Amazon Air's Summer Surge

Strategic Shifts for a Retailing Giant

Chaddick Policy Brief

by Joseph P. Schwieterman, Jacob Walls and Borja González Morgado

September 11, 2020

Our analysis of Amazon Air's summer operations indicates that the carrier…

- *Added nine planes from May – July, the most it has added over a three-month span in its history*
- *Has expanded flight activity 30%+ since April through fleet expansion and improved utilization*
- *Adheres to a point-to-point strategy, deemphasizing major hubs even more than last spring*
- *Significantly changed service patterns in the Northeast and Florida, creating several mini-hubs*
- *Continues to deemphasize international flying while adding lift to Hawaii and Puerto Rico*

Amazon Air expanded rapidly during summer 2020, a period otherwise marked by sharp year-over-year declines in air-cargo traffic.[1] This fully owned subsidiary of retailing giant Amazon made notable moves affecting its strategic trajectory.[2]

This brief offers an overview of Amazon Air's evolving orientation between May and late August 2020. The document draws upon publicly available data from a variety of informational sources.

- Data on 1,400 takeoffs and landings of Amazon Air planes from flightaware.com and flightradar24 in April and September 2020.
- Information on fleet registration from various published sources, including Planespotters.com.
- Geographic analysis of the proximity of Amazon Air airports to its 340 fulfillment centers.

The results build upon on our May 2020 Brief, showing the dynamic nature of the carrier's schedules, its differences from air-cargo integrators such as FedEx, its heavy emphasis on cargo-oriented airports with little passenger traffic, and why we believe its fleet could grow to 200 planes by 2028.

Six findings from our new analysis stand out.

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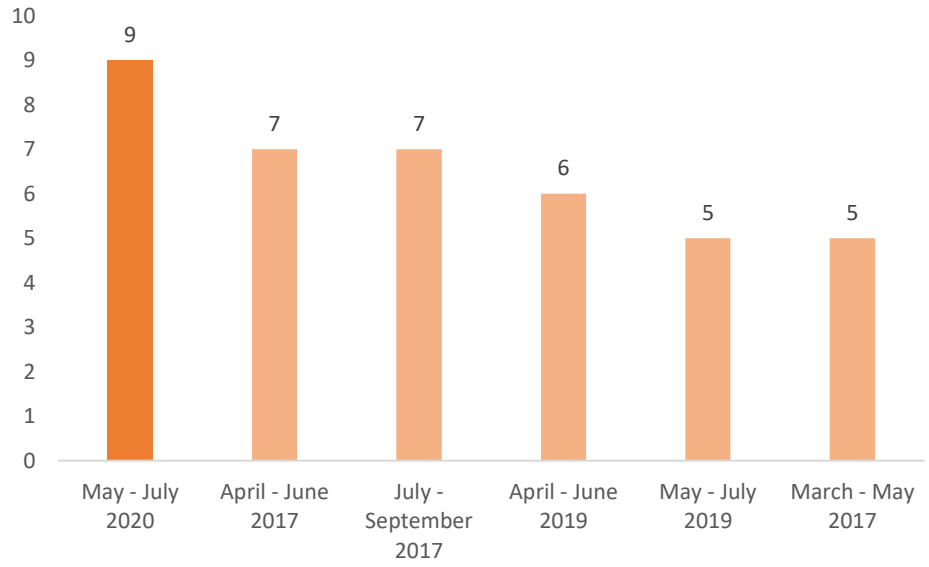
Observation I. Amazon Air's addition of *nine* planes to its fleet between May and July 2020—the most it has added over a three-month span since its inception—illustrates its continued commitment to growth. Three more planes subsequently took to the skies, bringing its present fleet to 54 planes, 29% more than at the start of May.

The nine Boeing 737 planes introduced between May and July 2020 pushed Amazon Air's fleet count upwards by 21.4% and makes this three-month period the most pronounced growth spurt, when measured in terms of airplane additions, in its history.[3] It outpaced past expansions in 2017 and 2019 when it added seven and five planes, respectively, over three-month periods. All of the nine planes added between May and July are operated by Sun Country Airlines, one of its newest contractors. Sun Country began flying a 10th new plane for Amazon in August. Then, this month, Southern Air and Air Transportation International began flying Amazon Air's 11th and 12th new planes of 2020. This brought the fleet to 54, 28.5% more than in early May, when it had 42.[4]

Figure 1: Amazon Air's Largest Growth Spurts
Over three-month periods since inception



The nine planes added between May and July 2020 outpace all previous expansions over three-month periods. Not all three-month combinations are shown for periods with six or less additions. These estimates are based the airline's reported fleet in early September and conservative assumptions of when Sun Country planes entered service in 2020 as noted in endnote 3.

Note about the fleet data: It is important acknowledge when interpreting these results that evaluating Amazon's full cargo-carrying capacity is hindered by the lack of publicly available details about its contractual arrangements. Its status as a private carrier, coupled with the proprietary nature of its contractual relationships with companies operating its planes, makes estimating its true flight capacity subject to uncertainty. Some investment analysts with whom we have spoken have noted that a significant amount of cargo may move on planes not registered to Amazon Air, particularly on

international routes. One recent media report indicates that Amazon Air now has nearly 70 planes. However, specific information about these planes is lacking. We suspect the source of the difference between these numbers and ours lies in arrangements for using planes not formally reported as belonging to Amazon Air. Nevertheless, our team maintains that monitoring *publicly available* data about planes registered by Amazon, and closely monitoring the changing utilization of those planes, is the most straightforward and verifiable way to assess the carrier's changing scale and orientation.

Amazon Air is projected on planespotter.com to add four additional planes soon, pushing its fleet to 58. If this occurs by December, the retailer will have added 16 planes this calendar year, tying the previous record from 2017. Such growth would give it a 38.1% expansion of its fleet in a single calendar year. This projection does not include the announced addition of more planes, mostly Boeing 767s, publicized in media reports, primarily involving Air Transport International (ATI). Details on these future additions are not yet listed on publically available websites.[5]

Observation II. Amazon Air flight activity grew from 85 flights per day on Thursday, April 23 to 108 flights on Thursday, August 20, a 27% increase. On other days of the week, its growth appears to be marginally higher, partially due to its success in utilizing its planes more intensively. These results, together with the fact that it added two more planes after we made these estimates, indicate that the company's flights have expanded by more than 30% since the start of April.

Between the second-to-last Thursday of April (April 23) and the second-to-last Thursday of August (August 20), daily flight activity expanded from 85 to 108, a 27.1% increase—extraordinary growth considering that it comes on the heels of much previous expansion, and that global air cargo was down more than 20% in June and July.[6] On Monday, August 24 and Tuesday, August 25, flight activity surged to 127 and 133 flights, respectively. Over the course of the six days we observed in August (which covered every day of the week except Sunday), Amazon Air appears to have grown roughly 28% – 30% since May (although our limited data from April does not allow us to conclude this with certainty). Nevertheless, considering that a Boeing 737 and Boeing 767 were added to the fleet this month, boosting its fleet by another 4% subsequent to our counts, it is safe to conclude that its overall growth since April has well exceeded 30%, and could be up as much as a third.

Such growth has been fueled by improved airplane utilization, which rose from 2.02 to 2.12 flights per plane per day on the successive Thursdays evaluated, a roughly 4% improvement. Over the six days observed in August, Amazon averaged 2.7 flights per plane, with the 737s being Amazon's workhorses, averaging 2.8 flights per day, compared to 2.5 for 767s. (If only planes that actually take to the skies on a particular day are included, excluding those, for example, undergoing maintenance, the number of flight segments is higher.) These are both impressive numbers considering that many planes used by

The cargo door is open on an Amazon Air Boeing 737 at Cincinnati CVG, adjacent to the DHL sorting center, on August 5, 2020 (Chaddick collection).

air-cargo integrators make only two flights per day, one in each direction to a major hub. We observed some Amazon planes completing *five segments* on the same day.

Amazon Air continues to use five primary contractors, Atlas Air, Air Transport International, Southern Air, and Sun Country Airlines (Southern Air is a subsidiary of Atlas Air). The outsourcing approach used by Amazon Air is similar to that of its over-the-road trucks and vans. It typically acquires the equipment and turns it over to subcontractors to operate it. Amazon's contractors also handle other business, so it is not possible to determine exactly how much Amazon cargo each handles. This month, the company took the notable step of taking the delivery of the first plane it will operate in-house, reportedly without the use of contractors. Please refer the endnote section for a summary of some of the unexpected ways this place is being used.[7]

Amazon Air's relationships appear unchanged since our earlier brief. Amazon has a 19.6% equity stake in ATI (parent of Air Transport Service Group). ATI is based in the airport at the Wilmington Air Park in Ohio, an Amazon mini-hub only about an hour's drive from Cincinnati. Amazon Air accounts for all of Sun County's freighters. This Twin Cities-based carrier is predominantly a passenger airline, giving it a less cargo-centric orientation than the other contractors.

An Amazon Air Boing 767 at Allentown Lehigh Valley Airport, with tails of several FedEx planes in the distance, on July 15, 2020 (Chaddick Collection).

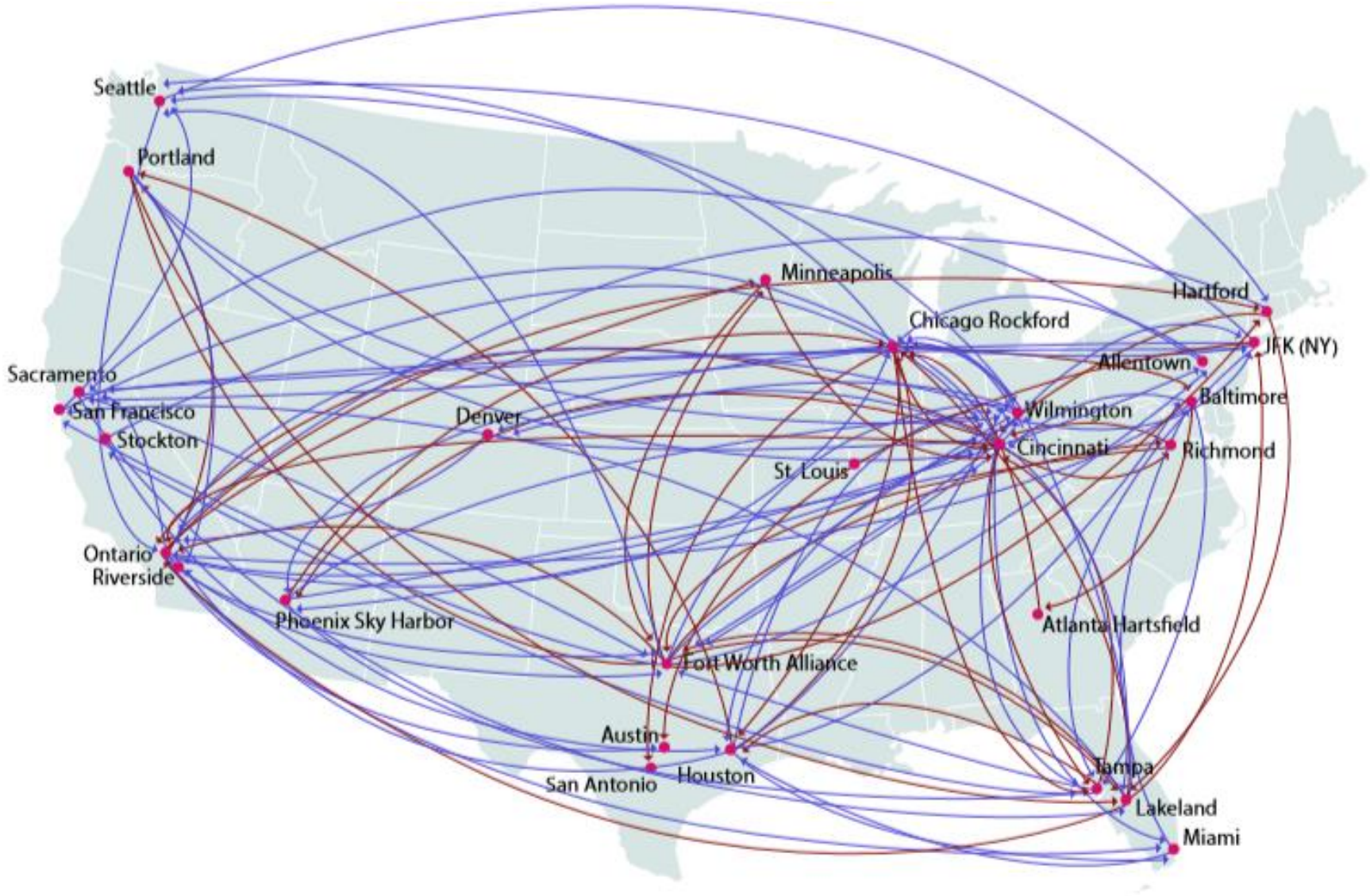
Observation III. As a result of Amazon Air's continuing emphasis on point-to-point flying, the share of flights using its Cincinnati/Northern Kentucky (CVG) hub fell between April and August. The share of takeoffs and landings involving the *three largest hubs* similarly dropped. We anticipate its decentralized orientation to persist even after Amazon takes occupancy of its massive new CVG facilities next year.

Amazon Air's flight network is more decentralized than it was only a few months ago. The percentage of takeoffs and landings involving its Cincinnati/Northern Kentucky (CVG) hub dropped from 14.1% in the April sample to just 10.6% during the six-day sample in August. The drop was even larger when focusing only on our Thursday-to-Thursday comparison, when it dropped from 14.1% to 10.2%. The percentage of takeoffs and landings involving its *three largest hubs* stood at 32.4% in April but dropped to 26.3% in August (CVG, Chicago Rockford, and Tampa International were its three largest hubs in April. However, Ontario International grew sufficiently to replace Tampa in the August sample). *See Appendix for a full summary of these results.*

CVG is only slightly larger than several of Amazon's other hubs. The Kentucky airport averaged 26 flights during the six August days observed, whereas Ontario and Chicago Rockford averaged 22.5 and 17.5 flights, respectively. On Thursday, August 20, CVG had but one more flight operation than Ontario. As noted below, however, the gap could widen when CVG's facilities open next year.

Figure 2: Amazon Flight Network within U.S. Mainland, August 24, 2020

Blue lines denote Boeing 767 flights; maroon lines denote Boeing 737s

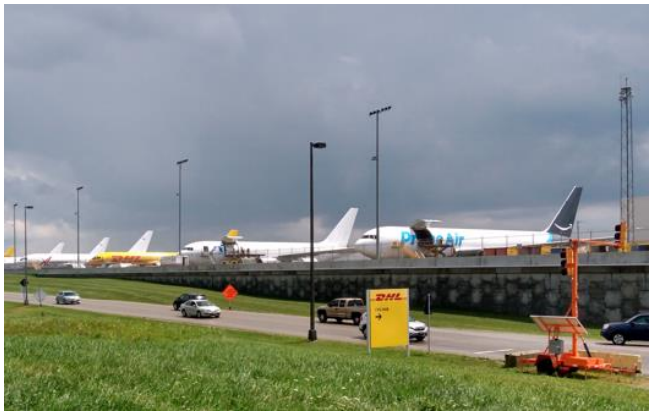


Some of the changes we observed are attributable to the emergence of several new mini-hubs described in the next section. Generally, however, our latest findings reinforce one of our main observations from the May brief: that Amazon is not trying to build a coordinated network of connecting flights akin to that of FedEx and UPS and acclimated toward overnight sorting and shipping. Instead, it is creating a network designed to link warehouses and distribution centers to help position goods for rapid shipment to customers once an order is placed.

Amazon's diminishing emphasis on centralized hubs is not the result of rapid expansion of international routes, which are apt to use coastal gateways. As noted below, the share of takeoffs and landings that involve international points as well as Hawaii and Puerto Rico stayed in the 6 – 8% range between April and August, respectively.

Observation IV. Amazon Air continues to have only a skeletal network outside of the United States and has not yet made a push to build an in-house delivery system suitable for rapidly shipping parcels across multiple continents. Its semi-regular flights to Amsterdam Schiphol Airport and Shanghai's Pudong International Airport, however, are well-positioned for linking warehouses in continental Europe and China with the North American market.

The hundreds of thousands of different products offered by Amazon makes positioning merchandise for rapid fulfilment once an order is placed an enormously complex proposition—and one that can be facilitated by using air freighters to help reposition inventory when sudden shifts in supply and demand occur. One of the alternatives—keeping massive inventory stocks at many dispersed locations—is both costly and impractical. Another—making the customer wait for goods to be repositioned by truck or boat—is out of step with the retailer's push to fulfill orders quickly. With respect to its push for speed, Amazon is making concerted efforts to more rapidly deliver products bought on its Amazon "marketplace" platform.



More than a dozen freighter aircraft line Airfield Road at Cincinnati CVG Airport on August 18, 2020.

Our analysis of summer flight activity suggests the airline's international network caters to the repositioning of inventory, presumably as dictated by the company's supply-chain algorithms. To support this, the airline often operates semi-regular flights between the U.S. mainland and both Amsterdam Schiphol and Shanghai Pudong International (Shanghai) airports—facilities widely regarded as focal points for logistics in continental European and China, respectively. Our assessment, supported by interviews with supply-chain professionals, leads us to believe that serving these points is most critical to just-in-time restocking.

We expect more flying to and from international points over the next several years. How quickly this occurs, however, is hard to predict. With the exception of more flights to Hawaii (which have become

Figure 3: Amazon Air Flights to Points off U.S. Mainland

Thursday, August 20

Monday, August 24

This chart shows that Amazon's Air network to points off the U.S. mainland remains primarily focused on serving Alaska, Hawaii, and Puerto Rico, with only semi-regular flights to Amsterdam, NL, and the Pacific Rim. The dashed line shows typical flights on a subsequent day after an international trip. Amazon's international flights to Chicago tend to use Chicago Rockford (RFD). It is probable, however, that Amazon contracts heavily with other cargo airlines for transoceanic packages and inventory shipments.

more frequent and more geographically comprehensive, thanks to Amazon's recently expanded flying to Kahului and Kona) and Puerto Rico, the orientation of Amazon's transoceanic network has changed relatively little in recent months.

Observation V. Amazon Air has made major moves in the Eastern United States, shifting some of its growth from its mini-hub at Allentown, PA to New York's John F. Kennedy Airport and Hartford, CT. Similarly, Florida's Lakewood Linder Regional Airport almost overnight jumped from being mostly a little-known general aviation airport to an important Amazon hub, regularly seeing upwards of a dozen daily Amazon flights. California's Ontario International has also seen robust growth.

Table 1: Busiest Amazon Air Airports

April vs. August 2020

Rank	Airport	April 24 Flights	August 20 Flights	Six day avg.* August	Notes
1	Cincinnati/Northern Ky., KY	24	22*	**26**	Emerging megahub; also DHL's primary hub
2	Ontario Int'l, CA	13	21	**22.25**	Could diminish with growth of San Bernardino; is major hub for UPS
3	Chicago/Rockford, IL	15	18	**17.5**	Also a major hub for UPS; Periodic Amazon flights to China
4	Fort Worth Alliance, TX	8	6	**15.5**	Also a mini-hub for FedEx
5	Wilmington, OH	13	12	**13.75**	Headquarters of contractor ATI
6	Lakeland Linder, FL	0	10	**11.5**	New facility; first flights in July
7	Tampa Int'l, FL	16	11	**11.5**	Continued growth despite opening of nearby Lakeland-Linder
8	Baltimore/Wash. (BWI), MD	6	7	**9.5**	Early hub for airline has not grown as fast as others
9	Seattle (SEA), WA	9	8	**9.25**	Adjacent to only large cluster of warehouses in Pac. NW region
10	Houston, TX	9	10	**8.75**	One of four airports in Texas Triangle
11	Portland, OR	6	7	**7.75**	Heavy emphasis on flights to Florida and Texas
12	Phoenix, AZ	4	8	**7.75**	Second only to Lakeland Linder in % growth among top airports; busiest in Mountain Time Zone
13	New York JFK, NY	0	9	**7.75**	Previously had only sporadic flights
14	Harford (Windsor Locks), CT	2	6	**7**	Replaces Providence, RI (no longer regularly used) as New Engl. hub

In our May brief, we stressed that Pennsylvania's Allentown Lehigh Valley Airport (ABE) had become the dominant hub for shipments to and from the New York and Philadelphia regions. Due to the vast amount of warehousing in the Lehigh Valley, which is also home to numerous Amazon facilities, we believed that this airport was poised for a much larger role, akin to that of Chicago Rockford or Ontario. Our analysis of recent flight activity, however, casts doubt on this proposition.

- **Activity around New York is no longer dominated by Allentown. Instead, operations have surged at New York's John F. Kennedy International Airport, rising from modest activity to an average of 7.8 flights per day, while Hartford's Windsor Locks Bradley International Airport has seen activity rise from just 2 to 6 – 8 flights daily.** These three airports allow Amazon to triangulate metropolitan New York, which is widely known to be a supply-chain bottleneck. Its trucks and delivery vehicles using these airports can access this vast market from three different directions while also having relatively uncongested lanes to Albany, NY, Boston, MA, Philadelphia, PA, and other Northeast population centers. As can been seen in Figure 1, Amazon's East Coast hubs—Harford, Kennedy, Allentown, and Baltimore-Washington International—are spaced almost equidistantly along the busy Northeast Corridor, which stretches from Boston to Washington, DC. If more regular service is added to Providence, RI, which we expect will happen soon, Amazon Air will have a fifth location on the corridor, each appropriately spaced to allow each airport to focus on different regions and clusters of warehouses.

- **Almost immediately after Amazon launched service to Lakeland Linder Airport on July 23, the general aviation facility emerged as Amazon's sixth busiest airport**. Considerable media coverage surrounding Amazon's investment at Lakeland Linder, and our August results, indicated that such coverage was deserved: Amazon averaged 11.5 flights per day on the six days observed, creating a tie with Tampa International for the title of the state's busiest Amazon cargo center and easily topping Miami International (8 flights per day). Tampa International, which is only 39 miles from Lakeland Linder via highway, has seen a marked reduction in activity. It had 16 flights on the Thursday we sampled in April, but just 11 on Thursday, August 20 and 11.5 over the six days sampled last month.

- **Southern California's Ontario International Airport saw a dramatic jump in flying and remains easily the most important Amazon Air hub west of the Mississippi River, with activity rising from 13 to 21 between the Thursdays observed in April and August**. The value of intensively using this longstanding cargo-aviation stronghold is facilitated by its role as UPS's second largest hub, which creates synergy. We nonetheless anticipate significant changes—and possible reductions—at Ontario once Amazon opens its hub at San Bernardino International Airport, which is only 18 miles away.[8] That cargo facility will reportedly be designed to handle 26 arrivals and departures daily and could reduce or slow the growth of operations at Ontario in a manner similar to that occurring at Tampa.

- **Amazon continues to put emphasis on serving several airports in areas having a concentration of warehouse locations**. This pattern is evident by its regular operations at two or more airports close to Cincinnati, OH; Dallas, TX; Los Angeles, CA; New York, NY; San Francisco, CA; and Tampa, FL. New airport arrangements could also emerge around Chicago, Colorado, and the Carolinas. Although Amazon has sporadic flights to Chicago O'Hare International Airport, these are not operated with much consistency. We expect the company will continue to take steps to diversify flights in this region beyond those at Chicago Rockford.

Observation VI. The Cincinnati CVG hub, now nearing completion, will have enormous capacity and likely multiple functions, including supporting truck-to-plane transfers and moving containers between planes. The hub will be almost ideally located to tap into the concentration of warehouses belonging to major retailers in the Columbus, OH – Cincinnati – Louisville, KY corridor. Yet, we do not expect a FedEx-style connecting complex for overnight package sorting to emerge.

This northern Kentucky facility will allow Amazon to easily tap into the expanding cluster of retail warehouses around Columbus Rickenbacker Airport (which is less than two hours away by truck) and the extensive warehousing, both by Amazon and other retail-oriented companies around CVG, which is apparently already integrated with DHL's flight operations at the airport. (The Amazon facility is literally across the road from DHL's main sorting center). CVG also enjoys close proximity to the UPS Worldport Facility in Louisville, a focal point for industrial supply chains that is only a 90-minute drive away. As a bonus, the facility is also less than two hours from Indianapolis International Airport, which is home to FedEx's second largest hub.

Amazon's massive complex at Cincinnati CVG, pictured above on August 5, 2020, is in the final stage of construction. The airside portion of the structure is in the distance. Pictured at right is an Amazon-commissioned drawing of how the structure will look and how the truck bays will be used upon completion (left, Chaddick collection; right, Amazon).

It seems possible, if not likely, that Amazon will push certain retailers selling on the Amazon platform to put inventory in close proximity to CVG. Already, Wayfair, one of the largest providers of home furnishings, has located its largest warehouse less than a five-minute drive from the new Amazon facility.

One of the important "unknowns" is whether flight operations at Wilmington Air Park near Dayton,

Ohio, (which is only about 60 highway miles from CVG) will diminish after the massive new Cincinnati facilities open in 2021. Wilmington Airport has a difficult history of losing out to CVG with respect to air-cargo services. The economies of scope associated with air cargo suggest that agglomerating in CVG would provide sizable benefits. Yet, as previously described, Amazon has often co-located hubs in the same region and one of its largest airline contractors, ATI, has Wilmington as its base. Wilmington also has a fulfillment center on airport grounds.

Our assessment: expect Wilmington's operations to remain and CVG to emerge as a transshipment point for containers ("cans") moving between airports and truck-to-plane transshipments while also having some package sorting involving inbound and outbound flights. We do not anticipate closely coordinated flight schedules to support overnight package sorting at CVG, akin to that associated with FedEx and UPS hubs. Although the facility will have room to park 100 airplanes, creating a network oriented toward overnight sorting would create a duplicate of that already provided by DHL. It would require a dramatic change in the nature of Amazon's flight scheduling and would necessitate a quantum leap in the size of the fleet, if this were to be done on a large scale. We think that this is unlikely, at least in the next several years.

Short-Term Outlook and Predictions

The remainder of 2020 will certainly bring more tactical moves by Amazon Air and possibly some major strategic initiatives. Based on our analysis of its recent activity and publicly available compilations and press reports, we anticipate by year-end:

- **More robust system-wide growth will occur due to the delivery of four more planes projected to become part of its fleet.** This will likely expand the fleet to upwards of 58 by year-end, up from 42 as recently as the start of May.
- **Daily flight operations** growing another 5 – 8% beyond present levels and regularly topping 150 daily flights on peak days.
- **More international flying** through a gradual process facilitated by the recent and planned addition of Boeing 767 freighters operated by Air Transport International. We observed this month for the first time a Tel Aviv flight (see endnote 7).
- **Addition new airports and additional flying at airports now only lightly used to help fill gaps in its system on the U.S. Mainland**. This will improve its ability to get inventory to locations that are now more than 5 – 6 hours' truck drive from an airport. This may mean more flying to Atlanta, GA, Denver, CO, and Minneapolis, MN, which have tended to see only one or two flights daily.

We anticipate by the middle of 2021:

- **The acquisition of more airplanes at a pace similar to this year**, pushing the fleet to perhaps 65 – 66, giving it two-thirds of the 100 that Morgan Stanley projects Amazon Air to have by 2025.
- **Significant expansion at Cincinnati CVG due to the opening of its massive new facilities on airport grounds.** In only a few months, activity at CVG could grow to double or triple that presently provided, which was in August limited to around 13 flights (26 takeoffs and landings) daily. We expect CVG's flights to be spread over the course of the day rather than highly concentrated during overnight hours for next-morning parcel delivery. Even if such expansion

occurs, only about a quarter to a third of daily Amazon Air flights will use the CVG hub due to concurrent expansion in other regions.

- **The introduction of significant flight operations at Southern California's San Bernardino International Airport,** with some activity possibly shifting from Ontario International.
- **A possible major move at Colorado Springs, CO,** due to a major facility being built there on airport grounds.[9] This could fill a gap in the Mountain States.
- **The launch of domestic service to more niche airports with limited passenger traffic**. Our analysis of flights after Labor Day indicate that Amazon Air has added at least occasional service to two niche airports that did not appear in our late-August sample: Lake City, FL, and Roswell, NM (see endnote 7).
- **A more detailed strategy to be revealed about the company's international plans**, which at present remain murky. Details about its highest-priority regions or airports have been lacking but will likely become clear over the next year.

By the end of 2021, Amazon Air could cross the 200-flights-a-day threshold, making it about twice the size it was in early 2020. With only a modest increase in fleet utilization, this will require about 74 – 75 airplanes, which the airline is on track to achieve.

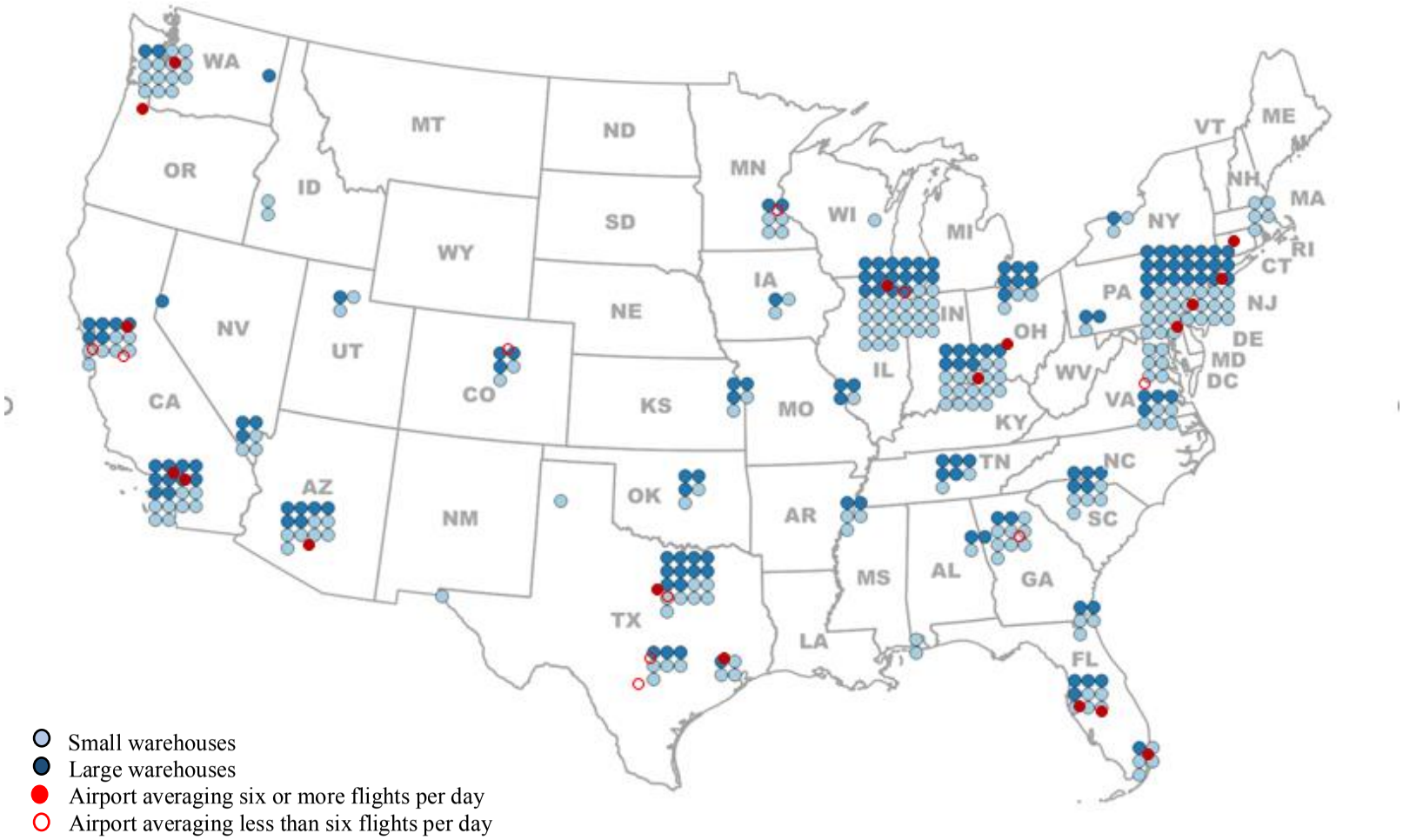
See Appendix for a flight activity summary and warehouse location overview

Appendix: Takeoffs & Landings at Airports Serviced by Amazon Air

Airport	Thursday April 23	Thursday August 20	Monday August 24	Tuesday August 25	Wednesday August 26	Friday, August 28	Saturday, August 29	Six-Day August Average
Allentown Lehigh Valley (ABE)	6	4	4	4	4	7	7	**6.2**
Amsterdam Schipol (AMS)	0	0	1	1	0	0	2	**1.0**
Anchorage International (ANC)	4	2	2	2	2	2	2	**2**
Atlanta Hartsfield-Jackson International (ATL)	0	2	2	2	2	2	2	**2**
Austin Bergstrom International (AUS)	0	4	4	4	4	4	4	**4**
Baltimore/Washington Int'l T. Marshall (BWI)	6	7	9	11	11	8	8	**9.5**
Chicago O'Hare International (ORD)	0	0	0	5	1	4	6	**3**
Chicago Rockford International (RFD)	15	18	21	16	15	14	15	**17.5**
Cincinnati/Northern Kentucky Int'l (CVG)	24	22	27	28	27	25	25	**26**
Denver International (DEN)	4	4	4	4	4	4	2	**4**
Fort Worth Alliance (AFW)	8	6	19	19	18	19	19	**15.5**
Honolulu International (HNL)	4	4	5	5	4	4	4	**4.5**
Houston George Bush Intercontinental (IAH)*	9	10	12	12	1	12	14	**8.75**
Incheon South Korea(ICN)	1	0	0	0	0	0	0	**0**
Kahului (OGG)	2	2	2	3	2	2	2	**2.25**
Kailua-Kona/Kona International (KOA)	0	2	1	1	2	2	2	**1.5**
Lakeland Linder Regional (LAL)	0	10	12	12	12	12	11	**11.5**
Miami International (MIA)	6	8	7	9	8	6	6	**8**
Minneapolis Saint Paul International (MSP)	2	2	4	4	4	4	4	**3.5**
New York John. F Kennedy Int'l (JFK)	0	8	9	8	6	8	9	**7.75**
Ontario International (ONT)	13	21	22	24	22	20	20	**22.25**
Osaka Kansai International Japan (KIX)	0	1	0	0	0	0	0	**0.17**
Phoenix Sky Harbor International (PHX)	4	7	8	8	8	4	4	**7.75**
Portland International (PDX)	6	7	8	8	8	8	10	**7.75**
Richmond (RIC)		2	4	4	4	8	8	**3.5**
Riverside March Air Reserve Base (RIV)	4	6	7	6	7	4	4	**6.5**
Sacramento International (SMF)	4	6	7	8	4	6	6	**6.25**
San Antonio/Kelly Field Annex (SKF)	2	2	2	2	1	6	6	**1.75**
San Francisco International (SFO)	2	4	4	2	3	2	2	**3.25**
San Juan Luis Muñoz Marin Int'l (SJU)	0	3	2	2	2	3	4	**2.25**
Seattle Tacoma International (SEA)	9	8	9	10	10	9	10	**9.25**
Shangai Pudong Int'l China (PVG)	0	1	0	2	0	0	0	**0.67**
Stockton Metropolitan (SCK)	4	4	4	4	4	4	4	**4**
Tampa International (TPA)	16	11	11	13	11	10	12	**11.5**
Wilmington Air Park (ILN)	13	12	15	15	13	12	15	**13.75**
Windsor Locks Bradley Int'l (Hartford) (BDL)	2	6	6	8	8	7	6	**7**
Total takeoffs & landings	**170**	**216**	**254**	**266**	**232**	**242**	**255**	**246**
Total flights	**85**	**108**	**127**	**133**	**116**	**121**	**127.5**	**123**
% of takeoff/landings involving CVG hub	14.1%	10.2%	10.4%	10.4%	11.4%	10.3%	9.8%	10.6%
% of takeoffs/landings at 3 largest hubs	32.4%	31.5%	28.5%	25.4%	27.1%	24.4%	23.5%	26.7%
% takeoffs/landings off U.S. Mainland	6.5%	6.9%	5.0%	6.0%	5.1%	5.4%	6.3%	5.8%

*Houston (IAH) activity was affected by severe weather on August 26.

Appendix: Clustering of Warehouses and Sorting/Fulfillment Centers, with Amazon airports shown in red



This map shows warehouses belonging to Amazon, clustered by metropolitan region to show areas of concentration. The depiction shows the tendency for warehouses to be most heavily concentrated in major metropolitan areas. The map doesn't encompass all warehouses—only those we identified—and aggregates them to the nearest major metropolitan area based on a distance formula, which provides a simplified depiction of their juxtaposition to airports. Major and minor airports are shown in red, with minor ones being hollow circles based on our August data. (Certain regions may be over-weighted due to the differing availability of data). Large warehouses are defined as > 75,000 square feet.

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In Memory of the Honorable Gerald L. Baliles

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Endnotes

[1] For a summary of the sluggish demand for air cargo traffic in June, please refer to https://www.stattimes.com/news/global-air-cargo-volumes-in-july-see-8-increase-over-june-clive-data/.

[2] Amazon Air is not to be confused with the retailer's experimental drone unit, Amazon Prime Air.

[3] Planespotters.com on September 5, 2020 showed Amazon has added 10 planes between June – July 2020. Press releases for Sun County Airlines, however, indicate that some (perhaps four) of the Boeing 737s began flying in May, as we noted in our June brief. To assure a conservative estimate, we report the number of plane additions from May to July to account for the discrepancy.

[4] These estimates are based on listing on planespotters.com when the analysis was completed on September 7, 2020. Please refer to our comments on page 3 on why we focus on *publicly available* sources as well as endnote 5 below. We encourage readers to contact other sources for information about the projected pace of airplane additions over the next 8 – 10 months, which are beyond the scope of the present study. Press releases from contractors and media accounts often provide conflicting accounts of the size of the Amazon Air fleet. Some accounts appear to include planes operated contractors that have not been publicly linked to Amazon their totals.

[5] Our principal sources for fleet information and fleet usage, planespotters,com (along with flightaware.com, and flightradar24.com) do not yet list some or all the recently announced fleet additions, the 12 767 freighters to be operated by ATI announced over summer, and a subsequent announcement about six more of the planes. Our efforts to reconcile various press releases suggest there is some ambiguity about whether all or most of the planes will be registered to Amazon Air. We encourage readers to contact other sources for information about the projected pace of airplane additions through next spring.

[6] Please refer to the stattimes.com article listed in footnote 1 above.

[7] The new airplanes delivered in September on the days we observed were mostly being used for hub flying, but we also recorded touchdowns and landings at four airports in which no flights were observed in our April and August samples: Lake City, FL (LCQ), Philadelphia, PA (PHL), Tel Aviv (TLV) and Roswell, NM (ROW). Tel Aviv flight, made in the plane not being operated by contractors (N503AZ) was reached from Philadelphia (possibly a fuel stop). The service to Lake City and Roswell follows a pattern we observed in our May brief: the airline's tendency domestic airports with little or no passenger traffic. For a discussion of the plane Amazon is operating in-house, please visit: https://finance.yahoo.com/news/amazon-acquires-boeing-767-cargo-130001470.html

[8] For a discussion of the San Bernardino operation, refer to https://www.sbsun.com/2020/05/08/amazon-is-landing-at-san-bernardino-airport-officials-say/.

For information, please refer to https://www.cpr.org/2020/02/13/new-colorado-springs-amazon-facility-will-bring-1000-jobs-to-the-city/.