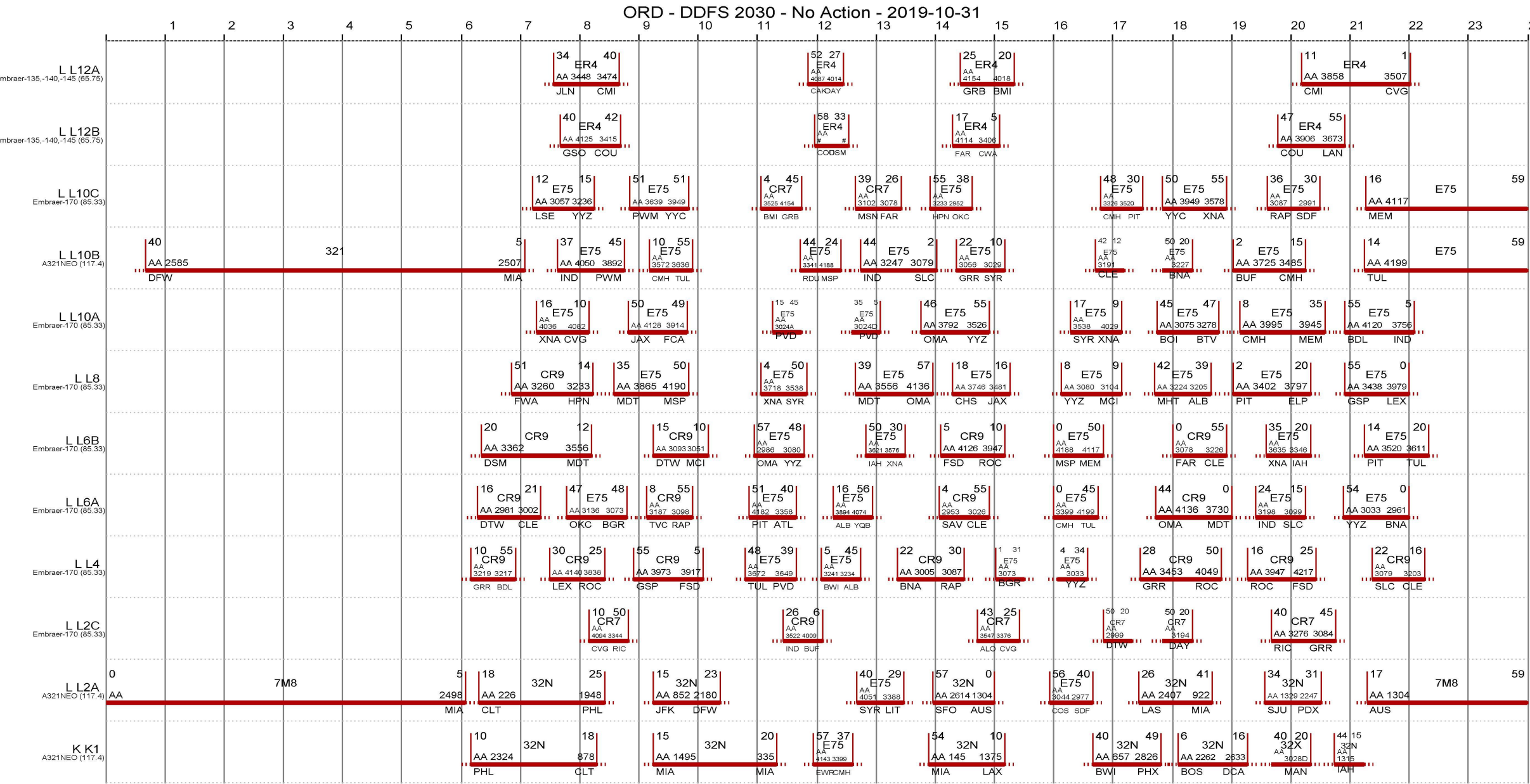
(ORD) O'Hare International IL, United States

OCTOBER 2019



(ORD) O'Hare International IL, United States

OCTOBER 2019



(ORD) O'Hare International IL, United States

OCTOBER 2019

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
K K2 Canadair-700 (76.25)								25 17 CR7 AA 3040 3148		34 10 CR7 AA 3112 3113		59 44 CR7 AA 3739 3336		34 19 CR7 AA 3071 3012			58 42 CR7 AA 3950 3889		39 45 CR7 AA 4045 4098		13 35 CR7 AA 3126 3124		2 5 CR7 AA 3104 3083		
K K3 A321NEO (117.4)					0 40 32N AA 1639	8 319 1 AA 2897 1585		40 20 32N AA 2723		10 32N 10 AA 2805 660		45 1 CR9 AA 3534 3686		37 20 E75 AA 3236 2995		45 32N 49 AA 1598 2346		20 32N 15 AA 226 2839		50 738 55 AA 115 1488		33 32N 30 AA 2448 2506		24 32N 45 AA 2427	
K K4 A321NEO (117.4)	28 AA 630 PHX			32N			5 447 PHX	45 AA 2812 DFW		32N		30 2184 BOS	8 50 CR9 AA 3017 3082	10 50 E75 AA 3707 4156		41 32N 55 AA 1629 2321 AUS BOS		15 32N 30 AA 2503 1251 AUS BOS		52 7M8 0 AA 773 82 DEN ATL		40 32N AA 1312 SJC	35 2228 TUS	11 32N 15 AA 2499 DCA	
K K5 B777-200,-300 (200)	0 AA		32N		0 2215 PHL	30 AA 3008A HNL		788		0 3008D HNL			50 789 20 AA 1408 DFW		30 788 30 AA 3029D PVG		5 789 35 AA 160 ATH		5 32N 9 AA 615 2529 PHX MCO		31 E75 50 AA 3526 3561 YYZ LIT		45 32N 0 AA 3007A OAK		
K K9 B777-200,-300 (200)	0 AA		32N		25 1784 CLT	2 AA 296 LAX	789	25 1163 LAX		57 32N 0 AA 1509 866 BOS PHX		1 32N 1 AA 1049 1239 EWR BOS		20 32N 33 AA 337 19 LGA RDU	48 789 48 AA 2412 DFW		45 789 15 AA 46 LHR		25 332 55 AA 42 VCE		45 332 15 AA 208 DUB		59 32N 23 AA 222 LGA		
K K13 B777-200,-300 (200)						10 AA	7M8	19 1637 PIT		6 32N 6 AA 370 2680 LGA SAN		35 788 5 AA 153 NRT				45 332 45 AA 209 DUB		9 321 19 AA 2223 2884 DFW LAS		39 32N 0 AA 1022 1691 MCO DCA		40 789 10 AA 40 BCN		59 32N 23 AA 222 LGA	
K K15 B777-200,-300 (200)	0 AA		32N				15 1625 DFW	45 789 AA 90 LHR		12 32N 23 AA 114 562 LGA PHX			41 32N 50 AA 2817 1315 CLT IAH		21 32N 47 AA 2285 2429 SNA DFW		20 789 50 AA 830 DFW		22 32N 48 AA 381 2409 LGA TPA		29 32N 4 AA 2634 2857 SFO CLT		37 32N 59 AA 2387 BOS		
K K19 B777-200LR,-300ER (212.6)					50 AA	32N 1300 ATL		5 33 32N 32 AA 1668 1668 CLT CLT		35 35X 5 JL 9 NRT		33 E75 31 AA 3838 3999 ROC CVG		0 359 50 EI 123 DUB		10 77W 10 AA 86 LHR		30 359 20 EI 125 DUB		30 359 20 EI 125 DUB		18 32N AA 891 PHX		59 32N AA 1680 PHL	
K K20 A321NEO (117.4)						2 32N 20 AA 1949 2052 PHX CLT	45 35 CR7 AA 3074 2953 FAR SAV		7 32N 7 AA 2721 2634 MCO SFO		6 32N 5 AA 2327 1553 AUS SNA		35 20 E75 AA 3352 3326 BUF CMH		43 7M8 55 AA 2338 2411 RNO MCO		44 32N 0 AA 1969 960 PHX ATL		29 32N 45 AA 1779 1062 SLC STL		30 32N 30 AA 883 357 PHX LGA		19 32N 15 AA 168 LAS		
K K18 B757-200W-300W (135)					40 AA	32N 10 451 SNA	38 32N 50 AA 2265 2486 BOS LAX			57 32N 5 AA 2095 1106 PHL DFW		39 32N 35 AA 601 601 PHX PHX		18 32N 20 AA 367 1464 LGA TPA		40 20 32X AA 3027D AMS		10 50 32N AA 2300 DFW		22 32N 31 AA 1159 245 MIA LAX		9 32N 15 AA 1029 2786 LAX LAX		59 32N 79 AA 1680 PHL	
K K16 B777-200LR,-300ER (212.6)	0 AA		32N		15 328 DFW	0 738 AA 896 GCM	15 40 32N 51 AA 1477 869 SYR IAH		25 5 32N 20 0 AA 277 2744 DEN LAX		32 15 E75 AA 3544 4095 JAX YYC		45 32 320 AA 2872 1224 CMH JAC		5 359 35 IB 6274 MAD		43 789 38 AA 1384 2715 LAX LAX		5 77W 35 AA 312 DFW		25 320 16 AA 1224 1681 JAC BUF		50 30 321 AA 1680 PHL		
K K12 B777-200,-300 (200)				10 AA	7M8 55 998 MSP	16 32N 30 AA 1980 1438 ATL MIA	0 7M8 2 AA 2849 1779 RDU SLC		38 32N 54 AA 1136 2095 CLT PHL		32 15 CR9 AA 3267 3181 GRR CLE		59 32N 1 AA 1313 1308 RSW MIA		40 32N 35 AA 2839 1277 DFW MIA		30 319 29 AA 3649 3967 PVD PWM		47 738 15 AA 1415 2208 YVR AUS		45 32N 45 AA 1505 SAT		5 789 35 AA 98 LHR		



OCTOBER 2019

TAP EA - 2030 No Project Page 8  
10/31/19 2:36 PM

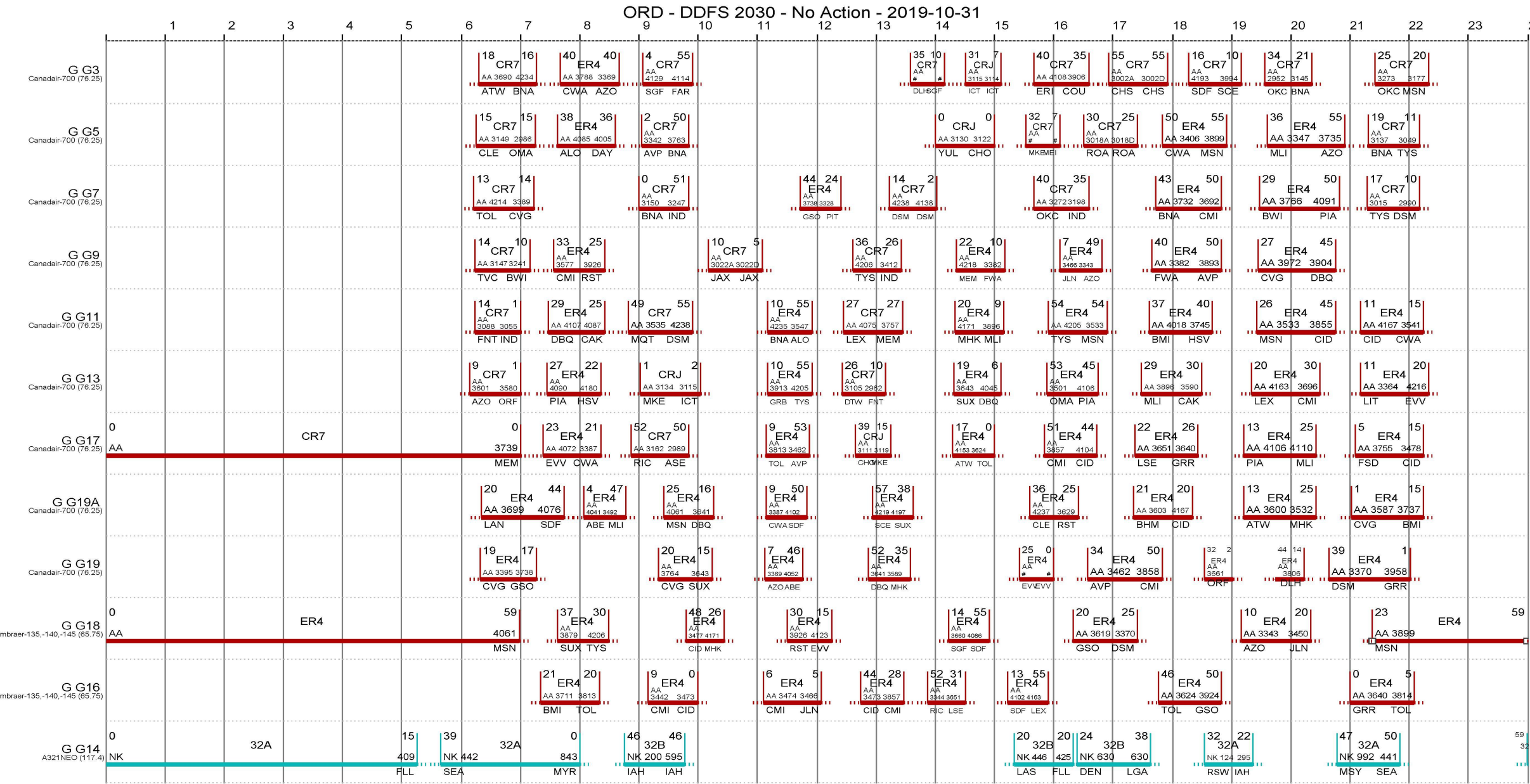
(ORD) O'Hare International IL, United States

OCTOBER 2019

ORD - DDFS 2030 - No Action - 2019-10-31																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
H H12 A321NEO (117.4)	10 AA 2776 LAX			32X			42 1384 LAX	10 50 E75 AA 3280 3105 BTVDTW	11 321 AA 2513 1356 MSY ABQ	16 48 738 46 AA 1393 657 TPA BWI	19 321 31 AA 2302 2398 LGA PBI	59 7M8 10 AA 2517 2841 SJC ATL	59 50 CR9 AA 2962 3218 FNT CLE	12 319 38 AA 1573 2852 SAT YYZ		35 738 36 AA 1045 1270 SEA ABQ	24 319 AA 751 2896 STL PIT	1 321 59 AA 2457 MIA						
H H10 A321NEO (117.4)					10 AA RSW	32N 2211 RSW	25 2211 RSW	15 59 319 AA 3211 3208 CLE CLE	33 321 30 AA 2180 527 DFW LGA	38 321 40 AA 2258 168 LAS LAS	3 738 0 AA 2780 1165 DEN SEA	9 32N 6 AA 2264 583 BOS CLT	10 321 30 AA 1356 2925 ABQ LGA	55 32N 18 AA 1101 1253 TPA SFO	40 32N 9 AA 1710 2738 MSY DFW									
H H8 A321NEO (117.4)				10 AA LGA	321 398 LGA	30 398 LGA	13 32N 0 AA 362 1217 LAX DFW	15 0 AA 3331 3880 IAH ELP	21 321 29 AA 1924 1475 LGA MCI	2 738 54 AA 2887 1486 RDU DCA	33 319 25 AA 3892 4120 PWM BDL	45 25 319 AA 2853 JAC	49 29 319 AA 1173 PIT	19 7M8 24 AA 1486 1582 DCA MCI	41 7M8 20 AA 363 2882 DCA MCI	59 39 321 AA 2431 LAX								
H H6 A321NEO (117.4)					15 AA LGA	321 337 LGA	30 337 LGA	9 320 55 AA 2889 659 BUF SAT	31 321 44 AA 1052 272 DFW JFK	15 321 30 AA 140 2302 BOS LGA	19 321 30 AA 956 2464 SAN LAS	22 321 30 AA 295 294 LGA LGA	50 319 50 AA 3825 3605 MSO IND	36 321 36 AA 245 1387 LAX DEN	13 321 0 AA 2520 DFW									
H H5 A321NEO (117.4)				20 AA DEN	321 2780 DEN	1 2780 DEN	29 321 35 AA 2883 395 MCI SJU	5 321 5 AA 1557 2456 TPA LAS	10 321 15 AA 1431 2427 ABQ RNO	51 32X 52 AA 2452 2611 LAX LAX	20 321 30 AA 1287 325 BOS LGA	37 17 319 AA 3358 4025 ATL STL	43 319 46 AA 3234 3221 ALB MHT	23 321 25 AA 1051 2311 SNA RNO	3 321 0 AA 241 MSP									
H H4 A321NEO (117.4)				0 AA LGA	321 129 LGA	0 129 LGA	30 319 AA 3349 3812 EWR ALB	3 321 30 AA 1003 349 STL LGA	14 55 E75 AA 3801 3475 ELP STL	37 321 30 AA 1734 381 DFW LGA	39 32N 49 AA 2843 2639 SMF SFO	13 321 30 AA 349 30 LGA LGA	59 32N 57 AA 2642 2798 SNA SFO	10 7M8 10 AA 3013A 3013D FLL FLL	44 32N 36 AA 1442 1103 PDX MSY	6 7M8 15 AA 30 LGA								
H H3A Canadair-700 (76.25)							20 CR7 AA 3598 4084 CID FNT	20 CR7 AA 3019A 3019D LNK LNK	5 CR7 10 AA 3001A 3001D CHS CHS	35 CR7 45 AA 3959 3950 GSP MQT	43 CR7 32 AA 3159 3240 TVC BNA	54 CR7 45 AA 3409 3875 LAN TVC	35 CR7 33 AA 3589 3682 MHK ORF	12 CR7 20 AA 3518 3626 EVV SGF	0 CR7 AA 3804 CMH								59	
H H2 Canadair-700 (76.25)							11 CR7 14 AA 3443 3789 MHK BWI	44 CR7 38 AA 3993 3927 SCE DLH	0 CR7 55 AA 3009A 3009D BUF BUF	16 CR7 1 AA 3148 3223 LSE MHT	28 CR7 30 AA 3908 3929 CMH MSN	29 CR7 24 AA 3174 3101 FWA DTW	54 CR7 40 AA 3135 3273 BNA OKC	33 CR7 25 AA 3253 3157 BTV OKC	50 CR7 15 AA 2973 3201 DTW OKC	0 CR7 5 AA 3059 3020 DTW FNT								
H H1B Canadair-700 (76.25)							39 CR7 39 AA 3186 2998 RST DTW	5 47 ER4 AA 3437 4219 HSV SCE	14 CR7 5 AA 3434 3360 ORF SGF	54 CR7 45 AA 2998 3159 DTW TVC	14 54 CR7 AA 3003 3277 SLC RIC	17 CR7 5 AA 3315 3351 LIT IND	49 CR7 44 AA 4137 3600 DSM ATW	32 CR7 20 AA 3189 2984 COU DTW	45 25 CR7 AA # LNK LNK	49 CR7 55 AA 3240 3255 BNA FAR								
H H1A Canadair-700 (76.25)							21 CR7 31 AA 3176 2975 MSN DSM	51 ER4 46 AA 3807 3525 DLH BMI	14 CR7 5 AA 3197 3102 DAY MSN	45 CR7 45 AA 3002 3056 CLE GRR	13 53 CR7 AA 3217 3016 BDL RST	22 52 CR7 AA 4190 3453 MSP	24 54 CR7 AA 4014 3423 GRR	47 CR7 35 AA 4014 3423 DAY FNT	24 CR7 26 AA 4197 4067 SUX TVC	40 CRJ 50 AA 3114 3127 ICT MKE								
G G1B Canadair-700 (76.25)					30 AA CMH	CR7 3534 CMH	25 ER4 43 AA 3540 4069 SGF PIA	13 CR7 0 AA 3951 3786 GRR LIT	38 CR7 40 AA 3210 3025 OKC FWA	5 ER4 15 AA 3580 3584 ORF CID	58 CR7 48 AA 3051 3276 MCI RIC	44 CR7 39 AA 3082 3062 SGF LSE	20 CR7 20 AA 4138 3886 DSM MQT	35 CRJ 50 AA 3122 3116 CHO CHO	26 56 CR7 AA 4067 TVC									
G G1A Canadair-700 (76.25)							20 CR7 20 AA 3648 3356 CAK RIC	7 CR7 55 AA 3138 3267 SDF GRR	20 CR7 42 AA 3389 4153 CVG ATW	5 ER4 15 AA 3356 3409 RIC LAN		55 30 CRJ AA # CRWRW	53 33 CR7 AA 3029 3438 MSGSP	53 33 CR7 AA 3699 3804 CVGCMH	58 CR7 59 AA 3351 3467 IND CVG	14 CR7 9 AA 3218 3195 CLE DTW								

(ORD) O'Hare International IL, United States

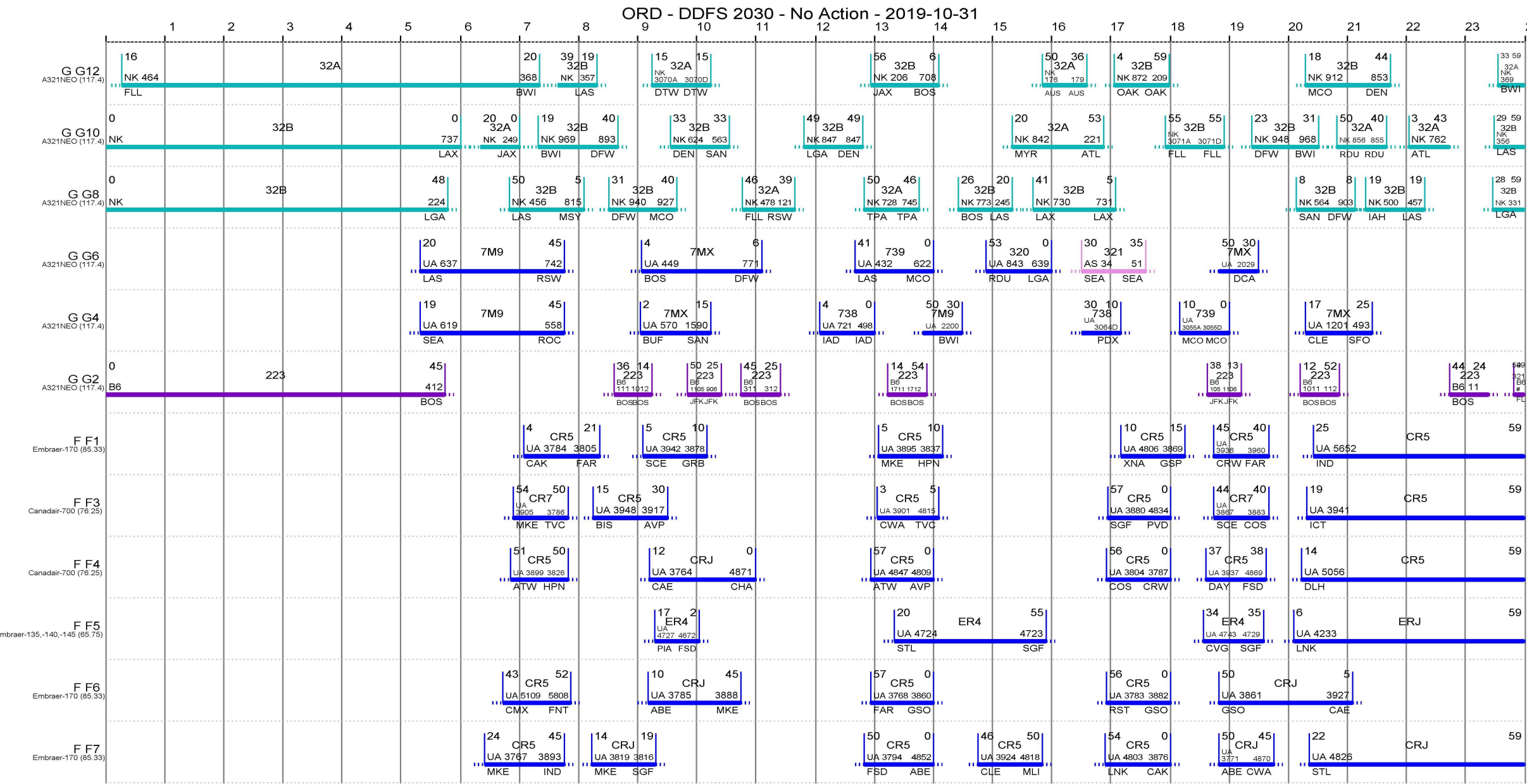
OCTOBER 2019





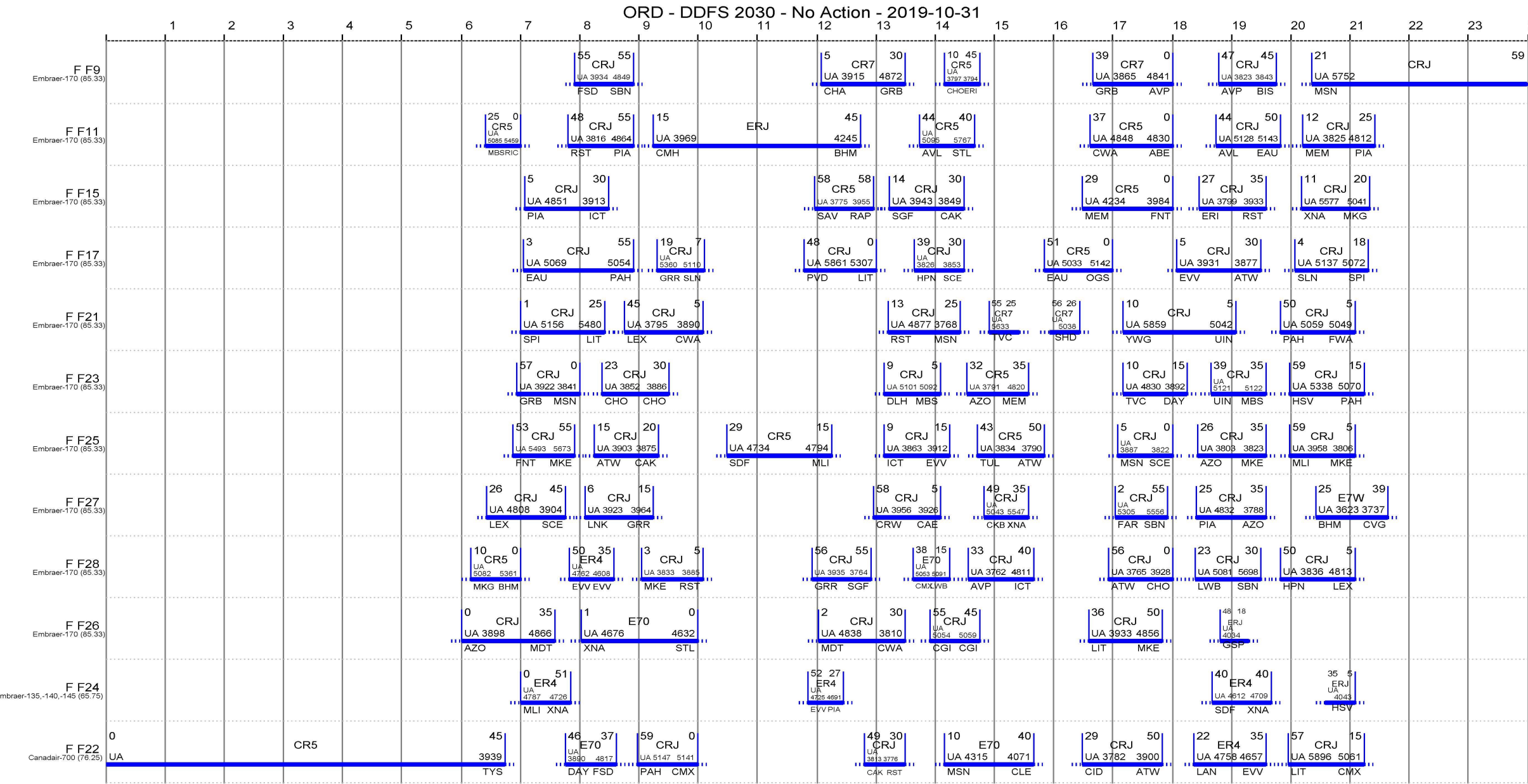
(ORD) O'Hare International IL, United States

OCTOBER 2019



(ORD) O'Hare International IL, United States

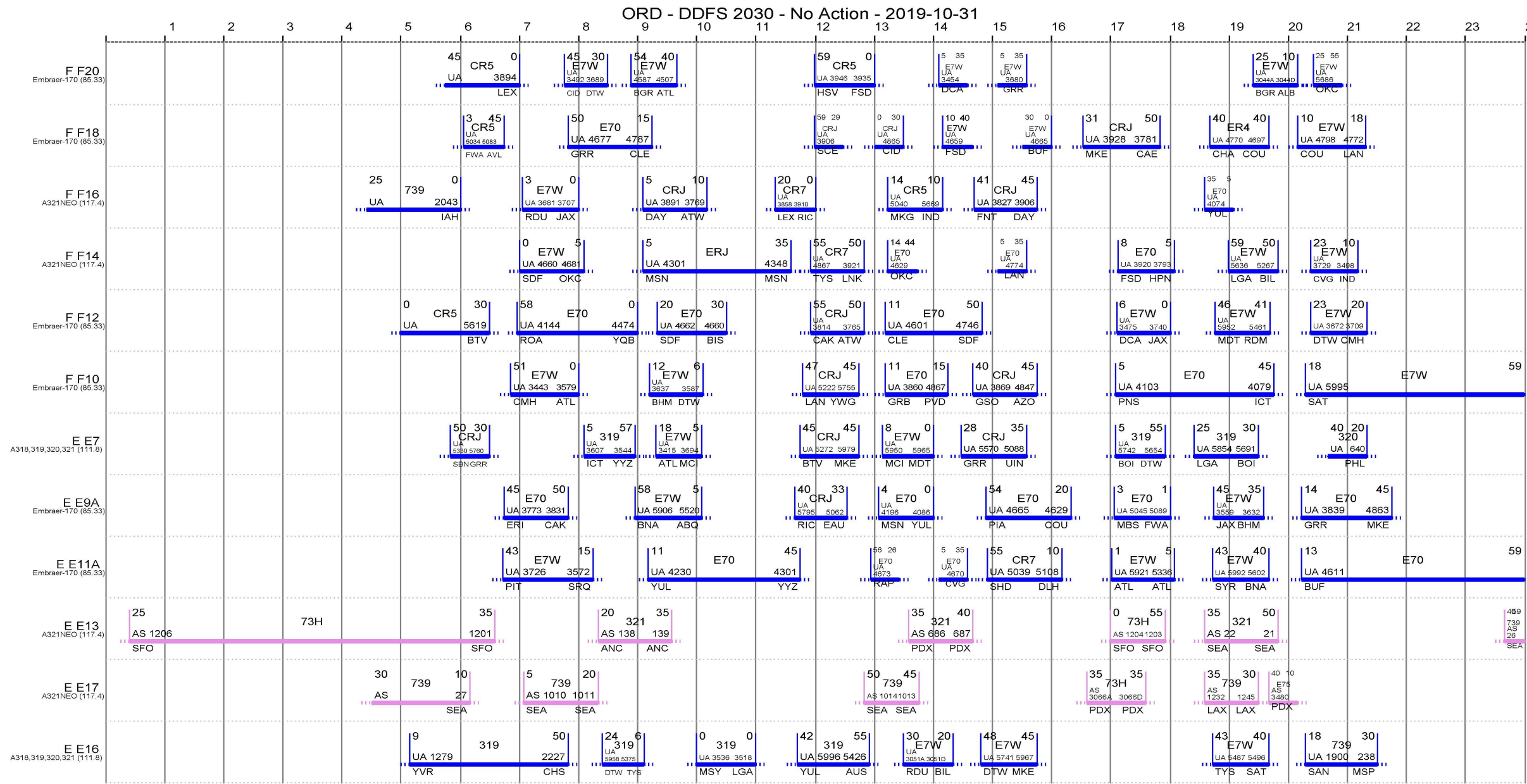
OCTOBER 2019



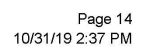


(ORD) O'Hare International IL, United States

OCTOBER 2019

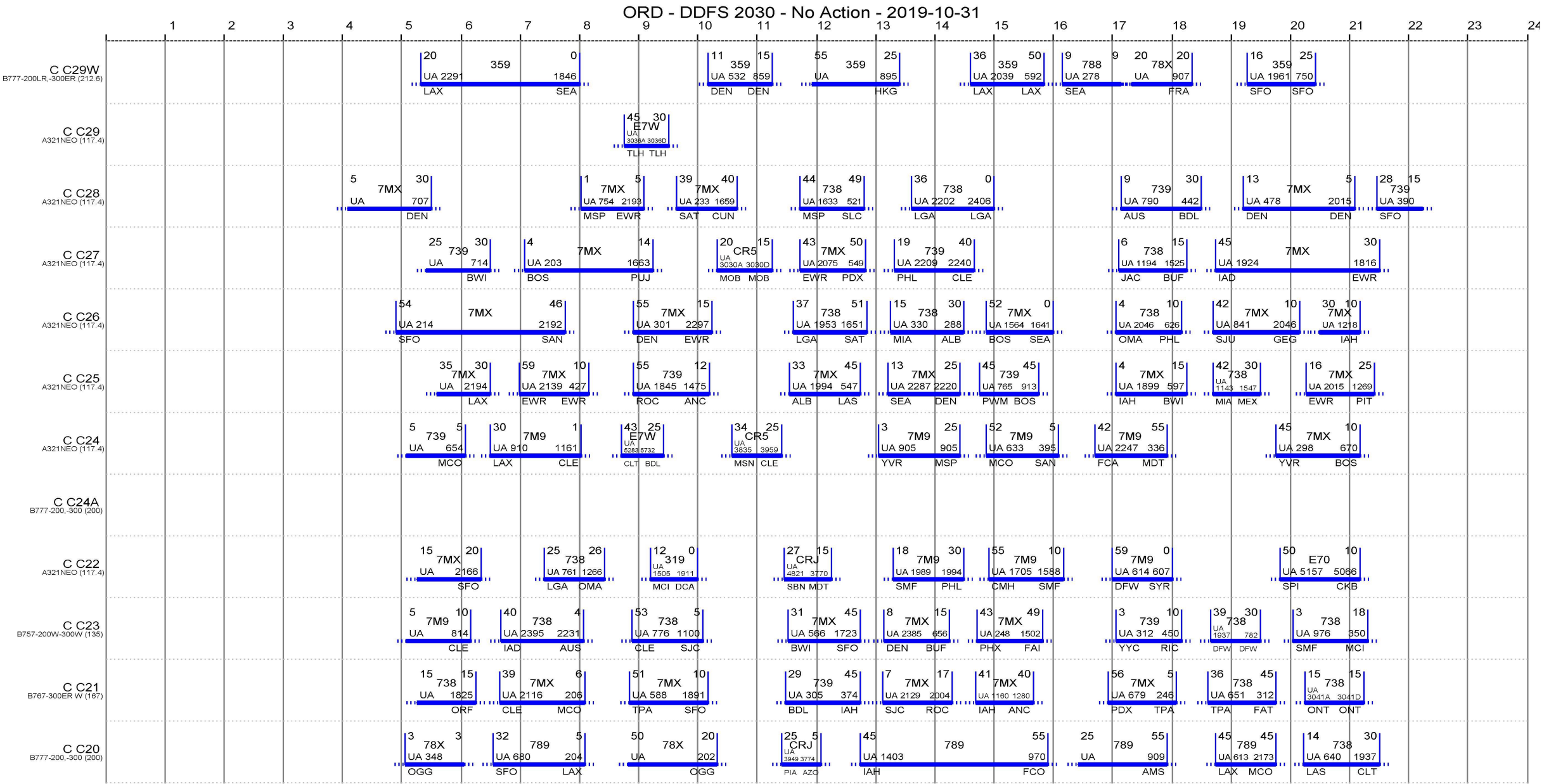


OCTOBER 2019



(ORD) O'Hare International IL, United States

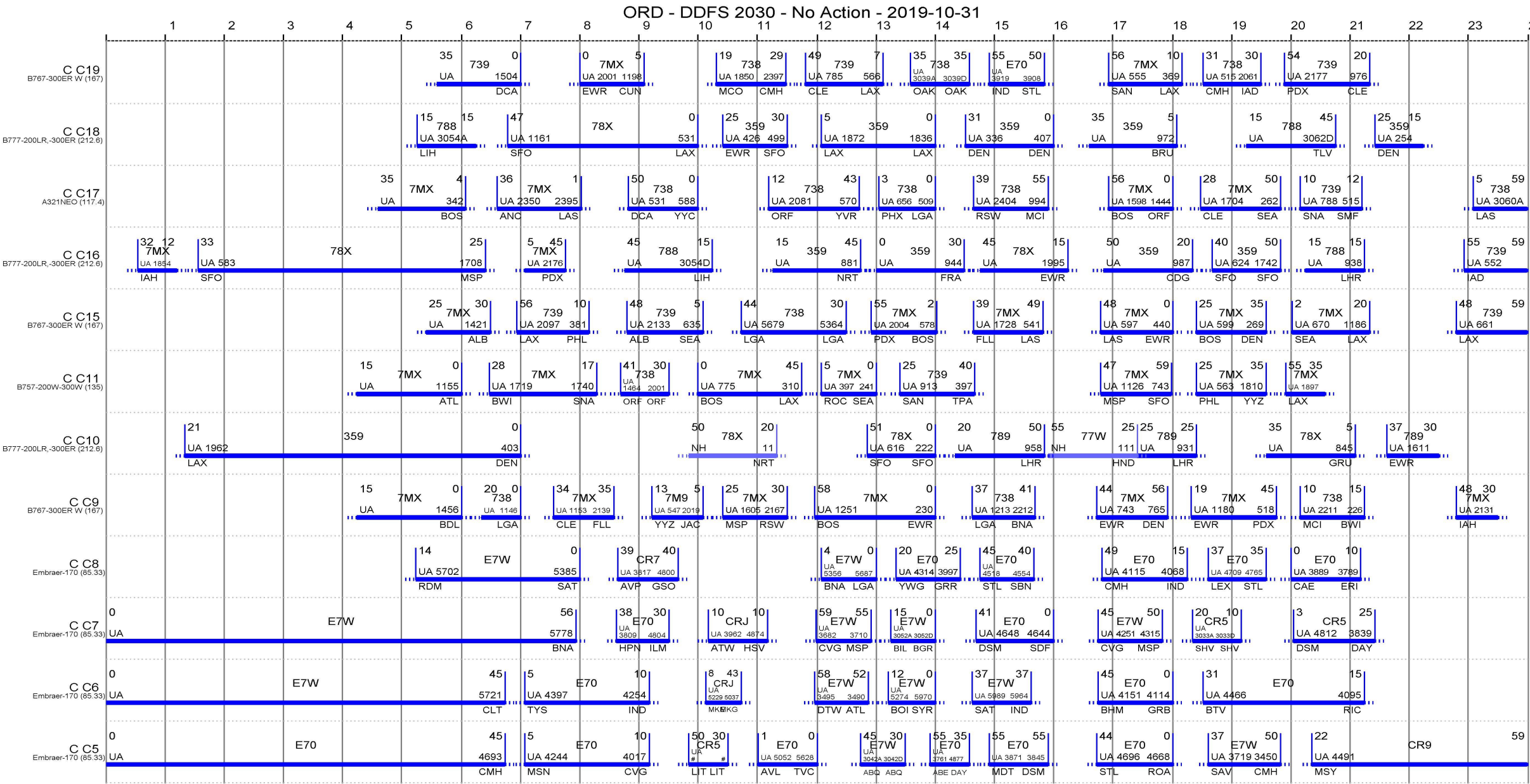
OCTOBER 2019





(ORD) O'Hare International IL, United States

OCTOBER 2019



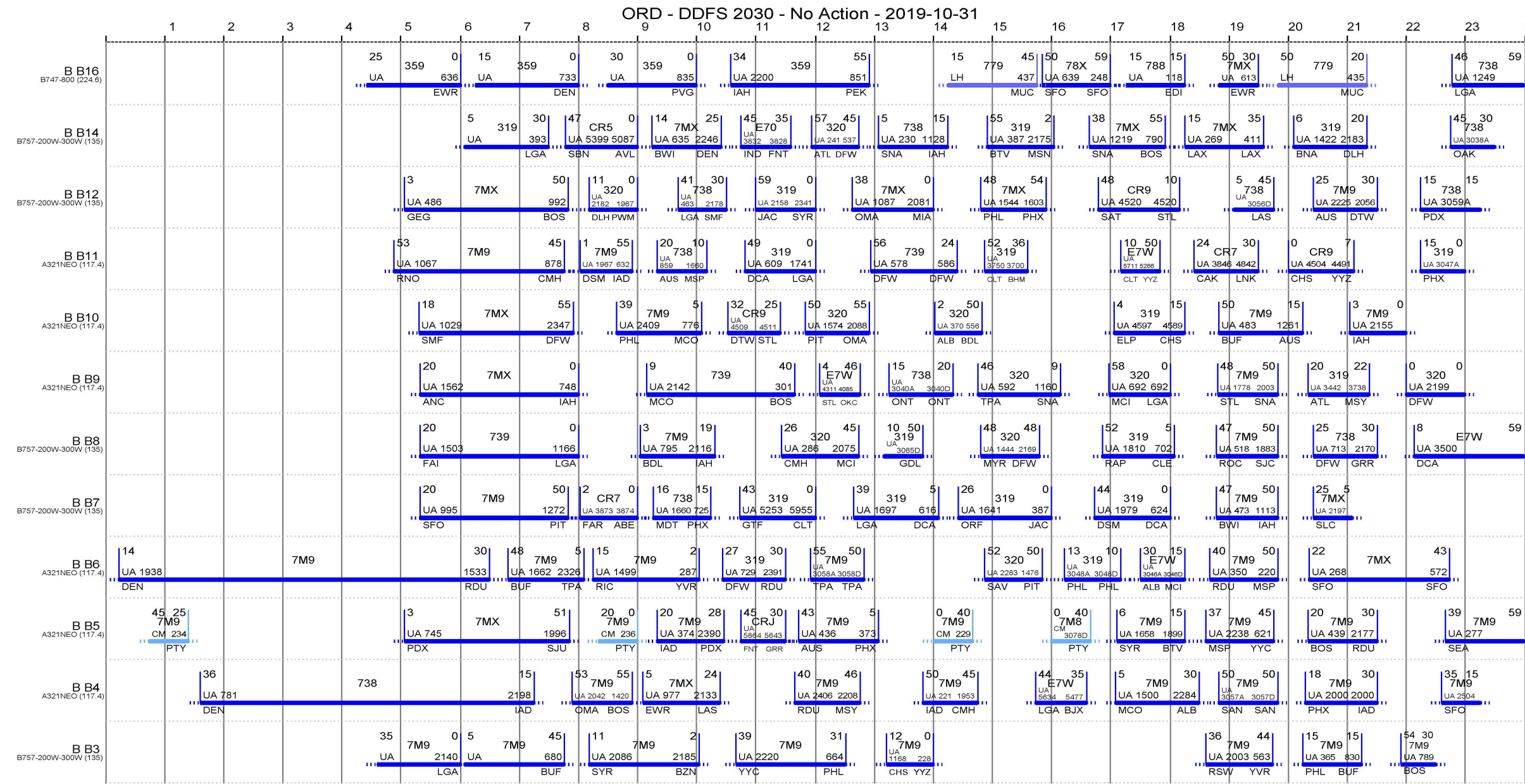
(ORD) O'Hare International IL, United States

OCTOBER 2019

		ORD - DDFS 2030 - No Action - 2019-10-31																																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23											
C C4 Embraer-170 (85.33)	0				E70			45	10	E70	35		58 28	15 45	8	E7W	30	51	E7W	55	44	E7W	7	30	E70	35	20		CR9		59				
	UA							4284	UA 4471	4275		UA 5621	YYC	UA 5586	UA 3997	4020	UA 3687	3677	UA 3499	3543	UA 4735	4792	UA 4876												
C C3 Embraer-170 (85.33)	0				E70			45	10	E7W	10	13 45	56	E7W	0	20	E7W	30	50 20		20 50	11	E7W	45	18	CR9	30								
	UA							4174	UA 3049A	3049D		UA 3985	CLT	CHS	UA 5445	5458	UA 3629	3400	UA 3834		UA 3985	UA 3539	3480	UA 5507	5904										
C C2 Embraer-170 (85.33)	0				E7W			54	20	E70	25	50	E7W	0	45	E70	45	5	E70	6	36	E70	40	5	E7W	0	30	15	3	CR9	25				
	UA							3722	UA 4608	4744	UA 5631	5681	UA 4348	4052	UA 4319	4413	UA 3859	3834	UA 5236	5694		UA 5236	3690A		UA 3801	4876									
C C1 Embraer-170 (85.33)	0				CR9			45	5	CR5	30	40	CR9	5	40	E7W	0	35	E70	0	34	E7W	35	0	E7W	55	28	E7W	30	0	CR9	10			
	UA							5656	UA 4817	3907	UA 3830	3872	UA 3691	3755	UA 4755	4717	UA 3519	3629	UA 3043A	3043D		UA 5204	5393	UA 4560	4515										
B B24 Embraer-135,-140,-145 (65.75)	0				ERJ			48	15	ERJ	25				55	ER4	5	55 25		5	35	10 40		20 50	18	E7W	15								
	UA							4405	UA 4107	4204			UA 4644	4795	UA 4736			UA 4135	4274	UA 4601	4015			UA 4265	UA 3737	3688									
B B23 Canadair-700 (76.25)	0				ERJ			53	15	ERJ	10	35	CR5	30	6	CR5	10	50	ERJ	45	48	ER4	4	28		ERJ	10								
	UA							4289	UA 4017	4133		UA 3778	4861		UA 3807	4837			UA 4135	4274	UA 4610	4768		UA 4072		ERJ	4072								
B B22 A318,319,320,321 (111.6)	0					5	319	0	4	320	0	42	319	30	53	E7W	50	11	E7W	2	44	CR9	37	58 28	20 50	25	E7W	30	52	320	13				
	UA							1023	UA 1436	1556		UA 1553	2025		UA 3608	3591	UA 3496	3476	UA 4536	4528	UA 4789			UA 4685	UA 5953	5587	UA 1709	2346							
B B21 A318,319,320,321 (111.6)	0				CRJ			0	53	320	50	39	319	30	10 45	E70	45	17	CR9	30	55	45	5	E7W	15	20	CR9	30	53	320	5	55 45			
	UA							5650	UA 558	1436		UA 519	1270		UA 3778			UA 4829	3785	UA 4546	4523	UA 4579	4525	UA 3035A	3035D	UA 5511	5761	UA 1268	788						
B B20 A318,319,320,321 (111.6)	0				E7W			16	47	320	50	25	320	30	3	E7W	0	30	15	11	25	48	CR9	55	18	0	45	15	10	319	4	52	319	59	
	UA							5420	UA 206	476		UA 628	2097	UA 5759	5590	UA 3606	3653	UA 5829	5642	UA 5544	5466	UA 3496	3642		UA 3618		UA 238	1606							
B B19 A318,319,320,321 (111.6)	0					19	320	45	25	319	30	59	CR9	25	55	CR9	2	1	45	3	320	5	25	E70	50	48	319	45	19	320	30	57 45			
	UA							1683	UA 490	1621	UA 4540	4585	UA 5523	5810	UA 3618	3581	UA 2284	2039	UA 5125	5695	UA 5365	5946		UA 5365	5946	UA 2074	483	UA 658							
B B18 Embraer-170 (85.33)	0							0	31	CR9	30	8	CR9	5	45	E7W	35	43	CR9	50			50	CR9	15	44	CR9	50	11	CR9	20	15	E7W	59	
	UA							4824	UA 4564	4541	UA 4575	4574	UA 5587	5807				UA 4576	4553				UA 4534	4578	UA 4593	4552	UA 4557	4536							
B B17 B747-800 (224.6)	0					55	78X				10				40	359	50	6	789	30	50	788	50	30	359	0	15	359	20	35	788	5	15	779	45
	UA														UA 682	775		UA 2265	2243	UA 153					UA 952	UA 1259	1126	UA							

(ORD) O'Hare International IL, United States

OCTOBER 2019





(ORD) O'Hare International IL, United States

OCTOBER 2019

