The Expanding Role of Cargo-Oriented Airports in the United States since the beginning of the COVID-19 Pandemic

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ABSTRACT

This study evaluates the differing impacts of the recent downturn in air-cargo traffic on airports specializing primarily in cargo shipments and those with more diversified cargo and passenger roles. After categorizing airports based on the amount of cargo each handles in relation to the number of passengers, it evaluates their changes in domestic cargo traffic using Bureau of Transportation Statistics data. The results show that:

- Cargo-focused airports outperformed other types of airports during the 12 months ending in April 2023 versus the previous year, experiencing a 3.4% drop in cargo traffic, which is less than half the 8.9% drop among large airports with a more diverse mix of traffic, and a 9.1% drop among all U.S. airports.

- The performance of cargo-focused airports is even greater over the 2019-2023 period, during which several more than doubled their traffic.

- Cargo-focused airports in Lakeland, FL, Laredo, TX, San Bernardino, CA, and Wilmington, OH, saw freight shipments markedly increase from 2022 to 2023, while Illinois' Chicago-Rockford International held steady.

- Although only two cargo-focused airports, Chicago-Rockford and Fort Worth Alliance in Texas, rank in the top 20 in cargo traffic among U.S. airports, most of these specialized airports are rising in rank, making them more prominent in U.S. transportation.

- Among the factors responsible for their ability to outperform other airports is their role as hubs for Amazon Air and air freight integrators, additional operational flexibility they provide air-freight handlers, and available land for warehouse development.

1. INTRODUCTION

Airports focusing primarily on cargo shipments, like almost all commercial airports, have been sharply affected by the global downturn in air cargo traffic since 2021 [1, 2]. Softening demand has prompted large-scale cutbacks by carriers that specialize in parcel shipments, including FedEx Express (FedEx) and United Parcel Service (UPS), and conventional cargo airlines [3, 4]. After benefitting from gradual rises in global traffic between 2009 and 2018, the air-cargo sector has recently experienced much volatility, which has persisted despite the end of the COVID-19 pandemic and jet fuel prices remaining well below historic highs.

This study helps fill a gap in public understanding of the downturn by assessing its varying impacts on airports specializing primarily in cargo shipments and those with more diversified cargo and passenger roles. The analysis evaluates Bureau of Transportation Statistics (BTS) domestic traffic data at airports across the U.S. mainland to develop insights about the changes between 2019 and 2023. The analysis utilizes a typology developed by Schwieterman & Hague that categorizes airports based on the amount of cargo each handles in relation to the number of passengers [5]. This typology allows the traffic changes at airports primarily specializing in cargo shipments to be compared with those having more balanced freight/passenger roles. The results illustrate the shifting contours of the changing air-cargo industry while providing airport officials and other industry stakeholders with a richer understanding of why some airports are being hurt by the downturn more than others and what further changes may lie ahead.

The analytical portion of the paper is divided into four sections. Section 2 summarizes the scale of the recent traffic downturn and reviews the notable research on cargo-focused airports. Section 3 describes the methods used to collect and evaluate data and examines the typology used to divide airports into categories. Section 4 compares the changes in traffic at cargo-focused airports with their less-specialized counterparts since 2019. The final section offers conclusions and recommendations for further study.

2. BACKGROUND

The review of the air-cargo traffic downturn and some of the pertinent literature on cargo-focused airports offer a practical background perspective relevant to the presented quantitative analysis.

a) The Downturn in Air Cargo Traffic since 2021

Airports Council International's annual review of the world's busiest cargo airport found that 18 of the 20 largest cargo hubs suffered cargo traffic declines in 2022 [1]. Most airports experienced drops in ton-kilometer traffic exceeding 5%, while seven had losses greater than 10%. Dubai International Airport had the greatest loss, at 25.5%. Cincinnati-Northern Kentucky International (CVG) and Louisville Muhammed Ali International (SDF) were the only two among the 20 to have a traffic increase. CVG's success has been fueled by its emergence as an Amazon Air "superhub," discussed in Section 3.

The early months of 2023 brought fresh reports about cargo traffic reductions. The International Air Transport Association data indicate that intra-North America cargo shipments, measured in ton-kilometers, fell 12.4% in April 2023 versus the previous year [2]. The May results were marginally better, with traffic dropping 8.1% versus 2022. This drop, however, occurred despite the industry's capacity

rising by 1.2%, indicating that more capacity is going unused. Traffic on flights linking North America to Europe was down -10.3% in May, consistent with the recent pattern of the traffic performance of international routes lagging domestic ones [2].

Cargo airlines have responded vigorously to the downturn. In April 2023, FedEx announced that it was reducing flight hours on FedEx Express, its aviation operating unit, by more than 10% [3]. The company pointed to falling demand for package shipments and other freight movements. Revenues at FedEx Express fell by 8% from the previous year, pushing adjusted operating income to around 81% of that the year before. The company additionally announced that it was laying off a significant number of workers [3].

Also in April, UPS announced even more significant cuts that reduced its aircraft utilization by 14%. The company adjusted its cargo-handling practices to use its nighttime freighters' capacity more effectively, making substantial reductions in daytime flying possible [4]. UPS's pullback included accelerating the retirement of older freighters, particularly the MD-11 model. Several months before the announcement, UPS began retiring 42 of these large widebodies and replacing them with 28 Boeing 767s widebodies with less payload capacity [4].

Amazon Air, the private air-cargo shipping unit of Amazon, Inc., reduced the growth of flight activity markedly in the six months ending in March 2023, compared to previous periods of similar length [6]. Although the overall scale of the unit grew, bucking the trend toward contraction, flights at many of its hubs and operational focal points declined, partly due to its increased emphasis on CVG [6]. Since then, Amazon has made some outright cuts, including reducing flights in Europe and ceasing to use one of its contractors, Silver Air, which, unlike other contractors, operated smaller turboprop planes [7].

b) Analysis of the Performance of Cargo-Focused Airports.

The performance of airports focusing heavily on cargo shipments has generated much analysis over the past several decades. Interest in these specialized airports has been fueled by the expansion of air freight integrators such as FedEx and UPS, which have built massive air, truck, and van networks to support door-to-door shipments. The integrators tend to concentrate their flight activity at centralized hubs to a greater degree than passenger-oriented airlines [8]

While there has been much scholarly emphasis on the development of hub networks among the integrators, less attention has been focused on the role of cargo-focused airports in this development. Fort Worth Alliance Airport (AFW) in Fort Worth, TX, built in 1989 and located in the Dallas-Fort Worth metropolitan area, is considered the first U.S. airport constructed explicitly to support cargo transport [9]. Despite the expanding cargo traffic that AFW handles, and its role as a major FedEx hub, its construction has not spurred the creation of comparably sized airports designed for cargo. Most cargo-focused airports to emerge have been former passenger, civilian, or military airports; some have turned to cargo due to waning passenger-flight activity [5].

Obstacles Facing Cargo-Focused Airports. Among the challenges facing cargo-oriented airports is an inability to exploit the complementarities of freight and passenger traffic in airport facility planning. Cargo-oriented airports that lack passenger flights are also less able to cross-utilize runways, taxiways, and air-traffic control systems. The tendency for cargo- and passenger-oriented flights to operate at different times can result in efficiencies at airports with a significant volume of both types. The operation

of freighters is often concentrated during nighttime and early morning hours, when passenger traffic is usually light or nonexistent [8, 11]. Airports with extensive nighttime and daytime flight activity can spread their fixed costs over a more extensive base of traffic, which can help justify large-scale capital improvements. UPS's massive Worldport facility at Louisville's international airport exemplifies how cargo and passenger facilities can extensively cross-utilize fixed assets.

Cargo-oriented airports also provide prospective shippers with less (or no) opportunity to transport freight in the belly compartments of larger passenger aircraft, which is often a relatively inexpensive shipping option. In addition, using "belly space" provides ancillary revenue for passenger-focused airlines, which can strengthen the performance of passenger operations [10]. Airports specializing in cargo can also face the problem of being long distances from freight-forwarding agents and consolidators, which serve as intermediaries between shippers, receivers, and airlines. These intermediaries are often situated near passenger airports, partly due to their historical emphasis on belly cargo.

Factors Benefitting Cargo-Focused Airports. More favorable for cargo-airport development are the differing objectives of cargo and passenger airlines concerning network design. Whereas passenger airlines may develop networks that make the total duration of the trip as short as possible and provide customers with many schedule options, cargo airlines may be motivated by a desire to guarantee that cargo arrives by a specific delivery time (such as by the morning of the next day). Kuby and Gray (1993) posit that the market for air cargo is less sensitive to additional mileage traveled than passenger traffic, making it feasible to locate air cargo hubs farther away from major cities, where road congestion is less severe [11]. The reduced congestion lessens the risk that ground transportation providers will miss "cut-off times" for the delivery and transfer of cargo to airlines and other freight forwarders. O'Kelly (2014) has observed that the consideration of fuel consumption strongly influences the location of cargo hubs [12].

Cargo-focused airports can also provide airlines with added operational flexibility, particularly during daytime hours, when airside facilities, including tarmacs and taxiways, are subject to much less congestion. Combination trucks and vans can more freely enter secured areas to bring shipments to ground-handling facilities, which can both reduce costs and safety risks. In some instances, trucks can cross tarmac and taxiways to reach air cargo facilities, reducing transshipment times and creating a more seamless logistics network.

Schwieterman and Hague, after analyzing data on cargo-focused airports, find that the demand for warehousing space and the emergence of Amazon Air has boosted specialized cargo airports. They show that cargo-focused airports have grown faster than airports with more diversified roles between 2010 and 2020 [18]. The present study assesses whether this pattern has continued through and after the pandemic.

3. METHODS USED AND TYPOLOGY OF CARGO AIRPORTS

To compare the effects of the traffic downturn on different types of cargo-oriented airports, the study team used the categorization developed by Schwieterman and Hague [5], which was used to identify two types of airports with prominent cargo-handling roles.

Large cargo-focused airports handle a large freight-hauling role but only a minor passenger role. This is defined as airports handling:

i) at least 20 million pounds (9.07 metric tons) of domestic air cargo annually; and

ii) fewer than 300,000 passengers annually (passenger enplanement and deplanements combined).

The passenger threshold is derived from analyses showing that airports handling fewer than 300,000 passengers annually have limited passenger service. The passenger threshold equates to about 410 originating passengers per day, or the equivalent of roughly a pair of Boeing 737-800 Max aircraft in a single-class configuration. Airports that meet the 20-million-pound threshold tend to have dedicated cargo flights serving them and rank in the top 130 U.S. airports concerning cargo volumes. Examples of airports in this category are Fort Worth's Alliance (AFW) and Chicago-Rockford International (RFD). RFD, roughly 90 miles northwest of Chicago, serves passenger traffic near the above threshold, while AFW, by design, does not handle scheduled passenger traffic.

TABLE 1: Definitions Used in this Study

Air freight integrator hub. An airport that serves as a major focal point for FedEx or UPS, with flight schedules synchronized to facilitate airplane-to-airplane parcel transfers.

Airport rank. The rank of an airport concerning domestic tonnage over 12 months, as reported by BTS.

Amazon Air hub. An airport with at least 15 daily flights on planes reported as belonging to Amazon Air in 2022 or 2023.

Cargo traffic. Annual air freight handled, in millions of pounds, by both flight arrivals and departures at an airport, including belly-hold cargo.

Large cargo-focused airport. An airport handling at least 20 million pounds of cargo and fewer than 320,000 passengers over a year-long period.

Large mixed-purpose airport. An airport that handles at least 20 million pounds of domestic freight and at least 320,000 domestic passengers over a year-long period.

Top-ranked cargo airport. An airport that ranks in the top 20 in the United States based on annual domestic cargo tonnage.

Large mixed-purpose airports refer to airports that meet the cargo threshold (20 million pounds of freight) while handling *more than* 300,000 passengers annually. Most of the country's largest commercial airports fall into this category, many far exceeding these thresholds by wide margins. Examples of airports in this category include Orlando International Airport (MCO), which handled 22 million passengers and 423 million pounds of cargo in 2022. However, prominent airports, such as New York LaGuardia Airport (LGA) in New York, NY, meet only the passenger traffic threshold and, accordingly, are excluded from the analysis. A summary of definitions used can be found in Table 1.

Why We Focus on Pounds of Cargo Handled Rather than Landed Weight

The analysis focuses on the pounds of cargo handled at airports rather than the landed weights of aircraft, which refers to the cumulative weight of all cargo airplanes (freighters) that touch down at a facility, including fuel, the payload, and the plane itself. Although there is much value in using landing weight for certain analyses, this measure doesn't account for the varying payload ratio of the freighters, the intensity to which the available cargo space is being used, and the cargo being shipped in the belly holds of passenger airplanes. For these reasons, we focus on this more direct measure of cargo handled.

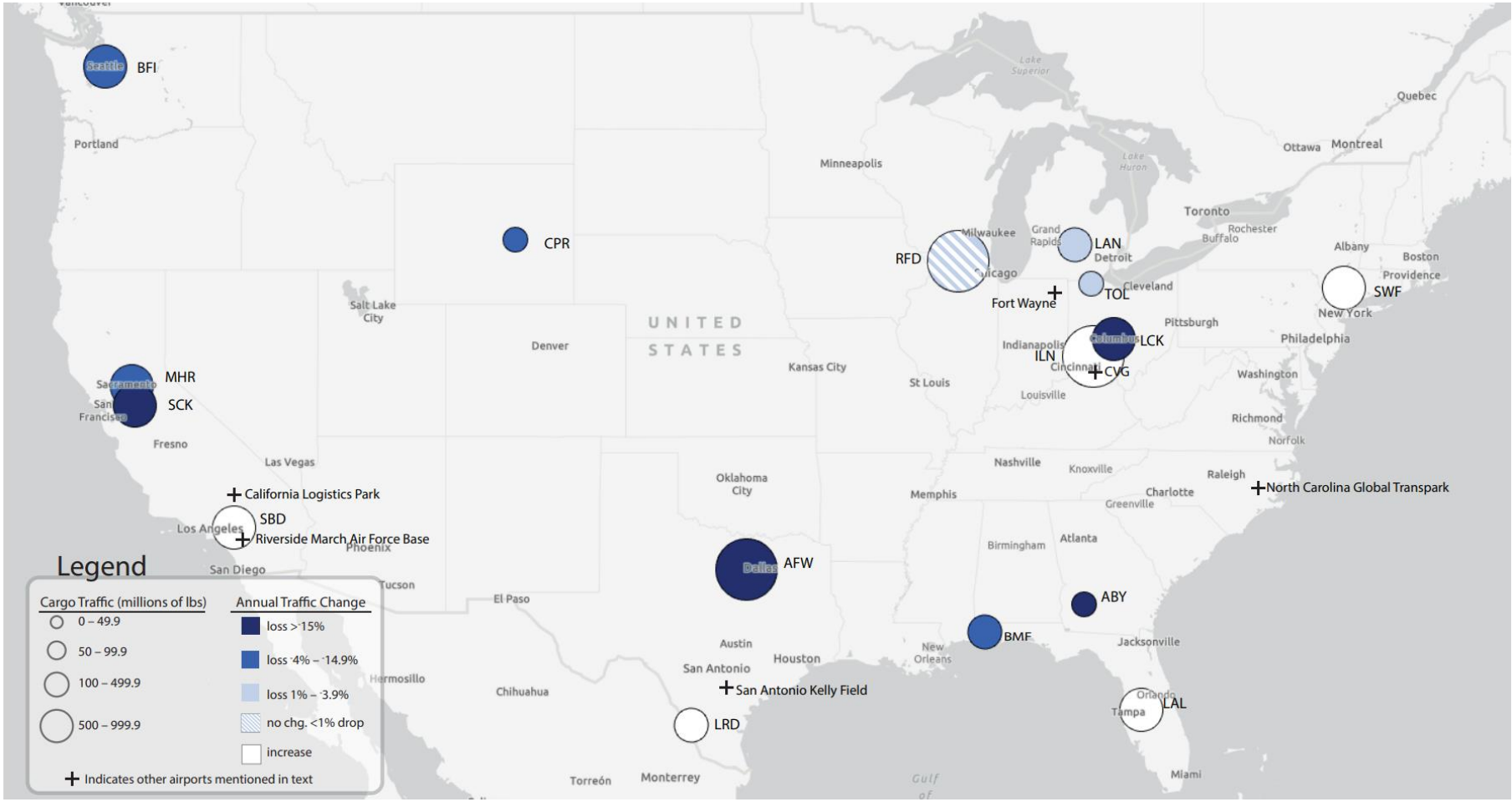
Passenger and cargo traffic for airports was collected from BTS's TranStats Data Portal, updated monthly, to determine if they meet the above criteria. This portal provides information on domestic cargo and passenger traffic over rolling 12-month periods, an airport's rank among all U.S. airports about its domestic cargo and passenger traffic, and other pertinent information using data from BTS's T-100 dataset [13]. Data for domestic passenger and cargo traffic over year-long periods ending in April 2022 and 2023 were collected and compared with calendar years 2019 (the last full year before the pandemic) and 2020. Considering traffic through April 2023 allows the study to evaluate the most updated year-over-year information available.

Number of Airports Meeting Criteria. The data showed that 16 airports met the definition of large cargo-focused airports based on their 12-month traffic performance through April 2022. Among these, five have no or minimal (fewer than ten passengers per day) reported passenger traffic. The data for these airports was compared with that for 16 mixed-purpose airports on the U.S. mainland that rank in the top 20 concerning cargo traffic. (Anchorage, AK's and Honolulu, HI's international airports also ranked in the top 20 but were not included due to the study's focus on the U.S. mainland).

A complete list of airports that met these criteria appears in Table 1 in Section 3. Several airports, including Indiana's Fort Wayne International, were found to have met the thresholds in earlier periods [5] but did not meet the criteria in 2022 due to having passenger traffic above 300,000. Two specialized airports that received much investment to facilitate the expansion of cargo traffic, California Logistics Park in Victorville, CA, and North Carolina Global TransPark in Kinston, NC, are also absent due to failing to meet the cargo threshold [14].

Clusters of Cargo-Focused Airports. A spatial representation of the 16 cargo-focused airports (Figure 1) shows a clustering of cargo-focused airports in the Midwest, particularly in Ohio, which is home to Columbus Rickenbacker International (LCK), Toledo Express (TOL), and Wilmington Air Park (ILN). The size of the circles indicates their traffic levels, while the shading reflects the intensity of the year-over-year traffic losses through April 2023. The other cargo-focused airports in this region are Michigan's Capital Region Airport (LAN) in Lansing and Illinois's RFD. Among the Midwestern airports represented, only ILN, lacked any regularly scheduled passenger traffic. This region and Northern Kentucky, which is home to CVG and Worldport, have long been home to prominent air cargo hubs [15].

FIGURE 1. Prominent Cargo-Focused Airports on the U.S. Mainland and 2022-23 Traffic Change



Data Source: Bureau of Transportation Statistics T-100 data. Map by Abby Mader, Chaddick Institute.

Another cluster of cargo-focused airports appears in California, including San Bernardino International (SNB), Sacramento Mather (MHR), and Stockton Metropolitan (SCK). Although Riverside's March Air Reserve Base (RIV) has some Amazon Air flights, it is not included in the analysis due to its absence from BTS data for unclear reasons. Oakland International (OAK) and Ontario International (ONT)

A third and more loosely defined cluster is in central and south Texas and the Deep South, represented by Texas's AFW and Laredo International (LRD), Alabama's Mobile International (BFM, formally known as Downtown Mobile Airport), and Albany, GA's Southwest Georgia Regional (ABY) airports. San Antonio's Kelly Field, which was noted as previously being a cargo-focused airport, did not appear in the BTS data.

4. RESULTS OF THE ANALYSIS OF AIRPORT TRAFFIC

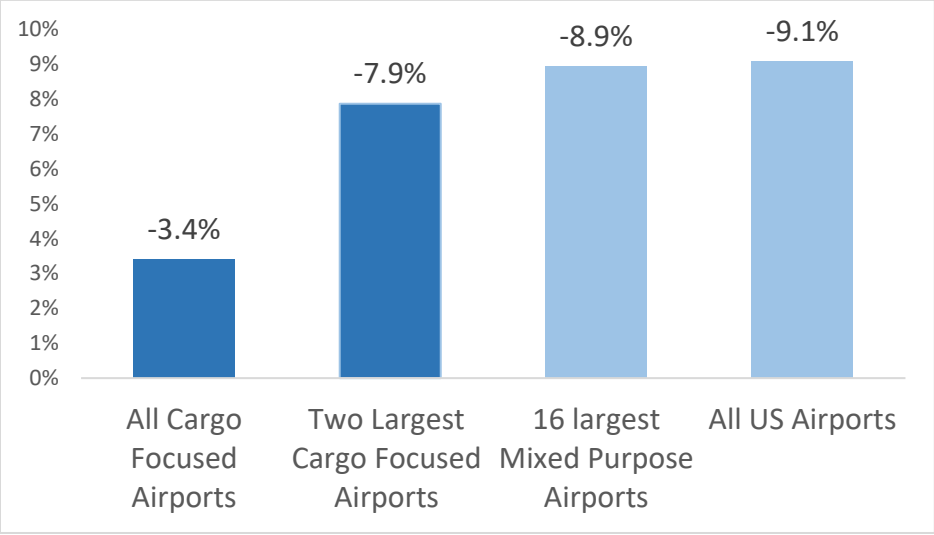
The results are presented in three sections, with the first section providing a general overview of traffic changes at the different types of airports. The second section evaluates the changing ranks of cargo-focused airports concerning their traffic. The final section statistically explores the degree to which cargo-focused airports, and airports that are either Amazon Air or air freight integrator hubs, have outperformed other airports across the country.

a) Comparing the Changing Traffic Levels by Type of Airport.

Several results from the comparative analysis stand out:

- Traffic at the 16 cargo-focused airports declined by 3.4% during the 12 months ending in April 2023 compared to the previous year, which was much more moderate than that at the 16 largest mixed-purpose airports on the mainland, which experienced a 7.9% traffic loss, roughly twice that of the specialized airports (Figure 2).

FIGURE 2: Annual Cargo Traffic Decline, April 2022 - April 2023, Rolling 12 Months
by Type of Airport



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- The two cargo-focused airports ranked in the top 20 U.S. airports in cargo traffic are Illinois's RFD, 14th in 2023, and Fort Worth's AFW, 18th, respectively. These airports together experienced a 7.9% decline, marginally outperforming the 16 high-ranking mixed-purpose airports.

This data, along with the rising ranks of the cargo airports and other results discussed in the following section, suggests that cargo-focused airports generally outperformed large mixed-purpose airports between 2022 and 2023. Among the factors responsible for their relative success, particularly among the larger facilities, has been a higher-than-average propensity to be hubs of Amazon Air and air freight integrators, a topic also revisited below.

The strength of traffic at cargo-focused airports from 2022-23 is attributable primarily to the performance of Rockford's RFD, San Bernardino's SNB, Wilmington's ILN, and Lakeland-Linder Airport (LAL) near Tampa, FL (Table 2). All of these airports saw freight shipments increase by 4% or more, except RFD, which saw traffic remain stable (-0.1%). Not coincidentally, each is an expanding Amazon Air hub, with RFD doubling as a central UPS hub [6]. In addition:

- Five of the 16 cargo-focused airports experienced traffic gains, and 10 outperformed the national average.
- San Bernadino International had the most significant gains, at 11.4%, while Columbus, OH's Rickenbacker (LCK) had the most significant decline, 20.7%. Rickenbacker's disproportionate emphasis on international shipping, which is not evaluated in this study, suggests caution in generalizing the findings regarding that airport's overall performance.
- Only one of the 16 large mixed-purpose airports saw growth, and only four outperformed the national average. The only one that grew, CVG, had a 4.6% increase, fueled by Amazon Air's expanding presence. Amazon Air has grown sharply since the company opened its "superhub" at CVG in August 2021 [16].
- All mixed-purpose airports with less than 10% traffic losses function either as Amazon, FedEx, or UPS hubs, a point revisited in Section 4. None of those with losses exceeding 12% function as such a hub.

The 16 large cargo-focused airports' growth trajectory has been even greater since 2019. Between 2019 and 2023, cargo traffic at these specialized airports grew by 53.6%, compared to 2.4% at the mixed-purpose airports and 12.2% at all U.S. airports. Several prominent cargo-focused airports have experienced traffic leaps since 2019, with traffic at AWF, ILN, SBD, and TOL more than doubling. However, comparing changes over this more extended period using this study's methodology may be subject to selection bias, considering that some cargo-focused airports that declined between 2019 and 2022 may be excluded from consideration due to their failure to meet the required 2022 traffic thresholds. The airports evaluated all had enough success leading up to 2022 to quality, which might not have been the case for some faltering airports.

TABLE 2: Cargo Traffic Changes at Cargo-Focused and Top-Ranking Mixed Purpose Airports on Mainland
In Millions of Pounds, 2020 – 2023

2023 US Rank	Airport Name and Code	Hub Status	Annual Cargo Handled (millions of lbs				Percent Change	
		Amazon or Integrato	*Calendar year 2019*	*Calenda r year 2020*	*12 months ending April 2022*	*12 months ending*	*2019 - 2023*	*2022 - 2023*
		Cargo-Focused Hub Airports, ranked by 2023 cargo traffic						
14	*Chicago/Rockford Int'l, I (RFD)*	*Amz, UPS*	*710*	*844*	*948*	*947*	*33.4%*	*-0.1%*
18	*Fort Worth Alliance, TX (AFW)*	*Amz, FedEx*	*363*	*558*	*876*	*744*	*105.0%*	*-15.1%*
24	*Wilmington Air Park (ILN)*	*Amz*	*113*	*442*	*519*	*543*	*380.5%*	*4.6%*
28	*San Bernardino Int'l, CA (SNB)*	*Amz*	*81*	*109*	*395*	*440*	*443.2%*	*11.4%*
36	*Lakeland-Linder, FL (LAL)*	Amz	282	296	282	296	*5.0%*	*5.0%*
51	*Boeing Field/King County Int'l (BFI)*		*228*	*226*	*215*	*201*	*-11.8%*	*-6.5%*
62	*Sacramento Mather, CA (MHR)*		*169*	*189*	*160*	*143*	*-15.4%*	*-10.6%*
69	*Rickenbacker, Columbus, OH (LCK)*		*153*	*165*	*145*	*115*	*-24.8%*	*-20.7%*
72	*Stewart Int'l., Newburgh, NY (SWF)*		*80*	*115*	*105*	*109*	*36.3%*	*3.8%*
75	*Stockton Metropolitan, CA (SCK)*		*125*	*116*	*126*	*107*	*-14.4%*	*-15.1%*
98	*Laredo International, TX (LRD)*		*49*	*39*	*55*	*60*	*22.4%*	*9.1%*
99	*Capital Region, Lansing MI (LAN)*		*50*	*55*	*58*	*56*	*12.0%*	*-3.4%*
103	*Mobile International, AL (BFM)*		*53*	*58*	*53*	*50*	*-5.7%*	*-5.7%*
105	*SW Georgia, Albany, GA (ABY)*		*55*	*53*	*57*	*49*	*-10.9%*	*-14.0%*
120	*Toledo Express, OH (TOL)*		*2*	*0.469*	*31*	*30*	*1400%*	*-3.2%*
133	*Casper/Natrona Co. Int'l, WY (CPR)*		34	25	24	21	*-38.2%*	*-12.5%*
	Category Total						**53.6%**	**-3.4%**
		Mixed Purpose Hub Airports, ranked by 2023 cargo traffic						
1	*Memphis Int'l, TN (MEM)*	FedEx	7781	8295	8372	7601	*-2.3%*	-9.2%
2	*Louisville Int'l, KY (SDF)*	UPS	5671	6013	6283	5934	*4.6%*	-5.6%
4	*Cincinnati-No. Kentucky, OH (CVG)*	AMZ	2419	2532	2314	2596	*7.3%*	12.2%
5	*Indianapolis Int'l, IN (IND)*	FedEx	1790	2025	2314	2040	*14.0%*	-11.8%
6	*Los Angeles Int'l (LAX)*		1806	2052	2322	1909	*5.7%*	-17.8%
7	*Ontario Int'l, CA (ONT)*	Amz, UPS	1532	1883	1754	1656	*8.1%*	-5.6%
8	*Oakland, CA (OAK)*	FedEx	1191	1249	1311	1159	*-2.7%*	-11.6%
12	*Newark Liberty Int'l, NJ (EWR)*	FedEx	1202	1145	1242	1154	*-4.0%*	-7.1%
10	*Dallas-Ft. Worth Int'l, TX (DFW)*	UPS	1269	1258	1230	1106	*-12.8%*	-10.1%
11	*O'Hare Int'l (ORD)*		1221	1387	1287	1067	*-12.6%*	-17.1%
13	*Miami - Int'l, Fl (MIA)*		861	996	1306	1021	*18.6%*	-21.8%
15	*Philadelphia (PA)*	UPS	945	1044	1030	930	*-1.6%*	-9.7%
16	*New York - JFK (JFK)*		693	879	1048	925	*33.5%*	-11.70%
17	*Atlanta Hartsfield Int'l, GA (ATL)*		737	819	989	821	*11.4%*	-16.99%
19	*Phoenix, AZ (PHX)*		800	815	856	739	*-7.6%*	-13.76%
29	*Boston Logan Int'l, MA (BOS)*		451	492	491	436	*-3.3%*	-11.2%
	Category Total						**2.4%**	**-8.9%**
	All US Airports						**12.2%**	**-9.1%**

Data source: Bureau of Transportation Statistics T-100 data.

b) The Rising Ranks of Cargo-Focused Airports

The changing ranks of large cargo-focused airports between 2022 and 2023 offer additional evidence of their rising prominence. Consider that:

- Nine of the 16 cargo-focused airports increased (or improved) their rank among U.S. airports, while four fell and three were unchanged.
- All of the five largest cargo-focused airports, each being Amazon Air hubs (and, in the case of AFW and RFD, being integrator hubs), either rose in rank or held steady. Although Amazon Air may have accounted for only a small share of cargo, its countercyclical growth and its recent focus on its largest hubs helped offset cutbacks by other carriers.
- The number of cargo airports in the top 100 rose from 11 to 12, whereas only 9 ranked this highly in 2019. The mean rank of the cargo-focused airports rose from 70.4 to 69.2, or 1.3 places, over the period.

TABLE 3: RANK OF CARGO-FOCUSED AIRPORTS IN TERMS OF TOTAL ANNUAL CARGO TRAFFIC

Airport Name and Code	Rank Among U.S. Airports				Ranking Change	
	Calendar year 2019	Calendar year 2020	Year ending April 2022	Year ending April 2023	2019 - 23	2022 - 23
Chicago/Rockford Int'l, IL (RFD)	*17*	*16*	*17*	*14*	*3*	*3*
Fort Worth Alliance, TX (AFW)	*29*	*23*	*18*	*18*	*11*	*0*
Wilmington Air Park (ILN)	*70*	*31*	*25*	*24*	*46*	*1*
San Bernardino Int'l, CA (SNB)	*85*	*76*	*33*	*28*	*57*	*5*
Lakeland-Linder, FL (LAL)	N/A	N/A	40	36	*N/A*	*4*
Boeing Field/King County Int'l (BFI)	*41*	*43*	*51*	*51*	*-10*	*0*
Sacramento Mather, CA (MHR)	*53*	*52*	*62*	*62*	*-9*	*0*
Rickenbacker, Columbus, OH (LCK)	*60*	*58*	*66*	*69*	*-9*	*-3*
Stewart Int'l., Newburgh, NY (SWF)	*87*	*71*	*78*	*72*	*15*	*6*
Stockton Metropolitan, CA (SCK)	*64*	*69*	*68*	*75*	*-11*	*-7*
Laredo International, TX (LRD)	*108*	*112*	*103*	*98*	*10*	*5*
Capital Region, Lansing MI (LAN)	*105*	*101*	*98*	*99*	*6*	*-1*
Mobile International, AL (BFM)	*103*	*100*	*107*	*103*	*0*	*4*
SW Georgia, Albany, GA (ABY)	*101*	*103*	*101*	*105*	*-4*	*-4*
Toledo Express, OH (TOL)	*210*	*352*	*124*	*120*	*90*	*4*
Casper/Natrona Co. Int'l, WY (CPR)	*120*	*130*	*136*	133	*-13*	*3*

Source: Bureau of Transportation Statistics T-100 data.

Stockton's SCK, which Amazon Air serves but does not use as a hub, had the largest decline, falling seven places. This could be attributable to a shift in flights to SNB, which has also resulted in reductions at various California airports [6].

Several airports saw dramatic leaps between 2019 and 2023. Toledo Express (TOL), at which Amazon Air began flights in 2022, rose from 210th in 2019 and 352nd in 2020 (when it handled less than a half-million pounds of cargo) to 120th this year. Lakeland-Linder (LAL) ranked 36th in 2022-23 after being unranked in 2019 due to the lack of reported cargo traffic. ILN went from 70th to 24th, while SNB went from 85th to 28th. The cargo-focused airports in Caspar, WY, and Mobile, AL, also rose in rank. Far fewer mixed-purpose airports rose in rank, with CVG having the most significant increase, moving from 6th to 4th.

c) The Effect of Hub Status on Traffic Performance

This final section offers a statistical perspective on how functioning as a hub for Amazon Air, FedEx, or UPS has shielded all types of airports from traffic decline or even allowed for gains. The results (Table 4) indicate that:

- The five cargo-focused airports functioning as *Amazon Air hubs* in 2022-23 saw an average traffic drop of 1.7%; however, large mixed-purpose airports and all U.S. airports with this role increased by 4.5% and 1.7%, respectively. In each category, airports that were Amazon Air hubs outperformed those that were integrator hubs.
- Traffic at cargo-focused airports functioning as *integrator hubs* dropped by 7.3%, while mixed-purpose and all airports having this role dropped by 8.9% and 9.0%, respectively. In each category, the drop was below the national average.
- In each category, airports that were *both Amazon Air and integrator hubs* did equally or better than those that had only one of these types of hubs or none at all.

TABLE 4: Cargo Traffic Changes by Type of Airport and Hub Status, in lbs. of cargo handled.

Airport Category	Changes in Annual Traffic				# of Airports Meeting Criteria			
	All Cargo-Focused Airports	Mixed Purpose Airports ranked top 20	All Airports ranked in top 20	All Types of US Airports	All Cargo-Focused Airports	Mixed Purpose Airports ranked top 20	All airports ranked in top 20	All Types of US Airports
		*2022 - 23 traffic changes**			*Number of Airports in 2023*			
All Amazon Air Hubs	-1.7%	4.5%	4.5%	1.7%	5	2	7	8
All Integrator Hubs	-7.3%	-9.0%	-8.9%	-9.0%	2	9	11	12
Both an Amazon & Integrator Hub	-7.3%	-5.6%	-6.5%	-6.5%	2	1	4	4
Neither Amazon/Integrator Hub	-8.6%	-15.7%	-15.7%	-10.9%	11	6	6	626
All airports	**-3.4%**	**-8.9%**	**-8.9%**	**-9.1%**	16	16	18	650
		*2019 - 23 traffic changes***						
All airports	**53.6%**	**2.4%**	**4.3%**	**12.2%**	*NA*	*NA*	*NA*	*650*

*2022-23 changes reflect lbs. handled, 12 months ending April 23 vs. same period the previous year.
** 2019-23 changes reflect lbs. handled, 12 months ending April 23 vs. calendar year 2019.
Source: Bureau of Transportation Statistics T-100 data.

By far, the worst performers were airports that function as neither Amazon nor integrator hubs, which saw traffic drops of 8.6% and 15.7% among cargo-focused and mixed-purpose airports, respectively, and

10.9% among all U.S. airports. Even so, it is notable that the cargo-focused airports with Amazon or integrator hubs had a less severe drop than those in the other categories.

As these results show, functioning as a hub for Amazon Air or an air-freight integrator did not fully shield airports from traffic losses. However, in all airport categories, being a hub kept the average cargo-traffic decline to less than the 9.1% national average. All but two airports that function as Amazon or integrator hubs rank in the top 20 in domestic cargo traffic. The exceptions are Baltimore/Washington Thurgood Marshall International (BWI), an Amazon Air hub, which ranks 25th, and Greensboro-Spartanburg International (GSO), a FedEx hub, which ranks 37th.

Various factors appear to explain the relatively strong performance of airports that function as Amazon Air or air freight integrator hubs. Chief among them is the greater sensitivity of cargo traffic to diminished demand on conventional carriers than on parcel-oriented carriers. Supply-related factors are also likely at play, particularly the tendency for airports that do not function as Amazon Air or air freight integrator hubs to rely more heavily on belly-hold shipments. Such shipments involve using space on passenger aircraft, which has been much less readily available and is more costly than before the pandemic. However, the amount of belly-hold space provided has recently bounced back [17].

5. IMPLICATIONS AND CONCLUSIONS

The above analysis has several notable implications for airports, cargo providers, and other stakeholders in the air-cargo sector. The first is that the traffic downturn has affected all airport categories. During the 2022-23, all types of airports had average traffic losses greater than 3%. This drop occurred despite the country's inflation-adjusted gross national product rising by around 3%, jet fuel prices remaining well below historic highs, and a gradual easing of labor shortages. Several other findings also stand out:

1. The economic headwinds facing airports concerning cargo development appear to stem from many factors, including the return to more traditional consumer activity at brick-and-mortar retail stores, the growing efficiency of transporting goods by truck (particularly for short- and medium-distance movements), and new supply chain strategies that de-emphasize costly air shipments. However, airports specializing in cargo and those functioning as hubs for parcel-shipment providers have seen more moderate declines than other airports and, in some cases, have had increased traffic. Cargo-oriented airports that handle at least 20 million annual pounds of domestic cargo have recently outperformed, by a considerable margin, large mixed-purpose airports and other airports across the United States.

2. Much, but not all, of the recent success of cargo-focused airports is attributable to their propensity to be hubs for overnight-delivery providers. Although the present study's methodology does not explore the wide range of other factors behind the recent success of these specialized airports, this could include the availability of land for new warehouse and fulfillment centers, lower levels of airside and ground-side congestion than at large mixed-purpose airports, and lower fees charged for using runways and purchasing or leasing property for air-cargo-supportive facilities.

3. Cargo-focused airports, because they have a smaller geographic footprint than most large U.S. mixed-purpose airports and lower passenger-traffic levels, allow cargo airlines greater operational flexibility than their less-specialized counterparts. They could give carriers more significant input into long-range planning decisions, will enable them to adjust flight schedules more freely from day to day, simplify the task of trans-loading cargo between trucks and planes, and lessen the risk they will face public resistance

when they seek to expand, particularly when it involves more night-time flying. Amazon's interest in cargo-focused airports appears to be driven heavily by a desire to have such flexibility and the more-ample availability of land for warehouse development [5].

4. The risks facing airports that fail to diversify their traffic are also evident in the results. Many mixed-purpose airports have benefitted from resurgent passenger traffic amid the present cargo downturn, which has mitigated some of the associated financial problems. Cargo airports appear more vulnerable to the annual swings in user-fee income than mixed-use airports, at which cargo-related revenues may only be a small portion of receipts. Although becoming an integrator or an Amazon Air hub can shield an airport from some of the cargo-related risks, airports that lack these hubs will likely find it increasingly difficult to become one, as these parcel-delivery companies appear less inclined to establish such hubs than in the past. Amazon Air and air freight integrators have adopted a more cautious approach to their expansion [19].

5. The BTS data used for this study is a versatile tool that can shed light on structural shifts underway in the air-cargo sector. The depth and timeliness of this data, including the changing ranks of airports based on cargo tonnage, indicate that significant changes are underway. Among the limitations of the present study, however, is that it focuses primarily on specialized cargo airports that enjoyed enough success in 2022 to qualify for inclusion while excluding airports that failed to reach the specified thresholds. Different methods, involving case-study analysis, are needed to determine more broadly why cargo-focused airports have recently fared well. Such research could consider the conditions in which governmental and private investments can expand an airport's cargo-handling role and whether they can generate a favorable societal return.

Interpreted broadly, the recent success of large cargo-focused airports in Fort Worth, TX, Lakeland, FL, Rockford, IL, San Bernardino, CA, Wilmington, OH, and other locations suggests that these specialized facilities are poised to continue rising in prominence. Although only two rank in the top 20 in cargo traffic, most are rising, with eleven now in the top 100, up from nine in 2019. The findings show that cargo-focused airports have recently outperformed other U.S. airports, indicating they are worth additional consideration among policymakers and transportation providers.

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